Reference Manual
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Rosemount™ 8800D Series Vortex Flowmeter

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Rosemount™ 8800D Series Vortex Flowmeter

⚠ CAUTION

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

⚠ CAUTION

The products described in this document are NOT designed for nuclear-qualified applications. Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Emerson™ Process Management Sales Representative.

⚠ WARNING

This product is intended to be used as a flowmeter for liquid, gas, or steam applications. Any use other than for which it was intended may result in serious injury or death.

Section 1 Introduction

1.1 How to use this manual

This manual provides installation, configuration, operation, troubleshooting, and other procedures for the use of the Rosemount™ 8800D Vortex Flowmeter. For model code ordering information, see the Rosemount 8800D Series Vortex Flowmeter Product Data Sheet.

Section 2: Configuration contains information on entering and verifying basic configuration parameters.

Section 3: Installation contains mechanical and electrical installation instructions.

Section 4: Operation contains information on advanced configuration parameters and functions that can aid in maintaining the 8800D.

Section 5: Troubleshooting provides troubleshooting techniques, diagnostic information, and transmitter verification procedures.

Appendix A: Specifications and Reference Data provides reference and specification data.

Appendix B: Product Certifications provides specific information for approval codes.

Appendix C: Electronics Verification provides a short procedure for verification of electronic output to assist in meeting the quality standards for ISO 9001 certified manufacturing processes.

Appendix D: HART® Fast Keys provides command tree, and Fast Key Sequence tables for the Field Communicator when used in conjunction with the Rosemount 8800D.

1.2 Safety messages

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Refer to the safety messages, listed at the beginning of each section, before performing any operations.

1.3 System description

The Rosemount 8800D Vortex Flowmeter consists of a meter body and transmitter, and measures volumetric flow rate by detecting the vortices created by a fluid passing by the shedder bar.

The meter body is installed in-line with process piping. A sensor is located at the end of the shedder bar which creates a sine wave signal due to the passing vortices. The transmitter measures the frequency of the sine wave and converts it into a flowrate.

Section 2 Configuration

2.1 Process variables

FastKeys	3, 2, 1

Process Variables for the Rosemount™ 8800D provides the flowmeter output. When commissioning a flowmeter, review each process variable, its function and output, and take corrective action if necessary before using the flowmeter in a process application.

2.1.1 Primary Variable (PV)

FastKeys	2, 2, 2, 1

The measured value of the variable mapped to the primary variable. This can be either Process Temperature (MTA option only) or Flow. Flow variables are available as mass, volume, corrected volume, or velocity. When bench commissioning, the flow values for each variable should be zero and the temperature value should be the ambient temperature.

If the units for the flow or temperature variables are not correct, refer to "Process Variable Units" on page 4. Use the Process Variable Units function to select the units for your application.

2.1.2 Percent of Range

FastKeys	3, 4, 3, 2

The primary variable as a percentage of range provides a gauge as to where the measured flow rate of the meter is within the configured range of the meter. For example, the range may be defined as 0 gal/min to 20 gal/min. If the measured flow rate is 10 gal/min, the percent of range is 50 percent.

2.1.3 Analog Output

FastKeys	3, 4, 3, 1

The analog output variable provides the analog value for the primary variable. The analog output refers to the industry standard output in the 4–20 mA range. Check the analog output value against the actual loop reading given by a multi-meter. If it does not match, a 4–20 mA trim is required. See "Analog Trim" on page 51.

2.1.4 Process Variable Units

FastKeys	2, 2, 2, 6

Allows for the viewing and configuration of Process Variable Units such as Volume, Velocity, Mass Flow, Electronics Temperature, Process Density, and Corrected Volume units, including corrected volume Special Units configuration.

Volume Flow

FastKeys	3, 2, 1

Allows the user to view the volumetric flow rate value.

Volume Flow Units

FastKeys	2, 2, 2, 6, 1

Allows the user to select the volumetric flow units from the available list.

gallons per second
gallons per minute
gallons per hour
gallons per day
cubic feet per second
cubic feet per minute
cubic feet per hour
cubic feet per day
barrels per second
barrels per minute
barrels per hour
barrels per day
imperial gallons per second
imperial gallons per minute
imperial gallons per hour
imperial gallons per day
liters per second
liters per minute
liters per hour
liters per day
cubic meters per second
cubic meters per minute
cubic meters per hour
cubic meters per day
mega cubic meters per day
special units

Corrected Volumetric Flow Units

FastKeys	2,2,2,6,2

Allows the user to select the corrected volumetric flow units from the available list.

- gallons per second
- gallons per minute
- gallons per hour
- gallons per day
- cubic feet per second
- standard cubic feet per minute
- standard cubic feet per hour
- cubic feet per day
- barrels per second
- barrels per minute
- barrels per hour
- barrels per day
- imperial gallons per second
- imperial gallons per minute
- imperial gallons per hour
- imperial gallons per day
- liters per second
- liters per minute
- liters per hour
- liters per day
- normal cubic meters per minute
- normal cubic meters per hour
- normal cubic meters per day
- cubic meters per second
- cubic meters per minute
- cubic meters per hour
- cubic meters per day
- special units

Note

When measuring corrected volumetric flow, a base density and process density must be provided.

Mass Flow

FastKeys	3, 2, 1

Allows the user to view the mass flow rate value and units.

Mass Flow Units

FastKeys	2, 2, 2, 6, 5

Allows the user to select the mass flow units from the available list. (1 STon = 2000 lb; 1 MetTon = 1000 kg)

grams per hour
grams per minute
grams per second
kilograms per day
kilograms per hour
kilograms per minute
kilograms per second
pounds per minute
pounds per hour
pounds per day
special units
short tons per day
short tons per hour
short tons per minute
pounds per second
tons (metric) per day
tons (metric) per hour
tons (metric) per minute

Note
If you select a ***Mass Flow Units*** option, you must enter process density in your configuration.

Velocity Flow

FastKeys	3, 2, 1

Allows the user to view the velocity flow rate value and units.

Velocity Flow Units

FastKeys	2, 2, 2, 6, 3

Allows the user to select the Velocity Flow Units from the available list.

feet per second
meters per second

Velocity Measurement Base

FastKeys	2, 2, 2, 6, 4

Determines if the velocity measurement is based on the mating pipe ID or the meter body ID. This is important for Reducer™ Vortex Applications.

Special Units

FastKeys	2,2,2,7 (Volume) 2,2,2,8 (Mass) 2,2,2,9 (Corrected Volume)

Allows the user to create flow rate units that are not among the standard options. Configuration of a special unit involves entry of these values: base flow unit, base time unit, user defined unit and conversion number. Suppose the user wants the Rosemount 8800D to display flow in beer barrels per minute instead of gallons per minute, and one beer barrel is equal to 31 gallons.

- Base volume unit: gal
- Base time unit: min
- User defined unit: br
- Conversion number: $^{1}/_{31.0}$

See the specific variables listed below for more information on setting special units.

Base Flow Unit

FastKeys	2,2,2,7,1 (Volume) 2,2,2,8,1 (Mass) 2,2,2,9,1 (Corrected Volume)

The unit from which the conversion is made. Select one of the Field Communicator defined unit options:

Volumetric flow	Mass flow	Corrected volume flow
U.S. gallon	gram	U.S. gallon
liter	kilogram	liter
imperial gallon	metric ton	imperial gallon
cubic meter	pound	barrel
barrel	short ton	standard cubic foot
cubic foot		normal cubic foot

Base Time Unit

FastKeys	2,2,2,7,4 (Volume) 2,2,2,8,4 (Mass) 2,2,2,9,4 (Corrected Volume)

Provides the time unit from which to calculate the special units. For example, if the special unit is a volume per minute, select minutes. Choose from the following units:

- Seconds (s)
- Minutes (min)
- Hours (h)
- Days (d)

Special Flow Unit

FastKeys	2,2,2,7,5 (Volume) 2,2,2,8,5 (Mass) 2,2,2,9,5 (Corrected Volume)

A user created custom flow unit. The special unit is limited to four characters. The Field Communicator indicates the special unit with SPCL. The LCD display will display the actual four character user defined special unit.

Conversion Number

FastKeys	2,2,2,7,2 (Volume) 2,2,2,8,2 (Mass) 2,2,2,9,2 (Corrected Volume)

Used to relate base units to special units. For a straight conversion of volume units from one to another, the conversion number is the number of base units in the new unit.

For example, if it is desired to convert from gallons to beer barrels there are 31 gallons in a beer barrel. The conversion equation is as follows (where beer barrels is the new volume unit):

1 gallon = 0.032258 bbl.

Total

FastKeys	2, 2, 4, 3, 1

Provides the output reading of the totalizer. Its value is the amount of liquid or gas that has passed through the flowmeter since the totalizer was last reset.

Totalizer Control

FastKeys	2, 2, 4, 3, 2

Allows the totalizer to be started, stopped, or reset.

Start—Starts the totalizer counting from its current value.

Stop—Interrupts the totalizer count until it is restarted again. This feature is often used during pipe cleaning or other maintenance operations.

Reset—Returns the totalizer value to zero. If the totalizer was running, it will continue to run starting at zero.

Totalizer Config

FastKeys	2, 2, 4, 3, 3

Used to configure the flow parameter (volume, mass, velocity, or corrected volume flow) that will be totaled.

Note
The totalizer value is saved in the non-volatile memory of the electronics every three seconds. Should power to the transmitter be interrupted, the totalizer value will start at the last saved value when the power is re-applied.

Note
Changes that affect the density, density ratio, or compensated K-Factor will affect the totalizer value being calculated. These changes will not cause the existing totalizer value to be recalculated.

Note
In order to totalize in compensated mass flow or compensated corrected volume flow, for units with the MTA option only, set pulse output to match the totalizer configuration even if the pulse output was not ordered.

Pulse Frequency

FastKeys	3, 2, 5, 3

Allows the user to view the pulse output frequency value. To configure the pulse output, refer to the section on pulse output found on page 54.

Shedding Frequency

FastKeys	3, 2, 5, 1

Allows the user to view the shedding frequency directly off of the sensor.

Electronics Temperature

FastKeys	3, 2, 6, 2

Allows the user to view the Electronics Temperature value and units.

Electronics Temperature Units

FastKeys	2, 2, 2, 6, 6 (without MTA) 2, 2, 2, 6, 7 (with MTA)

Allows the user to select the Electronics Temperature Units from the available list.

- deg C
- deg F

Calculated Process Density

FastKeys	3, 2, 1

Allows the user to view the calculated process density value when the transmitter is configured for temperature compensated steam or temperature compensated liquid applications.

Process Density Units

FastKeys	2, 2, 2, 6, 7 (without MTA) 2, 2, 2, 6, 8 (with MTA)

Allows the user to configure the Process Density Units from the available list.

- g/Cucm (cm^3)
- g/L
- kg/Cum (m^3)
- lb/Cuft (ft^3)
- lb/Cuin (in^3)

Process Temperature

FastKeys	3, 2, 1

Allows the user to view the Process Temperature value when the transmitter has the temperature sensor option, MTA.

Process Temperature Units

FastKeys	2, 2, 2, 6, 6 (only with MTA)

Allows the user to configure the units for the process temperature from the available list.

- deg C
- deg F
- deg R
- Kelvin

Temperature Sensor Failure Mode

FastKeys	2, 2, 1, 3, 1

Allows the user to configure the temperature sensor failure mode. In the event that the temperature sensor fails, the vortex can go either into an alarm output mode, or continue to operate normally using the Fixed Process Temperature value. See Fixed Process Temperature on page 12. This mode is only relevant with the MTA option.

Note
If the Primary Variable is set to Process Temperature and there is an error, the output will always go to alarm and this setting will be ignored.

2.2 Basic setup

FastKeys	2, 1, 1, 1

The Rosemount 8800D must be configured for certain basic variables in order to be operational. In most cases, all of these variables are pre-configured at the factory. Configuration may be required if your Rosemount 8800D is not configured or if the configuration variables need revision. The basic setup wizard will take you through all the steps required to set up the Rosemount Vortex meter for basic operation.

The remainder of this section contains details about how to enter basic configuration parameters in order to manually configure the Rosemount 8800D.

2.2.1 Tag

FastKeys	2, 2, Device Information, 1, 1

The quickest way to identify and distinguish between flowmeters. Flowmeters can be tagged according to the requirements of your application. The tag may be up to eight characters long. Long Tag is available for HART® 7 and allows for up to 32 characters.

2.2.2 Long Tag

FastKeys	2,2,Device Information,1,2

Available for HART 7 and allows for up to 32 characters.

2.2.3 Process configuration

The flowmeter can be used for liquid or gas/steam applications, but it must be configured specifically for the application. If the flowmeter is not configured for the proper process, readings will be inaccurate. Select the appropriate process configuration parameters for your application:

Transmitter Mode

FastKeys	2, 2, 1, 1, 1

For units with an integral temperature sensor, the temperature sensor can be activated here.

Without Temperature Sensor

With Temperature Sensor

Set Process Fluid

FastKeys	2, 2, 1, 1, 3

Select the fluid type—either Liquid, Gas/Steam, Tcomp Sat Steam, or Tcomp Liquids. Tcomp Sat Steam and Tcomp Liquids require the MTA Option and provide dynamic density compensation based on the process temperature reading.

Fixed Process Temperature

FastKeys	2, 2, 1, 1, 4

Needed for the electronics to compensate for thermal expansion of the flowmeter as the process temperature differs from the reference temperature. Process temperature is the temperature of the liquid or gas in the line during flowmeter operation.

May also be used as a back-up temperature value in the event of a temperature sensor failure if the MTA option is installed.

Fixed Process Density

FastKeys	2, 2, 3, 1

A Fixed Process Density must be accurately configured if mass flow or corrected volume flow measurements are used. In mass flow it is used to convert volume flow to mass flow. In corrected volume flow it is used with the base process density to derive a density ratio which in turn is used to convert volume flow to corrected volume flow. In temperature compensated fluids the fixed process density is still required as it is used to convert volume flow sensor limits to sensor limits for temperature compensated fluids.

Note

If mass or corrected volume units are chosen, you must enter the density of your process fluid into the software. Be careful to enter the correct density. The mass flow rate and density ratio are calculated using this user-entered density, and unless the transmitter is in TComp Sat Steam or TComp Liquids mode where changes in density are automatically being compensated for, any error in this number will cause error in the measurement.

Base Process Density

FastKeys	2, 2, 3, 2, 1

The density of the fluid at base conditions. This density is used in corrected volume flow measurement. It is not required for volume flow, mass flow, or velocity flow. The Base Process Density is used with the Process Density to calculate the Density Ratio. In temperature compensated fluids, the Process Density is calculated by the transmitter. In non-temperature compensated fluids the Fixed Process Density is used to calculate a fixed Density Ratio. Density Ratio is used to convert actual volumetric flow to standard volumetric flow rates based on the following equation:

$$\text{DensityRatio} = \frac{\text{density at actual (flowing) conditions}}{\text{density at standard (base) conditions}}$$

2.2.4 Reference K-factor

FastKeys	2, 2, 1, 2, 1

A factory calibration number relating the flow through the meter to the shedding frequency measured by the electronics. Every 8800 meter manufactured by Emerson is run through a water calibration to determine this value.

2.2.5 Flange Type

FastKeys	2, 2, 1, 4, 2

Enables the user to specify the type of flange on the flowmeter for later reference. This variable is preset at the factory but can be changed if necessary.

- Wafer
- ASME 150
- ASME 150 Reducer
- ASME 300
- ASME 300 Reducer
- ASME 600
- ASME 600 Reducer
- ASME 900
- ASME 900 Reducer
- ASME 1500
- ASME 1500 Reducer
- ASME 2500
- ASME 2500 Reducer
- PN10
- PN10 Reducer
- PN16
- PN16 Reducer
- PN25
- PN25 Reducer
- PN40
- PN40 Reducer
- PN64
- PN64 Reducer
- PN100
- PN100 Reducer
- PN160
- PN160 Reducer
- JIS 10K
- JIS 10K Reducer
- JIS 16K/20K
- JIS 16K/20K Reducer
- JIS 40K
- JIS 40K Reducer
- Spcl

2.2.6 Pipe ID

FastKeys	2, 2, 1, 1, 6

The pipe ID (inside diameter) of the pipe adjacent to the flowmeter can cause entrance effects that may alter flowmeter readings. Configuring the actual mating pipe inside diameter will correct for theses effects. Enter the appropriate value for this variable.

Pipe ID values for schedule 10, 40, and 80 piping are given in Table 2-1. If the mating pipe ID is not listed in the table, confirm pipe ID with manufacturer or measure the pipe ID.

Table 2-1. Pipe IDs for Schedule 10, 40, and 80 Piping

Pipe size inches (mm)	Schedule 10 inches (mm)	Schedule 40 inches (mm)	Schedule 80 inches (mm)
½ (15)	0.674 (17.12)	0.622 (15.80)	0.546 (13.87)
1 (25)	1.097 (27.86)	1.049 (26.64)	0.957 (24.31)
1½ (40)	1.682 (42.72)	1.610 (40.89)	1.500 (38.10)
2 (50)	2.157 (54.79)	2.067 (52.50)	1.939 (49.25)
3 (80)	3.260 (82.80)	3.068 (77.93)	2.900 (73.66)
4 (100)	4.260 (108.2)	4.026 (102.3)	3.826 (97.18)

Pipe size inches (mm)	Schedule 10 inches (mm)	Schedule 40 inches (mm)	Schedule 80 inches (mm)
6 (150)	6.357 (161.5)	6.065 (154.1)	5.761 (146.3)
8 (200)	8.329 (211.6)	7.981 (202.7)	7.625 (193.7)
10 (250)	10.420 (264.67)	10.020 (254.51)	9.562 (242.87)
12 (300)	12.390 (314.71)	12.000 (304.80)	11.374 (288.90)

2.2.7 Variable mapping

FastKeys	2, 2, 2, 5

Allows the user to select which variables the 8800D will output.

Primary Variable

FastKeys	2, 2, 2, 1

The variable mapped to the analog output. Selections for the primary variable are Mass Flow, Volumetric Flow, Corrected Volume Flow, Velocity Flow, and Process Temperature.

Secondary Variable

FastKeys	2, 2, 2, 2

Selections for the secondary variable include all variables that can be mapped to the Primary Variable, and also Shedding Frequency, Pulse Frequency, Calculated Process Density, and Electronics Temperature. The full list is given below:

- Mass Flow
- Volumetric Flow
- Corrected Volumetric Flow
- Direct Shedding Frequency
- Pulse Output Frequency
- Totalizer
- Velocity
- Process Temperature (MTA only)
- Calculated Process Density (MTA only)
- Thermocouple Cold Junction Temperature (MTA only)
- Electronics Temperature
- Signal Strength

Third Variable

FastKeys	2, 2, 2, 3

Selections for the Third Variable are identical to those of the Secondary Variable.

Fourth Variable

FastKeys	2, 2, 2, 4

Selections for the Fourth Variable are identical to those of the Secondary Variable.

2.2.8 Process Variable Units

FastKeys	2, 2, 2, 6

This selection allows the user to set the units of measure for all available process variables.

2.2.9 Analog Output

FastKeys	3, 4, 3, 1

Enables you to set the upper and lower range values in order to maximize the resolution of the analog output. The meter is most accurate when operated within the expected flow ranges for your application. Setting the range to the limits of expected readings will maximize flowmeter performance.

The range of expected readings is defined by the Lower Range Value (LRV) and Upper Range Value (URV). Set the LRV and URV within the limits of flowmeter operation as defined by the line size and process material for your application. Values set outside that range will not be accepted.

Primary Variable Upper Range Value (PV URV)

FastKeys	2, 2, 4, 1, 3

This is the 20 mA set point for the meter.

Primary Variable Lower Range Value (PV LRV)

FastKeys	2, 2, 4, 1, 4

This is the 4 mA set point for the meter, and is typically set to 0 when the primary variable is a flow variable.

2.2.10 Damping

FastKeys	2, 1, 4, 1

Damping changes the response time of the flowmeter to smooth variations in output readings caused by rapid changes in input. Damping is applied to the ***Analog Output***, ***Primary Variable***, ***Percent of Range***, and Vortex Frequency.

The default damping value is 2.0 seconds. This can be configured to any value between 0.2 to 255 seconds when PV is a flow variable or 0.4 to 32 seconds when PV is Process Temperature. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics in your system.

Note
If the vortex shedding frequency is slower than the damping value selected, no damping is applied. Process Temperature damping can be modified when PV is set to Process Temperature.

2.2.11 Optimize DSP (Digital Signal Processing)

FastKeys	2, 1, 1, 3

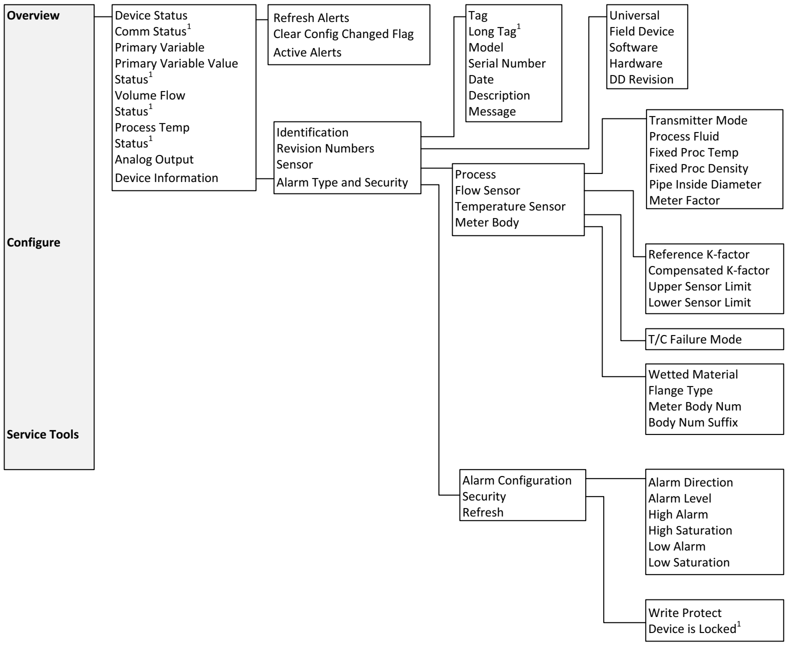
A function that can be used to optimize the range of the flowmeter based on the density of the fluid. The electronics uses process density to calculate the minimum measurable flow rate, while retaining at least a 4:1 signal to the trigger level ratio. This function will also reset all of the filters to optimize the flowmeter performance over the new range. If the configuration of the device has changed, this method should be executed to ensure the signal processing parameters are set to their optimum settings. For dynamic process densities, select a density value that is lower than the lowest expected flowing density.

Table 2-2. Fast Keys for Rosemount 8800D HART 7 Device Revision 2 (DD Revision 1)/ HART 5 Device Revision 3 (DD Revision 1)

Function	Fast Key	Function	Fast Key
Analog Output	3, 4, 3, 1	Polling Address	2, 2, –[1], 2, 1
Analog Trim	3, 4, 3, 7	Primary Variable	2, 2, 2, 1
Base Mass Unit (MF)	2, 2, 2, 8, 1	Process Fluid Type	2, 2, 1, 1, 3
Base Process Density	2, 2, 3, 2, 1	Process Variables	3, 2, 3
Base Time Unit (CVF)	2, 2, 2, 9, 4	Pulse Output	3, 2, 5, 3
Base Time Unit (MF)	2, 2, 2, 8, 4	Pulse Output Test	3, 5, 3, 4
Base Time Unit (VF)	2, 2, 2, 7, 4	Reference K-Factor	2, 2, 1, 2, 1
Base Volume Unit (CVF)	2, 2, 2, 9, 1	Reset Transmitter	3, 4, 4, 1, 2
Base Volume Unit (VF)	2, 2, 2, 7, 1	Restore Default Filters	2, 1, 4, 6
Compensated K-Factor	2, 2, 1, 2, 2	Restore Factory Calibration	3, 4, 3, 9
Conversion Factor (CVF)	2, 2, 2, 9, 2	Revision Numbers	2, 2, –[1], 2
Conversion Factor (MF)	2, 2, 2, 8, 2	Scaled Analog Trim	3, 4, 3, 8
Conversion Factor (VF)	2, 2, 2, 7, 2	Second Variable	2, 2, 2, 2
Date	2, 2, –[1], 1, 5	Self Test	3, 4, 4, 1, 1
Corrected Volumetric Flow	3,2,1	Set Damping	2, 1, 4, 1
Corrected Volumetric Flow Units	2,2,2,6,2	Set Low Flow Cutoff	2, 1, 4, 3
Density Ratio	2, 2, 3, 4	Set Low-pass Corner Frequency	2, 1, 4, 4
Descriptor	2, 2, –[1], 1, 6	Set Trigger Level	2, 1, 4, 5
Device ID	2, 2, –[1], 1	Shedding Frequency	3, 2, 5, 1
Device Status	1, 1	Signal Strength	3, 4, 2, 1, 4
Display	2, 1, 1, 2	Special Flow Unit (CVF)	2, 2, 2, 9, 5
Electronics Temp	3, 2, 6	Special Flow Unit (MF)	2, 2, 2, 8, 5
Electronics Temp Units	2, 2, 2, 6, 7	Special Flow Unit (VF)	2, 2, 2, 7, 5
Final Assembly Number	2, 2, 1, 4, 3	Special Volume Unit	2, 2, 2, 7, 3
Fixed Process Density	2, 2, 1, 1, 5	Tag	2, 2, –[1], 1, 1
Fixed Process Temperature	2, 2, 1, 1, 4	Third Variable	2, 2, 2, 3
Flange Type	2, 2, 1, 4, 2	Total	2, 2, 4, 3, 1
Flow Simulation	3, 5, 1, 2, 1	Totalizer Configuration	2, 2, 4, 3, 3
Fourth Variable	2, 2, 2, 4	Totalizer Control	2, 2, 4, 3, 2
Loop Test	3, 5, 2, 7	Transmitter Mode	2, 2, 1, 1, 1
Lower Range Value	2, 2, 4, 1, 4	Upper Range Value	2, 2, 4, 1, 3
Lower Sensor Limit	2, 2, 4, 1, 6	Upper Sensor Limit	2, 2, 4, 1, 5
Mass Flow	3, 2, 1	Variable Mapping	2, 2, 2, 5
Mass Flow Units	2, 2, 2, 6, 5	Velocity Flow	3, 2, 1
Message	2, 2, –[1], 1, 7	Velocity Flow Units	2, 2, 2, 6, 3
Meter Factor	2, 2, 1, 1, 7	Velocity Measurement Base	2, 2, 2, 6, 4
Minimum Span	2, 2, 4, 1, 7	Volume Flow	3, 2, 1
Optimize DSP	2, 1, 1, 3	Volume Flow Units	2, 2, 2, 6, 1
Percent of Range	3, 4, 3, 2	Wetted Material	2, 2, 1, 4, 1
Pipe Inside Diameter	2, 2, 1, 1, 6	Write Protect	2, 2, –[1], 4, 1

1. These items are in a list format without numeric labels. To access these features, you must scroll to this option in the HART Communicator.

Figure 2-1. Overview Menu Map

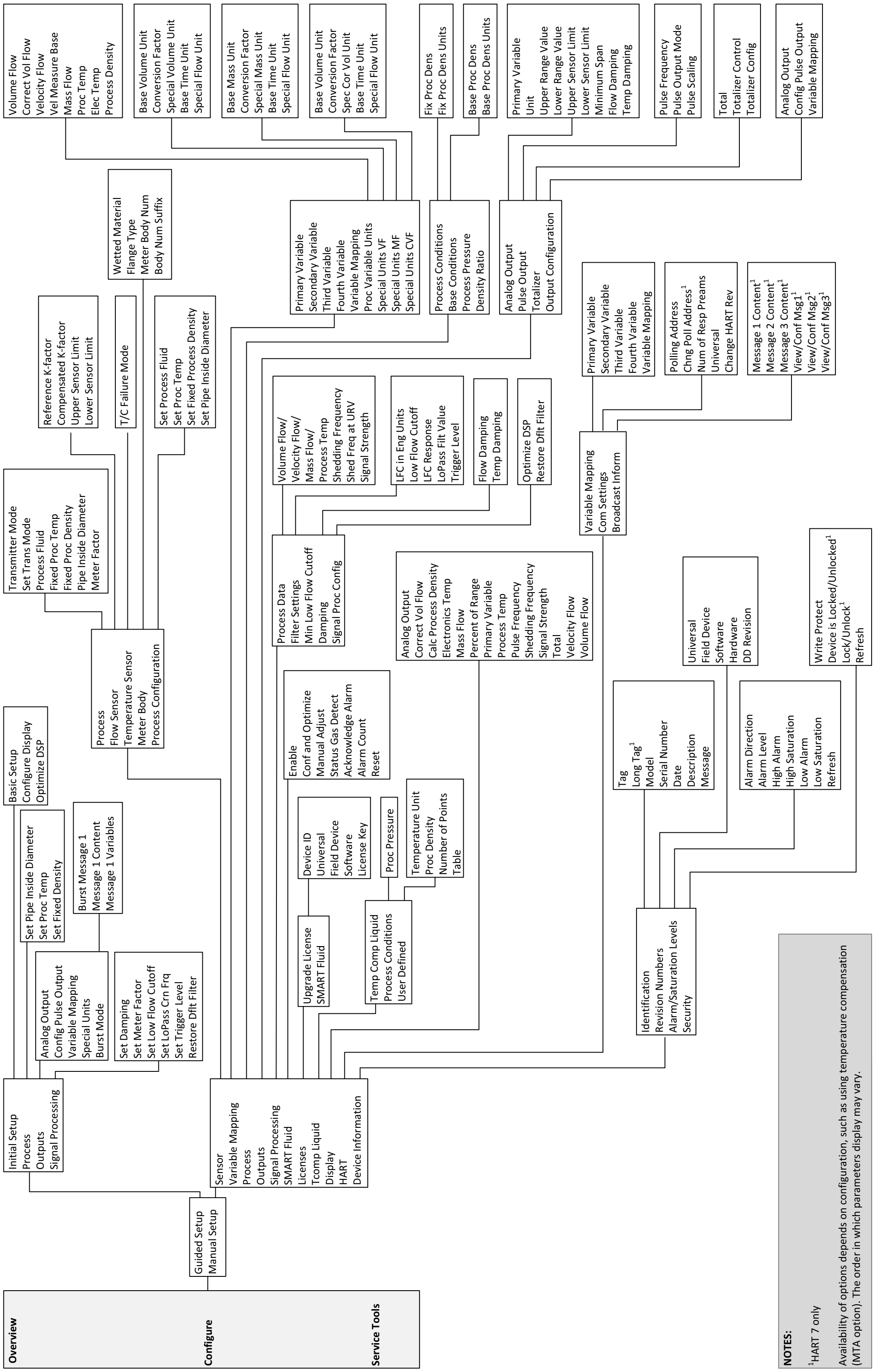


NOTES:

[1] HART 7 only

Availability of options depends on configuration, such as using temperature compensation (MTA option). The order in which parameters display may vary.

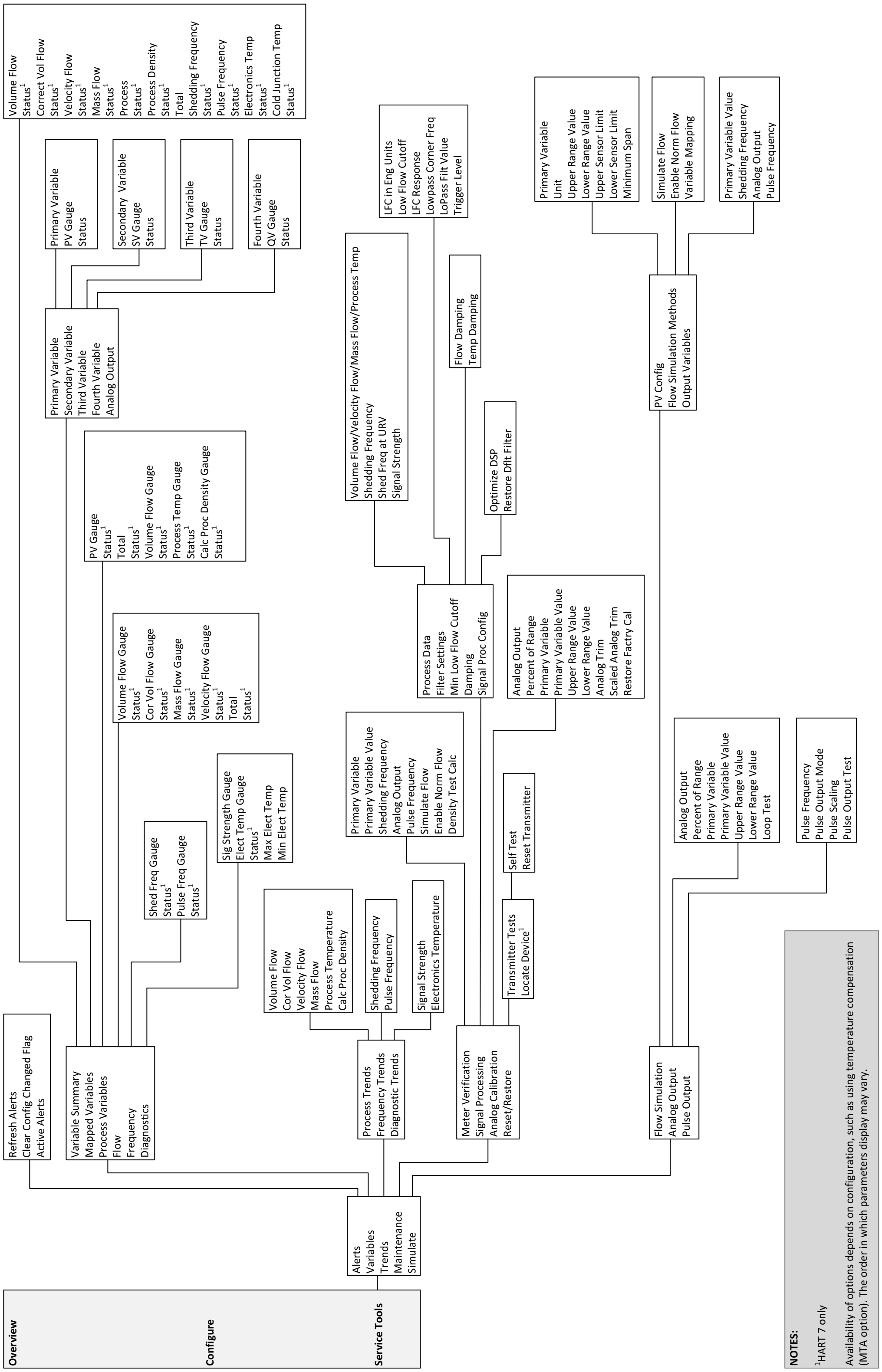
Figure 2-2. Configure Menu Map



NOTES:
[1] HART 7 only

Availability of options depends on configuration, such as using temperature compensation (MTA option). The order in which parameters display may vary.

Figure 2-3. Service Tools Menu Map



NOTES:

[1] HART 7 only

Availability of options depends on configuration, such as using temperature compensation (MTA option). The order in which parameters display may vary.

Section 3 Installation

This section provides installation instructions for the Rosemount™ 8800D Vortex Flowmeter. Dimensional drawings for each Rosemount 8800D variation and mounting configuration are included in Appendix A: Specifications and Reference Data.

The options available for the Rosemount 8800D Flowmeter are also described in this section. The numbers in parentheses refer to the codes used to order each option.

3.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing any operation in this section.

⚠WARNING

Explosions could result in death or serious injury.

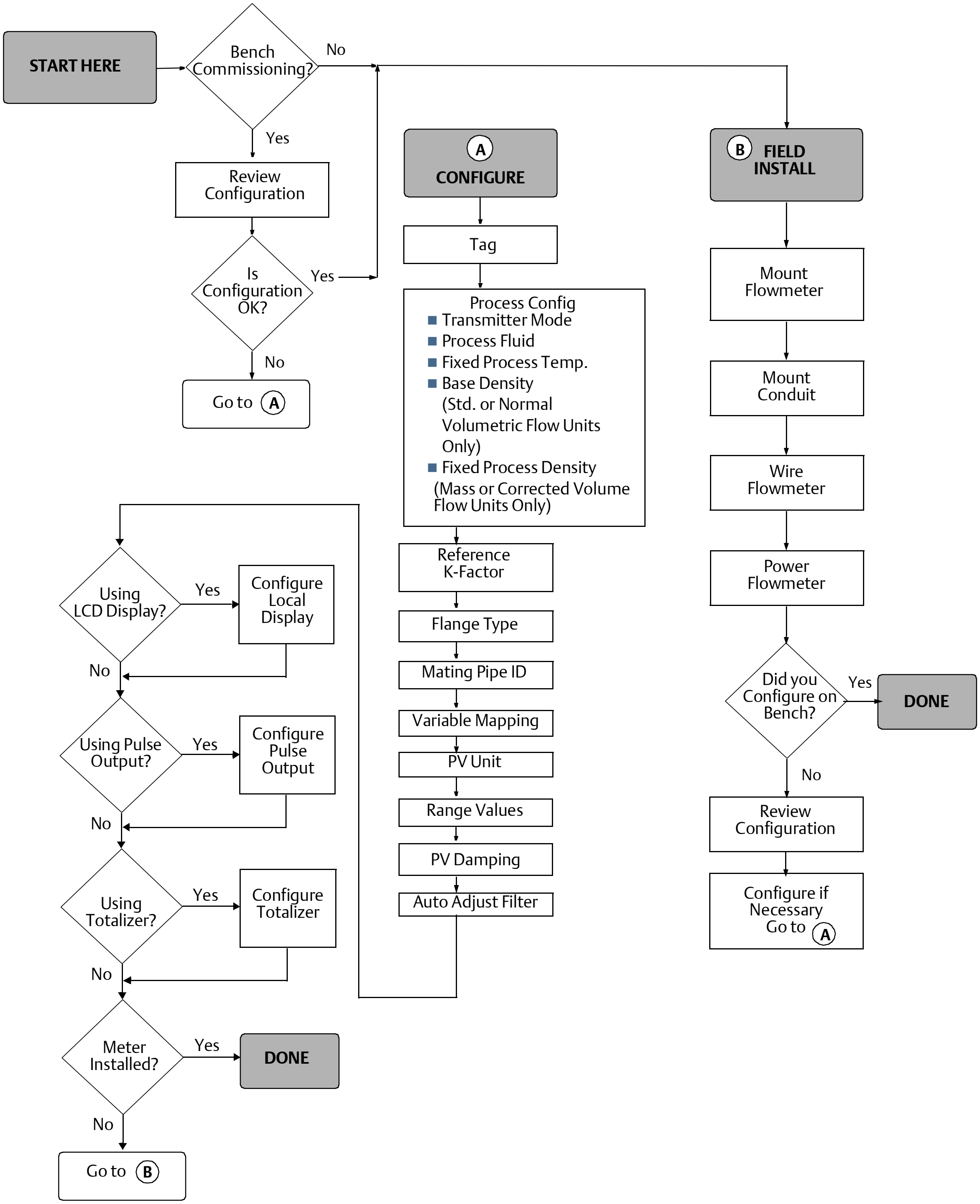
- Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART®-based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.

Figure 3-1. Installation Flowchart



3.2 Commissioning

Commission the Rosemount 8800D before putting it into operation. This ensures proper configuration and operation of the meter. It also enables you to check hardware settings, test the flowmeter electronics, verify flowmeter configuration data, and check output variables. Any problems can be corrected – or configuration settings changed – before going out into the installation environment. To commission on the bench, connect the Field Communicator or AMS™ Device Manager (or other communications device) to the signal loop in accordance with the specifications for your device.

Before you install a flowmeter in any application, you must consider flowmeter sizing (the line size) and location. Choose the correct flowmeter size for an application to increase rangeability and minimize pressure drop and cavitation. Proper location of the flowmeter can ensure a clean and accurate signal. Follow the installation instructions carefully to reduce start-up delays, ensure ease of maintenance, and ensure optimum performance.

3.2.1 Flowmeter sizing

Correct meter sizing is important for flowmeter performance. The Rosemount 8800D is capable of measuring flow within the limitations described in Appendix A: Specifications and Reference Data.

To determine the correct flowmeter size for an application, process conditions must be within the stated requirements for Reynolds number and velocity. See Appendix A: Specifications and Reference Data for sizing data.

Contact your local Rosemount Inc. sales representative to obtain a copy of Instrument Toolkit™ which contains a sizing module for the Rosemount 8800D Vortex Flowmeter. The vortex sizing module will calculate valid flowmeter sizes based on user-supplied application information.

3.2.2 Flowmeter orientation

Design process piping so the meter body will remain full, with no entrapped air. Allow enough straight pipe both upstream and downstream of the meter body to ensure a nonskewed, symmetrical flow profile. Install valves downstream of the meter when possible.

Vertical installation

Vertical, upward, installation allows upward process liquid flow and is generally preferred. Upward flow ensures that the meter body always remains full and that any solids in the fluid are evenly distributed.

The vortex meter can be mounted in the vertical down position when measuring gas or steam flows. This type of application should be strongly discouraged for liquid flows, although it can be done with proper piping design.

Note
To ensure the meter body remains full, avoid downward vertical liquid flows where back pressure is inadequate.

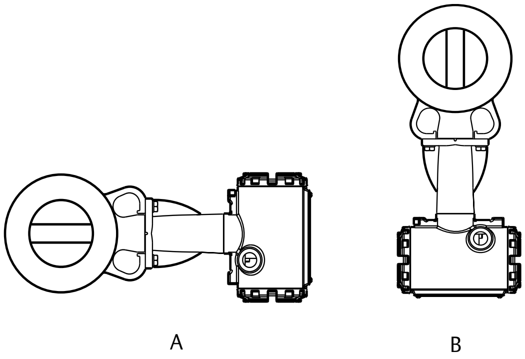
Horizontal installation

For horizontal installation, the preferred orientation is to have the electronics installed to the side of the pipe. In liquid applications, this ensures any entrained air or solids do not strike the shedder bar and disrupt the shedding frequency. In gas or steam applications, this ensures any entrained liquid (such as condensate) or solids do not strike the shedder bar and disrupt the shedding frequency.

High-temperature installations

Install the meter body so the electronics are positioned to the side of the pipe or below the pipe as shown in Figure 3-2. Insulation may be required around the pipe to maintain an electronics temperature below 185 °F (85 °C). See Figure 3-10 on page 34 for special insulation considerations.

Figure 3-2. Examples of High-Temperature Installations

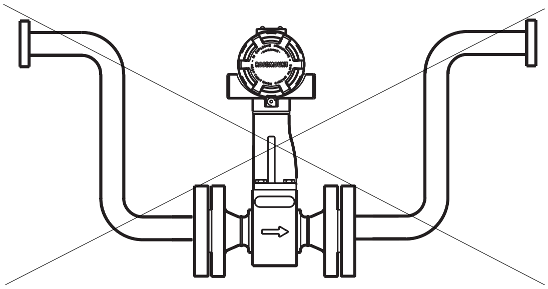


A. Preferred installation—The meter body installed with the electronics to the side of the pipe.
B. Acceptable installation—The meter body installed with the electronics below the pipe.

Steam installations

For steam applications, avoid installations such as the one shown in Figure 3-3. Such installations may cause a water-hammer condition at start-up due to trapped condensate. The high force from the water hammer can over stress the sensing mechanism and cause permanent damage to the sensor.

Figure 3-3. Avoid this Type of Installation for Steam Applications



Upstream/downstream piping

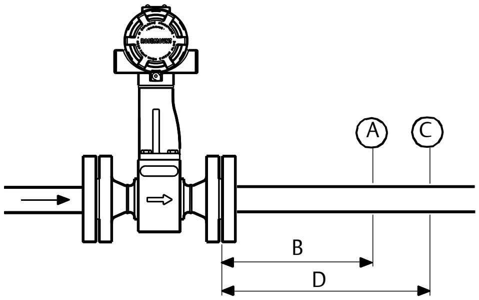
The vortex meter may be installed with a minimum of ten diameters (D) of straight pipe length upstream and five diameters (D) of straight pipe length downstream.

To achieve reference accuracy, straight pipe lengths of 35D upstream and 5D downstream are required. The value of the K-factor may shift up to 0.5% when the upstream straight pipe length is between 10D and 35D. Please see Technical Data Sheet (00816-0100-3250) on Installation Effects for optional K-factor corrections. This effect can be corrected for using the "Meter Factor" on page 53.

Pressure and temperature transmitter location

When using pressure and temperature transmitters in conjunction with the Rosemount 8800D for compensated mass flows, install the transmitter(s) downstream of the Vortex Flowmeter. See Figure 3-4.

Figure 3-4. Pressure and Temperature Transmitter Location



A. Pressure transmitter
B. Four straight pipe diameters downstream
C. Temperature transmitter
D. Six straight pipe diameters downstream

Note
The MTA option can be purchased for an integral temperature measurement and mass flow temperature compensation for saturated steam and liquids.

3.2.3 Wetted material selection

Ensure that the process fluid is compatible with the meter body wetted materials when specifying the Rosemount 8800D. Corrosion will shorten the life of the meter body. Consult recognized sources of corrosion data or contact your Emerson Flow Sales Representative for more information.

Note
If Positive Material Identification (PMI) is required, perform test on a machined surface.

3.2.4 Environmental considerations

Avoid excessive heat and vibration to ensure maximum flowmeter life. Typical problem areas include high-vibration lines with integrally mounted electronics, warm-climate installations in direct sunlight, and outdoor installations in cold climates.

Although the signal conditioning functions reduce susceptibility to extraneous noise, some environments are more suitable than others. Avoid placing the flowmeter or its wiring close to devices that produce high intensity electromagnetic and electrostatic fields. Such devices include electric welding equipment, large electric motors and transformers, and communication transmitters.

3.3 Hazardous locations

The Rosemount 8800D has an explosion-proof housing and circuitry suitable for intrinsically safe and non-incendive operation. Individual transmitters are clearly marked with a tag indicating the certifications they carry. See Appendix B: Product Certifications for specific approval categories.

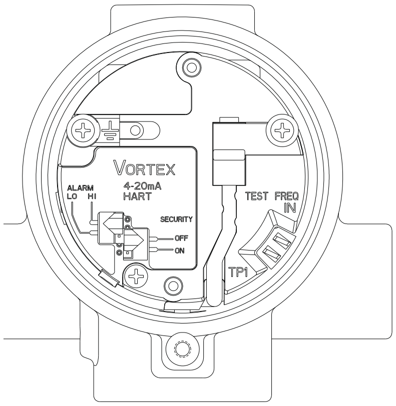
3.4 Hardware configuration

The hardware jumpers on the Rosemount 8800D enable you to set the alarm and security. (See Figure 3-5.) To access the jumpers, remove the electronics housing cover from the electronics end (opposite of the terminal blocks) of the Rosemount 8800D. If your Rosemount 8800D includes an LCD option, the alarm and security jumpers are found on the face of the LCD indicator. (See Figure 3-6 on page 28.)

Note
If you will be changing configuration variables frequently, it may be useful to leave the security lockout jumper in the OFF position to avoid exposing the flowmeter electronics to the plant environment.

Set these jumpers during the commissioning stage to avoid exposing the electronics to the plant environment.

Figure 3-5. Alarm and Security Jumpers



Alarm

As part of normal operations, the Rosemount 8800D continuously runs a self-diagnostic routine. If the routine detects an internal failure in the electronics, flowmeter output is driven to a low or high alarm level, depending on the position of the failure mode jumper.

The failure mode jumper is labeled ALARM and is set at the factory per the CDS (Configuration Data Sheet); the default setting is HI.

Security

You can protect the configuration data with the security lockout jumper. With the security lockout jumper ON, any configuration changes attempted on the electronics are disallowed. You can still access and review any of the operating parameters and scroll through the available parameters, but no actual changes will be permitted. The security lockout jumper is labeled SECURITY and is set at the factory per the CDS; the default setting is OFF.

3.4.1 Failure mode vs. saturation output values

The failure mode alarm output levels differ from the output values that occur when the operating flow is outside the range points. When the operating flow is outside the range points, the analog output continues to track the operating flow until reaching the saturation value listed below; the output does not exceed the listed saturation value regardless of the operating flow. For example, with standard alarm and saturation levels and flows outside the 4—20 mA range points, the output saturates at 3.9 mA or 20.8 mA. When the transmitter diagnostics detect a failure, the analog output is set to a specific alarm value that differs from the saturation value to allow for proper troubleshooting. The saturation and alarm levels are software selectable between Rosemount Standard and NAMUR levels.

Table 3-1. Analog Output: Standard alarm values vs. Saturation Values

Level	4—20 mA saturation value	4—20 mA alarm value
Low	3.9 mA	≤ 3.75 mA
High	20.8 mA	≥ 21.75 mA

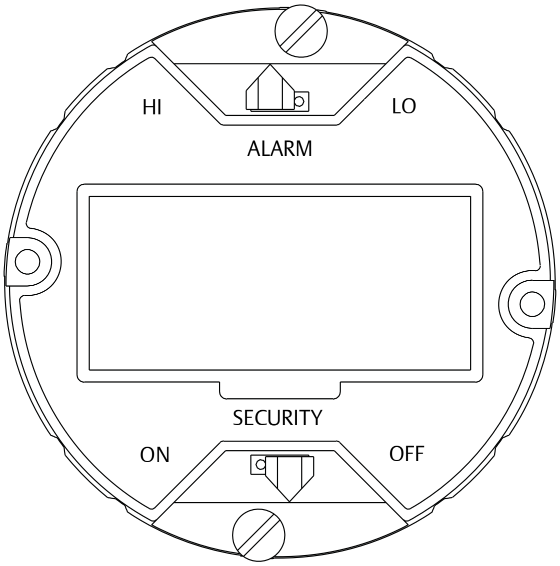
Table 3-2. Analog Output: NAMUR-Compliant Alarm Values vs. Saturation Values

Level	4—20 mA saturation value	4—20 mA alarm value
Low	3.8 mA	≤ 3.6 mA
High	20.5 mA	≥ 22.6 mA

3.4.2 LCD indicator option

If your electronics are equipped with the LCD indicator (Option M5), the ALARM and SECURITY jumpers are located on the face of the indicator as shown in Figure 3-6.

Figure 3-6. LCD Indicator Alarm and Security Jumpers



3.5 Meter body installation tasks

The installation tasks include detailed mechanical and electrical installation procedures.

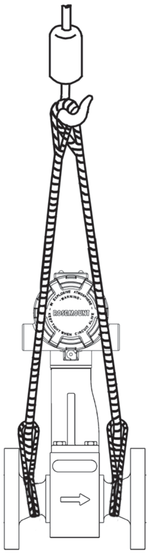
3.5.1 Handling

Handle all parts carefully to prevent damage. Whenever possible, transport the system to the installation site in the original shipping containers. Keep the shipping plugs in the conduit connections until you are ready to connect and seal them.

Note

Do not lift the flowmeter by the transmitter. Lift the meter by the meter body. Lifting supports can be tied around the meter body as shown in Figure 3-7.

Figure 3-7. Lifting Supports



3.5.2 Flow direction

Mount the meter body so the FORWARD end of the flow arrow, shown on the meter body, points in the direction of the flow in the pipe.

3.5.3 Gaskets

The Rosemount 8800D requires gaskets supplied by the user. Be sure to select gasket material that is compatible with the process fluid and pressure ratings of the specific installation.

Note
Ensure the inside diameter of the gasket is larger than the inside diameter of the flowmeter and adjacent piping. If gasket material extends into the flow stream, it will disturb the flow and cause inaccurate measurements.

3.5.4 Flange bolts

Install the Rosemount 8800D Flowmeter between two conventional pipe flanges, as shown in Figure 3-8 on page 32 and Figure 3-9 on page 32. Table 3-3, 3-4, and 3-5 list the recommended minimum stud bolt lengths for wafer-style meter body size and different flange ratings.

Table 3-3. Minimum Recommended Stud Bolt Lengths for Wafer Installation with ASME B16.5 (ANSI) Flanges

	Minimum recommended stud bolt lengths (in Inches) for each flange rating		
Line size	Class 150	Class 300	Class 600
½-inch	6.00	6.25	6.25
1-inch	6.25	7.00	7.50
1½-inch	7.25	8.50	9.00
2-inch	8.50	8.75	9.50
3-inch	9.00	10.00	10.50
4-inch	9.50	10.75	12.25
6-inch	10.75	11.50	14.00
8-inch	12.75	14.50	16.75

Table 3-4. Minimum Recommended Stud Bolt Lengths for Wafer Installation with DIN Flanges

	Minimum recommended stud bolt lengths (in mm) for each flange rating			
Line size	PN 16	PN 40	PN 63	PN 100
DN 15	160	160	170	170
DN 25	160	160	200	200
DN 40	200	200	230	230
DN 50	220	220	250	270
DN 80	230	230	260	280
DN 100	240	260	290	310
DN 150	270	300	330	350
DN 200	320	360	400	420

Table 3-5. Minimum Recommended Stud Bolt Lengths for Wafer Installation with JIS Flanges

	Minimum recommended stud bolt lengths (in mm) for each flange rating		
Line size	JIS 10k	JIS 16k and 20k	JIS 40k
15mm	150	155	185
25mm	175	175	190
40mm	195	195	225
50mm	210	215	230
80mm	220	245	265
100mm	235	260	295
150mm	270	290	355
200mm	310	335	410

3.5.5 Wafer-style flowmeter alignment and mounting

Center the wafer-style meter body inside diameter with respect to the inside diameter of the adjoining upstream and downstream piping. This will ensure the flowmeter achieves its specified accuracy.

Alignment rings are provided with each wafer-style meter body for centering purposes. Follow these steps to align the meter body for installation. Refer to Figure 3-8 on page 32.

1. Place the alignment rings over each end of the meter body.
2. Insert the studs for the bottom side of the meter body between the pipe flanges.
3. Place the meter body (with alignment rings) between the flanges. Make sure the alignment rings are properly placed onto the studs. Align the studs with the markings on the ring that correspond to the flange you are using. If a spacer is used, see Spacers and Table 3-6 below.

Note
Be sure to align the flowmeter so the electronics are accessible, the conduits drain, and the flowmeter is not subject to direct heat.

4. Place the remaining studs between the pipe flanges.
5. Tighten the nuts in the sequence shown in Figure 3-11 on page 35.
6. Check for leaks at the flanges after tightening the flange bolts.

Note
The required bolt load for sealing the gasket joint is affected by several factors, including operating pressure and gasket material, width, and condition. A number of factors also affect the actual bolt load resulting from a measured torque, including condition of bolt threads, friction between the nut head and the flange, and parallelism of the flanges. Due to these application-dependent factors, the required torque for each application may be different. Follow the guidelines outlined in ASME PCC-1 for proper bolt tightening. Make sure the flowmeter is centered between flanges of the same nominal size as the flowmeter.

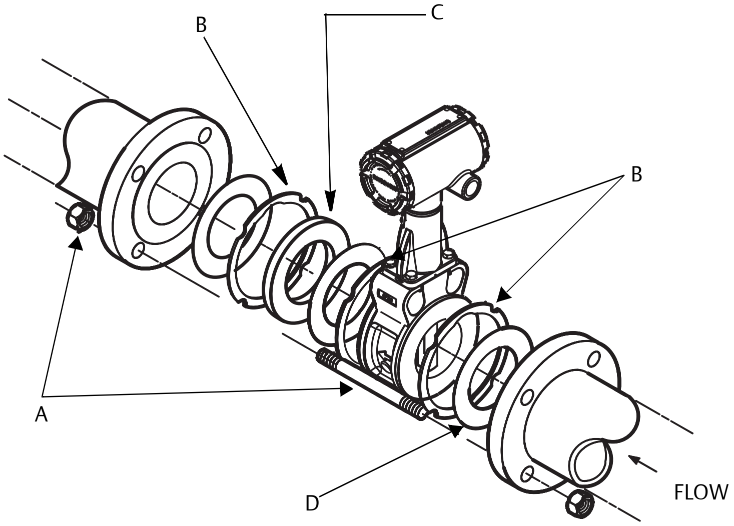
Spacers

Spacers are available with the Rosemount 8800D to maintain the Rosemount 8800A dimensions. If a spacer is used, it should be downstream of the meter body. The spacer kit comes with an alignment ring for ease of installation. Gaskets should be placed on each side of the spacer.

Table 3-6. Spacer Dimensions for 8800A Lay Length

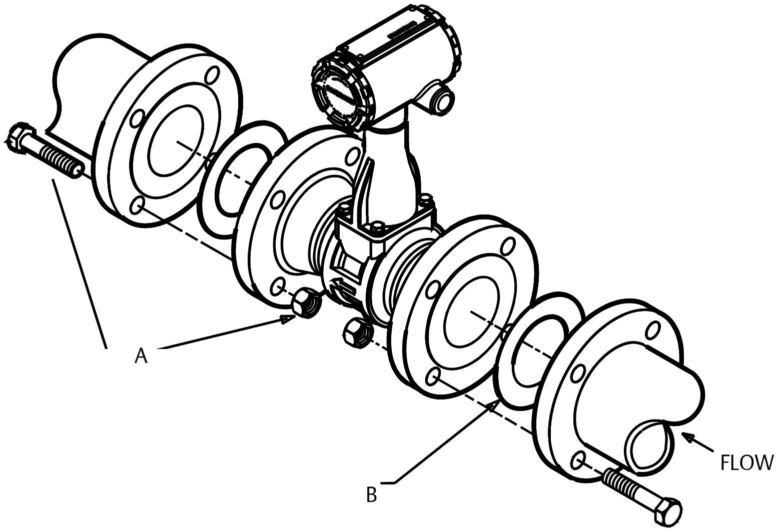
Line size	Dimensions inch (mm)
1.5 (40)	0.47 (11.9)
2 (50)	1.17 (29.7)
3 (80)	1.27 (32.3)
4 (100)	0.97 (24.6)

Figure 3-8. Wafer-Style Flowmeter Installation with Alignment Rings



A. Installation studs and nuts (supplied by customer)
B. Alignment rings
C. Spacer (for Rosemount 8800D to maintain Rosemount 8800A dimensions)
D. Gaskets (supplied by customer)

Figure 3-9. Flanged-Style Flowmeter Installation



A. Installation bolts and nuts (supplied by customer)
B. Gaskets (supplied by customer)

3.5.6 Flanged-style flowmeter mounting

Physical mounting of a flanged-style flowmeter is similar to installing a typical section of pipe. Conventional tools, equipment, and accessories (such as bolts and gaskets) are required. Tighten the nuts following the sequence shown in Figure 3-11.

Note
The required bolt load for sealing the gasket joint is affected by several factors, including operating pressure and gasket material, width, and condition. A number of factors also affect the actual bolt load resulting from a measured torque, including condition of bolt threads, friction between the nut head and the flange, and parallelism of the flanges. Due to these application-dependent factors, the required torque for each application may be different. Follow the guidelines outlined in ASME PCC-1 for proper bolt tightening. Make sure the flowmeter is centered between flanges of the same nominal size as the flowmeter.

Insert integral temperature sensor (MTA option only)

The MTA option equips the vortex meter with a Type N Thermocouple. The transmitter uses the process temperature measurement to compensate for changes in fluid density. Saturated steam mass flow rate, liquid mass flow, and corrected volumetric flow can all take advantage of the dynamic density corrections for increased accuracy.

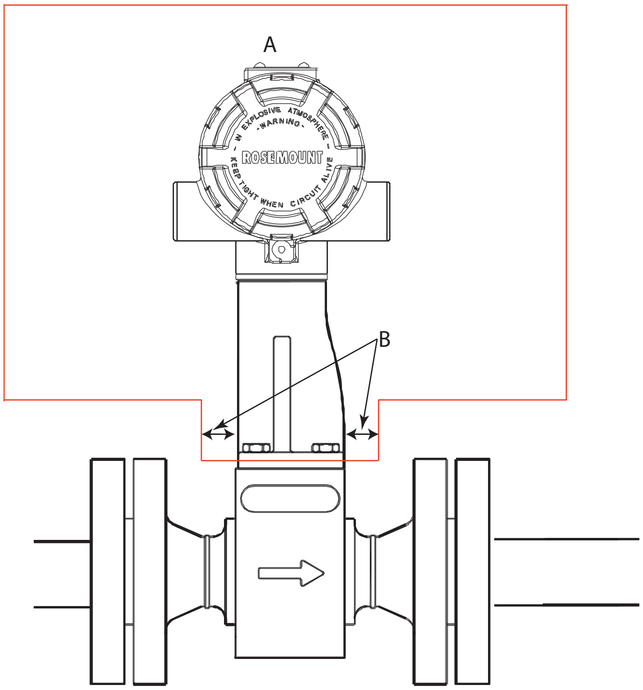
The temperature sensor is coiled and attached to the electronics bracket. Remove the Styrofoam around sensor and insert temperature sensor into the hole at the bottom of the meter body. There is no need to remove the opposite end from the electronics. Insert temperature sensor into the hole in the bottom of meter body until it reaches the bottom of the hole. Hold it in place and tighten bolt with $^1/_2$ inch open end wrench until it reaches $^3/_4$ turns past finger tight.

The meter body should be insulated to achieve stated temperature accuracy. Insulation should extend to the end of the bolt on the bottom of the meter body and should leave at least 1-in. (25 mm) of clearance around the electronics bracket. The electronics bracket and electronics housing should not be insulated. See Figure 3-10.

⚠CAUTION

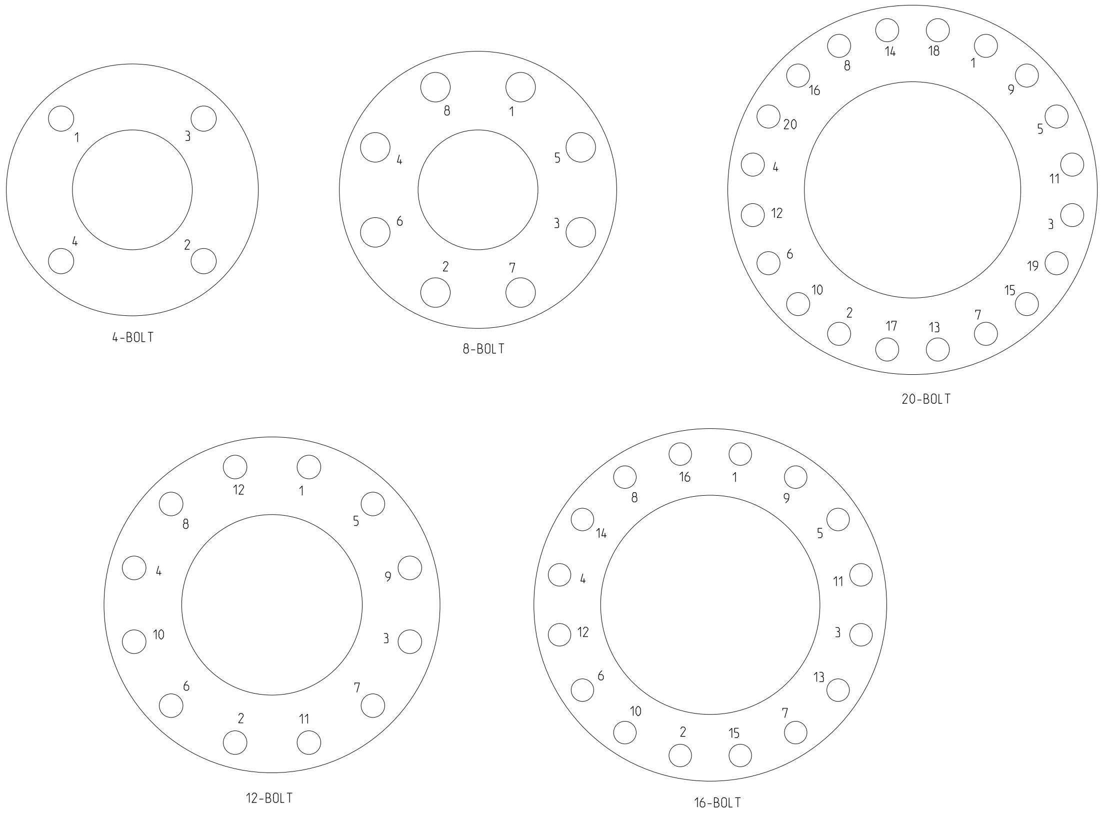
Do not loosen or remove the temperature connection at the electronics when the housing integrity needs to be maintained.

Figure 3-10. RED Area for Both Integral and Remote Electronics Connection Types



A. Do not insulate within the RED area for both integral and remote electronics connection types.
B. 1 in. (25 mm) minimum

Figure 3-11. Flange Bolt Torquing Sequence



3.5.7 Flowmeter grounding

Grounding is not required in typical vortex applications; however, a proper ground will eliminate possible noise pickup by the electronics. Grounding straps may be used to ensure that the meter is grounded to the process piping. If you are using the transient protection option (T1), grounding straps are required to provide a proper low impedance ground.

Note
Properly ground flow meter body and transmitter per the local code.

To use grounding straps, secure one end of the grounding strap to the bolt extending from the side of the meter body and attach the other end of each grounding strap to a suitable ground.

3.6 Electronics considerations

Both integral and remote mounted electronics require input power at the electronics. For remote mount installations, mount the electronics against a flat surface or on a pipe that is up to two inches in diameter.
Remote mounting hardware includes an L bracket that is stainless steel and one stainless steel u-bolt. See Appendix A: Specifications and Reference Data for dimensional information.

3.6.1 High-temperature installations

Install the meter body so the electronics are positioned to the side of or below the pipe as shown in Figure 3-2 on page 24. Insulation may be required around the pipe to maintain an ambient transmitter temperature below 185 °F (85 °C) or the more restrictive temperature ratings marked on hazardous locations tags.

3.6.2 Conduit connections

The electronics housing has two ports for $^1/_2$–14 NPT or M20 ×1.5 conduit connections. Unless marked otherwise conduit entries in the housing are $^1/_2$ NPT. These connections are made in a conventional manner in accordance with local or plant electrical codes. Be sure to properly seal unused ports to prevent moisture or other contamination from entering the terminal block compartment of the electronics housing. Additional conduit entry types are available via adapters.

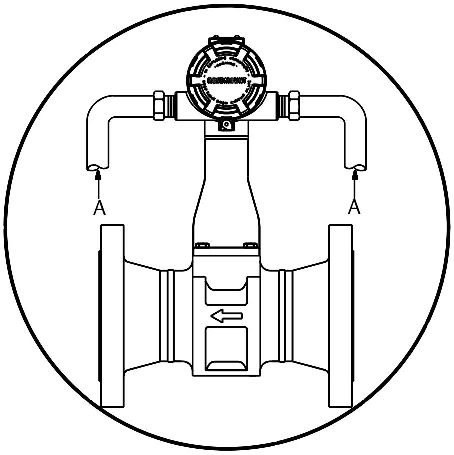
Note
In some applications it may be necessary to install conduit seals and arrange for conduits to drain to prevent moisture from entering the wiring compartment. Conduit plugs should not be removed when circuit is live or in explosive atmosphere.

3.6.3 High-point installation

Prevent condensation in any conduit from flowing into the housing by mounting the flowmeter at a high point in the conduit run. If the flowmeter is mounted at a low point in the conduit run, the terminal compartment could fill with fluid.

If the conduit originates above the flowmeter, route conduit below the flowmeter before entry. In some cases a drain seal may need to be installed.

Figure 3-12. Proper Conduit Installation with Rosemount 8800D



A. Conduit line

3.6.4 Cable gland

If you are using cable glands instead of conduit, follow the cable gland manufacturer's instructions for preparation and make the connections in a conventional manner in accordance with local or plant electrical codes. Be sure to properly seal unused ports to prevent moisture or other contamination from entering the terminal block compartment of the electronics housing.

3.6.5 Grounding the transmitter case

The transmitter case should always be grounded in accordance with national and local electrical codes. The most effective transmitter case grounding method is direct connection to earth ground with minimal impedance. Methods for grounding the transmitter case include:

- **Internal Ground Connection:** The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol (⏚), and is standard on all Rosemount 8800D transmitters.
- **External Ground Assembly:** This assembly is located on the outside of the electronics housing and is included with the optional transient protection terminal block (Option Code T1). The External Ground Assembly can also be ordered with the transmitter (Option Code V5) and is automatically included with certain hazardous area approvals.

Note
Grounding the transmitter case using the threaded conduit connection may not provide a sufficient ground. The transient protection terminal block (Option Code T1) does not provide transient protection unless the transmitter case is properly grounded. See "Transient protection" on page 46 for transient terminal block grounding. Use the above guidelines to ground the transmitter case. Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive electric current if a lightning strike occurs.

3.6.6 Wiring procedure

The signal terminals are located in a compartment of the electronics housing separate from the flowmeter electronics. Connections for a HART-based communicator and an electric current test connection are above the signal terminals. Figure 3-13 on page 38 illustrates the power supply load limitations for the flowmeter.

Note
A power disconnect is required to remove power from the transmitter for maintenance, removal, and replacement.

Power supply

The DC power supply should provide power with less than two percent ripple. The total resistance load is the sum of the resistance of the signal wiring and the load resistance of the controller, indicator, and related pieces. Note that the resistance of intrinsic safety barriers, if used, must be included.

Note

A minimum loop resistance of 250 ohms is required to exchange information with a HART-based communicator. With 250 ohms of loop resistance, the flowmeter will require a minimum power supply voltage (V_{ps}) of 16.8 volts to output 24 mA.

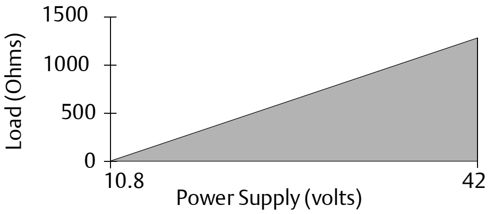
Note

If a Smart Wireless THUM™ Adapter is being used with the Rosemount 8800D flowmeter to exchange information via IEC 62591 (***Wireless***HART® Protocol) technology, a minimum loop resistance of 250 ohms is required. In addition, a minimum power supply voltage (V_{ps}) of 19.3 volts will be required to output 24 mA.

Note

If a single power supply is used to power more than one Rosemount 8800D Flowmeter, the power supply used and circuitry common to the flowmeters should not have more than 20 ohms of impedance at 1200 Hz. See Figure 3-13 and Table 3-7.

Figure 3-13. Power Supply Load Limitations



$R_{max} = 41.7(V_{ps} - 10.8)$
V_{ps} = power supply voltage (volts)
R_{max} = maximum loop resistance (ohms)

Table 3-7. Resistance Based on Wire Gauge

Gauge number A.W.G.	Ohms per 1,000 ft (305 m) at 68°F (20°C) equivalent
14	2.5
16	4.0
18	6.4
20	10
22	16
24	26

Analog output

The flowmeter provides a 4–20 mA dc isolated electric current output, linear with the flow rate.

To make connections, remove the FIELD TERMINALS side cover of the electronics housing. All power to the electronics is supplied over the 4–20 mA signal wiring. Connect the wires as shown in Figure 3-16 on page 41.

Note
Twisted pairs are required to minimize noise pickup in the 4–20 mA signal and digital communication signal. For high EMI/RFI environments, shielded signal wire is required and recommended in all other installations. To ensure communication, wiring should be 24 AWG or larger and not exceed 5,000 ft (1500 m).

Pulse output

Note
Remember when using the pulse output, all power to the electronics is still supplied over the 4–20 mA signal wiring.

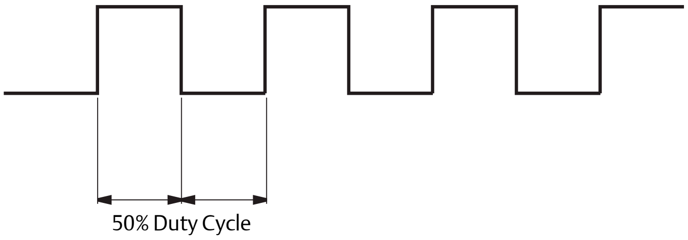
The flowmeter provides an isolated transistor switch-closure frequency output signal proportional to flow, as shown in Figure 3-14 on page 39. The frequency limits are as follows:

- Maximum Frequency = 10000 Hz
- Minimum Frequency = 0.0000035 Hz (1 pulse/79 hours)
- Duty Cycle = 50%
- External Supply Voltage (V_S): 5 to 30 V dc
- Load Resistance (R_L): 100 Ω to 100 kΩ
- Max Switching Current = 75 mA >= V_S/R_L
- Switch Closure: Transistor, open collector
  Open contact < 50 µA leakage
  Close contact < 20 Ω

The output may drive an externally powered electromechanical or electronic totalizer, or may serve as a direct input to a control element.

To connect the wires, remove the FIELD TERMINALS side cover of the electronics housing. Connect the wires as shown in Figure 3-17 on page 41.

Figure 3-14. Example: The Pulse Output will Maintain a 50 Percent Duty Cycle for all Frequencies

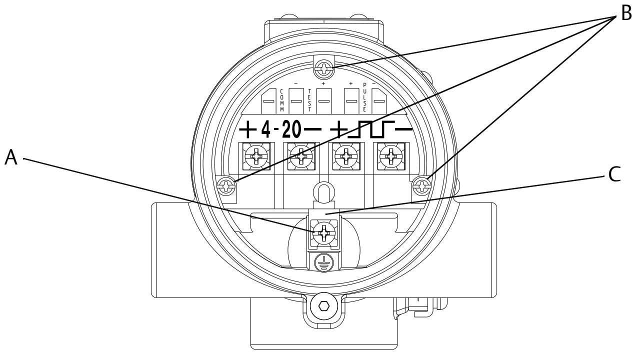


Note

When using pulse output, be sure to follow these precautions:

- Shielded twisted pair is required when the pulse output and 4–20 mA output are run in the same conduit or cable trays. Shielded wire will also reduce false triggering caused by noise pickup. Wiring should be 24 AWG or larger and not exceed 5,000 ft. (1500 m).
- Do not connect the powered signal wiring to the test terminals. Power could damage the test diode in the test connection.
- Do not run signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. If needed, ground signal wiring at any one point on the signal loop, such as the negative terminal of the power supply. The electronics housing is grounded to the meter body.
- If the flowmeter is protected by the optional transient protector, you must provide a high-current ground connection from the electronics housing to earth ground. Also, tighten the housing ground screw in the bottom of the terminal block to provide a good ground connection.

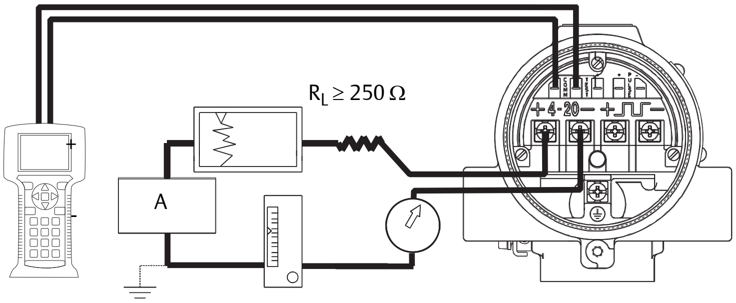
Figure 3-15. Transient Terminal Block



A. Housing ground screw
B. Captive screws
C. Transient terminal block ground tab

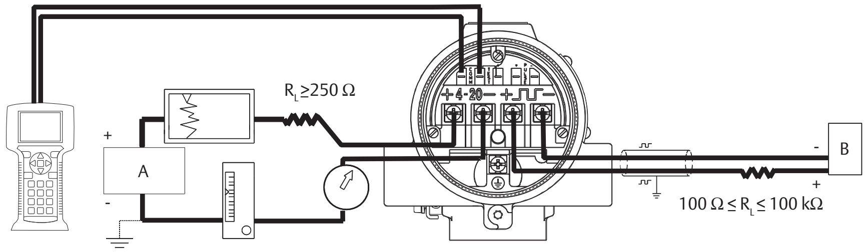
- Plug and seal all unused conduit connections on the electronics housing to avoid moisture accumulation in the terminal side of the housing.
- If the connections are not sealed, mount the flowmeter with the conduit entry positioned downward for drainage. Install wiring with a drip loop, making sure the bottom of the drip loop is lower than the conduit connections or the electronics housing.

Figure 3-16. 4-20 mA Wiring



A. Power supply

Figure 3-17. 4–20 mA and Pulse Wiring with Electronic Totalizer/Counter



A. Power supply
B. Power supply with counter

3.6.7 Remote electronics

If you order one of the remote electronics options (options R10, R20, R30, R33, R50, or Rxx), the flowmeter assembly will be shipped in two parts:

1. The meter body with an adapter installed in the support tube and an interconnecting coaxial cable attached to it.
2. The electronics housing installed on a mounting bracket.

If you order the armored remote electronics options, follow the same instructions as for the standard remote cable connection with the exception that the cable may not need to be run through conduit. Armored includes the glands.

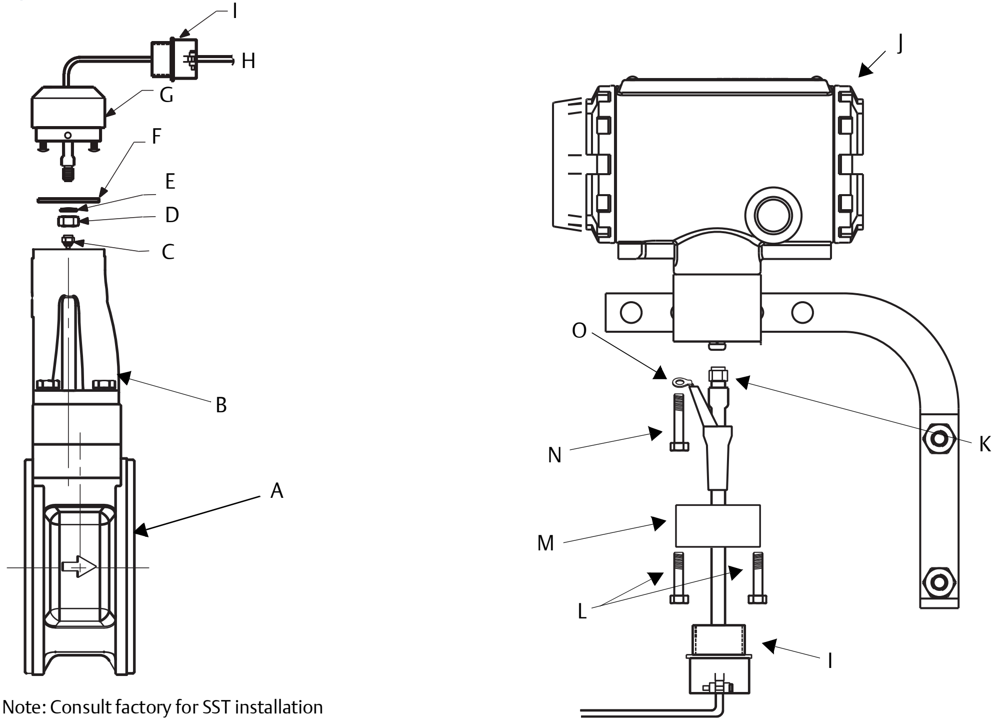
Mounting

Mount the meter body in the process flow line as described earlier in this section. Mount the bracket and electronics housing in the desired location. The housing can be repositioned on the bracket to facilitate field wiring and conduit routing.

Cable connections

Refer to Figure 3-18 and the following instructions to connect the loose end of the coaxial cable to the electronics housing. (See "Remote electronics procedure" on page 88 if connecting/disconnecting the meter adapter to the meter body.)

Figure 3-18. Remote Electronics Installation



Note: Consult factory for SST installation

A. Meter body
B. Support tube
C. Sensor cable nut
D. Nut
E. Washer
F. Union
G. Meter adapter
H. Coaxial cable
I. ½ NPT conduit adapter or cable gland (supplied by customer)
J. Electronics housing
K. Coaxial cable nut
L. Housing adapter screws
M. Housing adapter
N. Housing base screw
O. Ground connection

1. If you plan to run the coaxial cable in conduit, carefully cut the conduit to the desired length to provide for proper assembly at the housing. A junction box may be placed in the conduit run to provide a space for extra coaxial cable length.
2. Slide the conduit adapter or cable gland over the loose end of the coaxial cable and fasten it to the adapter on the meter body support tube.
3. If using conduit, route the coaxial cable through the conduit.
4. Place a conduit adapter or cable gland over the end of the coaxial cable.
5. Remove the housing adapter from the electronics housing.

6. Slide the housing adapter over the coaxial cable.
7. Remove one of the four housing base screws.
8. Attach the coaxial cable ground wire to the housing via the housing base ground screw.
9. Attach and securely tighten the coaxial cable nut to the connection on the electronics housing.
10. Align the housing adapter with the housing and attach with two screws.
11. Tighten the conduit adapter or cable gland to the housing adapter.

Caution

To prevent moisture from entering the coaxial cable connections, install the interconnecting coaxial cable in a single dedicated conduit run or use sealed cable glands at both ends of the cable.

In remote mount configurations when ordered with a hazardous area option code, the remote sensor cable and the interconnecting thermocouple cable (MTA option) are protected by separate intrinsic safety circuits, and must be segregated from each other, other intrinsically safe circuits, and non-intrinsically safe circuits per local and national wiring code.

3.6.8 Calibration

Rosemount 8800D Flowmeters are wet-calibrated at the factory and need no further calibration during installation. The calibration factor (K-factor) is indicated on each meter body and is entered into the electronics. Verification can be accomplished with a Field Communicator or AMS Device Manager.

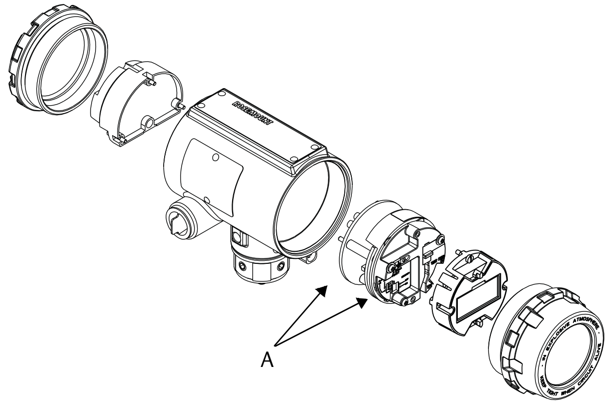
3.7 Software configuration

To complete the installation of the Rosemount 8800D Vortex Flowmeter, configure the software to meet the requirements of your application. If the flowmeter was pre-configured at the factory, it may be ready to install. If not, refer to Section 2: Configuration.

LCD display

The LCD display (option M5) provides local indication of the output and abbreviated diagnostic messages governing operation of the flowmeter. The display is located on the electronics side of the flowmeter electronics. An extended cover is required to accommodate the display. Figure 3-19 on page 44 shows the flowmeter fitted with the LCD display and extended cover.

Figure 3-19. Rosemount 8800D with Optional Indicator



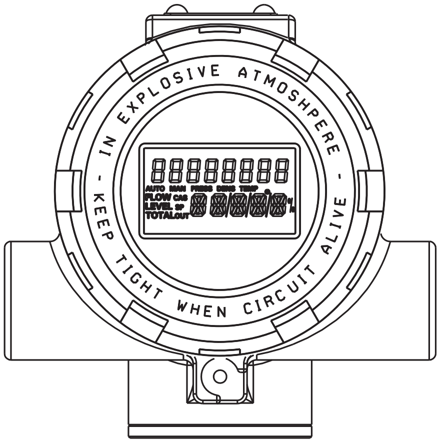
A. Electronics board

The indicator features an eight-character (and five alphanumeric) liquid crystal display that gives a direct reading of the digital signal from the microprocessor. During normal operation, the display can be configured to alternate between the following readings:

- Primary variable in engineering units
- Percent of range
- Totalized flow
- 4–20 mA electrical current output
- Shedding Frequency
- Electronics Temperature
- Pulse Output Frequency
- Process Temperature
  (MTA Option Only)
- Mass Flow
- Volume Flow
- Velocity Flow
- Calculated Process Density
  (MTA Option Only)
- Signal Strength
- Corrected Volume Flow

Figure 3-20 on page 45 shows the indicator display with all segments lit.

Figure 3-20. Optional Liquid Crystal Display



A HART-based communicator can be used to change the engineering units of the parameters displayed on the indicator. (See Section 4: Operation for more information).

3.7.1 Installing the indicator

For flowmeters ordered with the LCD indicator, the indicator is shipped installed. When purchased separately from the Rosemount 8800D, you must install the indicator using a small instrument screwdriver and the indicator kit. The indicator kit includes:

- One LCD indicator assembly
- One extended cover with o-ring installed
- One connector
- Two mounting screws
- Two jumpers

Referring to Figure 3-19 on page 44, use the following steps to install the LCD indicator:

1. If the flowmeter is installed in a loop, secure the loop and disconnect the power.
2. Remove the flowmeter cover on the electronics side.

Note
The circuit board is electrostatically sensitive. Be sure to observe handling precautions for static-sensitive components.

3. Insert the mounting screws into the LCD indicator.
4. Remove the two jumpers on the circuit board that coincide with the Alarm and the Security settings.
5. Insert the connector into the Alarm/Security junction.
6. Gently slide the LCD indicator onto the connector and tighten the screws into place.
7. Insert jumpers into ALARM and SECURITY positions on the face of the LCD indicator.
8. Attach the extended cover and tighten at least one-third turn past O-ring contact.

Note
The indicator may be installed in 90-degree increments for easy viewing. Mounting screws may need to be installed in the alternative holes based on LCD display orientation. One of the four connectors on the back of the indicator assembly must be positioned to fit into the 10-pin connector on the electronic board stack.

Note the following LCD display temperature limits:

Operating:	–4 to 185°F	(–20 to 85°C)
Storage:	–50 to 185°F	(–46 to 85°C)

3.8 Transient protection

The optional transient terminal block prevents damage to the flowmeter from transients induced by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are located in the terminal block.

The transient terminal block was verified using test waveforms specified in the following standard:

IEEE C62.41 - 2002 Category B	3 kA crest (8 X 20 µs)
	6 kV crest (1.2 X 50 µs)
	6 kV/0.5 kA (0.5 µs, 100 kHz, ring wave)

Note
The ground screw inside the terminal housing must be tightened for the proper operation of the transient protection. Also, a high-current ground connection to earth is required.

3.8.1 Installing the transient protector

For flowmeters ordered with the transient protector option (T1), the protector is shipped installed. When purchased separately from the Rosemount 8800D, you must install the protector on a Rosemount 8800D Flowmeter using a small instrument screwdriver, a pliers, and the transient protection kit.

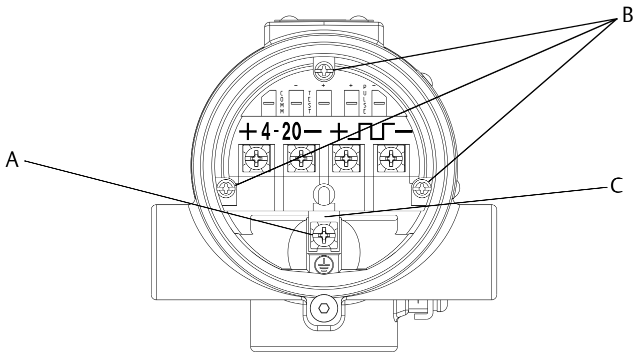
The transient protection kit includes the following:

- One transient protection terminal block assembly
- Three captive screws

Use the following steps to install the transient protector:

1. If the flowmeter is installed in a loop, secure the loop and disconnect power.
2. Remove the field terminal side flowmeter cover.
3. Remove the captive screws. Refer to Figure 3-21.
4. Remove the housing ground screw.
5. Use pliers to pull the terminal block out of the housing.
6. Inspect the connector pins for straightness.
7. Place the new terminal block in position and carefully press it into place. The terminal block may have to be moved back and forth to get the connector pins started into the sockets.
8. Tighten the captive screws.
9. Install and tighten the ground screw.
10. Replace the cover.

Figure 3-21. Transient Terminal Block



A. Housing ground screw
B. Captive screws
C. Transient terminal block ground tab

Section 4 Operation

This section contains information for advanced configuration parameters and diagnostics.

The software configuration settings for the Rosemount™ 8800D can be accessed through a HART®-based communicator or through a control system. The software functions for the Field Communicator are described in detail in this section of the manual. It provides an overview and summary of communicator functions. For more complete instructions, see the communicator manual.

Before operating the Rosemount 8800D in an actual installation, you should review all of the factory set configuration data to ensure they reflect the current application.

4.1 Diagnostics/service

Use the following functions to verify the flowmeter is functioning properly, or when you suspect component failure or a problem with loop performance, or when instructed to do so as part of a troubleshooting procedure. Initiate each test with the Field Communicator or other HART-based communications device.

4.1.1 Device Alerts

FastKeys	3, 1

Shows any active device alerts and allows the user to reset alert status to verify that corrected alerts have been cleared.

Density Test Calculation

FastKeys	3, 4, 1, 7

Allows for the density test calculation for temperature compensated density. The vortex meter will calculate the associated density at a user entered temperature value. Process Fluid must be set to Tcomp Sat Steam or Tcomp Liquid in order to run this test.

Minimum Electronics Temperature

FastKeys	3, 2, 6, 5

Displays the lowest temperature that the electronics has been exposed to.

Maximum Electronics Temperature

FastKeys	3, 2, 6, 4

Displays the highest temperature that the electronics has been exposed to.

Self Test

FastKeys	3, 4, 4, 1, 1

Although the Rosemount 8800D performs continuous self-diagnostics, you can initiate an immediate diagnostic to check for possible electronics failure.

Self test checks proper communications with the transmitter and provides diagnostic capabilities for transmitter problems. Follow on-screen instructions if problems are detected, or check the appropriate appendix for error messages relating to your transmitter. Initiating a Self Test will suspend flow measurement for up to five seconds.

Reset Transmitter

FastKeys	3, 4, 4, 1, 2

Restarts the transmitter (same as cycling power). This function does not change or reset the configuration parameters.

4.1.2 Loop Test

FastKeys	3, 5, 2, 7

Verifies the analog output of the flowmeter, the integrity of the loop, and the operation of any recorders or similar devices. Conduct the loop test after the flowmeter is installed in the field.

If the meter is located in a loop with a control system, the loop will have to be set to manual control before the loop test is performed.

Loop test allows the device to be set to any output between the 4 mA and 20 mA.

4.1.3 Flow Simulation

FastKeys	3, 5, 1

Enables the operator to verify electronics functionality. The transmitter supports internal and external flow simulation. The PV must be configured to Volume Flow, ***Velocity Flow***, Mass Flow, or ***Corrected Volume Flow*** before ***Flow Simulation*** can be enabled.

Primary Variable (PV)

FastKeys	3, 5, 1, 3, 1

Shows the primary variable value in engineering units for the flow simulation.

Shedding Frequency

FastKeys	3, 5, 1, 3, 2

Shows the shedding frequency for the flow simulation.

Simulate Flow

FastKeys	3, 5, 1, 2, 1

Allows flow simulation using either an internal or external sensor input signal.

Internal Flow Simulation

FastKeys	3, 5, 1, 2, 1, 2

Disconnects the sensor signal from the electronics, and allows for configuration of the internal flow simulation for fixed or ramped flow.

Fixed Flow

FastKeys	3, 5, 1, 2, 1, 2, 1

The fixed flow simulation signal can be entered as either a percent of range or flow rate in engineering units. This simulation locks the input signal at the configured fixed flow rate.

Ramped Flow

FastKeys	3, 5, 1, 2, 1, 2, 2

The minimum and maximum flowrate can be entered as either percent of range or as a flow rate in engineering units. The ramp time can be entered in seconds from a minimum of 0.6 seconds to a maximum of 34951 seconds. This simulation causes the output of the meter to continuously ramp from the minimum entered rate to the maximum entered rate and back over the ramp time.

External Flow Simulation (sensor offline)

FastKeys	3, 5, 1, 2, 1, 3

With external flow simulation, the sensor connection must be removed from the electronics such that an external frequency source can be used to test and verify the electronics.

Enable Normal Flow

FastKeys	3, 5, 1, 2, 1, 1

Exits the flow simulation mode (internal or external) and return to normal operation mode. Enable Normal Flow must be activated after any simulation is run. Failure to enable normal flow will leave the vortex in simulation mode.

4.1.4 Analog Trim

FastKeys	3, 4, 3, 7

Trims and verifies the analog output in a single function. If the analog output is trimmed, it will be scaled proportionally through the range of the output.

To trim the digital-to-analog output, initiate the Analog Trim function and connect an ammeter to the loop to measure the actual analog output of the meter. Follow the on-screen functions to complete the task.

4.1.5 Scaled Analog Trim

FastKeys	3, 4, 3, 8

Calibrates the flowmeter analog output using a different scale than the standard 4-20 mA output scale. Non-scaled Analog Trim (described above), is typically performed using an ammeter where calibration values are entered in units of milliamperes. Both non-scaled Analog Trim and Scaled Analog Trim allow you to trim the 4-20 mA output to approximately ±5% of the nominal 4 mA end point and ±3% of the nominal 20 mA end point. Scaled Analog Trim allows you to trim the flowmeter using a scale that may be more convenient based upon your method of measurement.

For example, it may be more convenient for you to make electrical current measurements by direct voltage readings across the loop resistor. If your loop resistor is 500 Ohms, and you want to calibrate the meter using voltage measurements made across this resistor, you could rescale (select CHANGE on the Field Communicator) your trim points from 4-20 mA to 4-20 mA x 500 ohm or 2-10 VDC. Once your scaled trim points have been entered as 2 and 10, you can now calibrate your flowmeter by entering voltage measurements directly from the voltmeter.

4.1.6 Shedding Frequency at URV

FastKeys	3, 4, 2, 1, 3

Gives the shedding frequency corresponding to the URV (Upper Range Value). If the Primary Variable (PV) is Process Temperature, the Shedding Frequency at URV represents the shedding frequency of the Volumetric Flow URV. This can be set by assigning Volumetric Flow to PV and setting range values.

4.2 Advanced functionality

The Rosemount 8800D enables the configuration of the flowmeter for a wider range of applications and special situations. Advanced configuration items not detailed in Section 2: Configuration are shown here.

Flow Sensor

FastKeys	2, 2, 1, 2

Provides information on Reference and Compensated K-factor and displays values for the Upper and Lower Sensor Limit.

Upper Sensor Limit—30 ft/s for liquids, 300 ft/s for gases, 800 °F for process temp.

Lower Sensor Limit—0 ft/s (liquid or gas), -58 °F for process temp.

The reference K-factor is factory set according to the actual K-factor for your application. It should only be changed if you replace parts of the flowmeter. Contact your Rosemount representative for details.

The compensated K-factor is based on the reference K-factor as compensated for the given process temperature, wetted materials, body number, and pipe ID. Compensated K-factor is an informational variable that is calculated by the electronics of your flowmeter.

Meter Body

FastKeys	2, 2, 1, 4

Wetted Material is a factory set configuration variable that reflects the construction of your flowmeter.

Flange Type is a factory set configuration value that reflects the flange type and rating.

Meter Body Serial Number is a factory set configuration value that identifies the meter body number.

Body Number Suffix is a factory set configuration variable that stores the body number of your particular flowmeter and the type of construction. The meter body number is found to the right of the body number on the meter body tag, which is attached to the support tube of the meter body.

The format of this variable is a number followed by an alpha character. The number designates the body number. The alpha character designates the meter body type. There are three options for the alpha character:

- None—Indicates welded meter construction
- A—Indicates welded meter construction
- B—Indicates cast construction

Meter Factor

FastKeys	2, 2, 1, 1, 7

Compensates the flowmeter for installation effects caused by less than ideal straight run piping. See reference graphs located in the Rosemount 8800 Vortex Installation Effects Technical Data Sheet for the percent of K-factor shift based on entrance effects of upstream disturbances. This value is entered as a flow multiplication factor of the range of 0.8 to 1.2.

Alarm/Saturation Levels

FastKeys	2, 2, Device Information, 3

Displays the analog output settings for high and low saturation. You can also view the alarm direction to determine if the alarm jumper on the device electronics is set to high or low.

The Alarm/Saturation Levels can also be set to either Rosemount Standard or NAMUR.

Restore Factory Calibration

FastKeys	3, 4, 3, 9

Restores factory analog trim settings.

4.2.1 Pulse Output

FastKeys	2, 2, 4, 4, 2

Can be configured using the configuration tool guided setups.

Note
Configuration of the pulse features is allowed even if the pulse option (Option P) was not ordered.

The Rosemount 8800D comes with an optional pulse output option (P). This enables the flowmeter to output the pulse rate to an external control system, totalizer, or other device. If the flowmeter was ordered with the pulse mode option, it may be configured for either pulse scaling (based on rate or unit) or shedding frequency output.

There are several methods for configuring the pulse output:

- Off
- Direct (Shedding Frequency)
- Scaled Volume
- Scaled Velocity
- Scaled Mass
- Scaled Corrected Volumetric

Note
In order to totalize in compensated mass flow, for units with the MTA option only, set pulse output to Scaled Mass even if the pulse output was not ordered or will not be used.

Direct (shedding)

This mode provides the vortex shedding frequency as output. In this mode, the software does not compensate the K-factor for effects such as thermal expansion or differing mating pipe inside diameters. Scaled pulse mode must be used to compensate the K-factor for thermal expansion and mating pipe effects.

Scaled volumetric

This mode allows for configuration of the pulse output based on a volumetric flow rate. For example, set 100 gallons per minute = 10,000 Hz. (The user enterable parameters are flow rate and frequency.)

Scaled corrected volumetric

This mode allows for configuration of the pulse output based on a corrected volumetric flow rate.

Scaled velocity

This mode allows for configuration of the pulse output based on a velocity flow rate.

Scaled mass

This mode allows for configuration of the pulse output based on based on a mass flow rate. If Process Fluid = Tcomp Sat Steam or Tcomp Liquid, this is a temperature compensated mass flow.

Pulse scaling based on flow rate

Allows the user to set a certain flow rate to a desired frequency.

For example:

1000 lbs/hr = 1000HZ

1. Enter a flow rate of 1000 lbs/hr.
2. Enter a frequency of 1000Hz.

Pulse scaling based on flow unit

Allows the user to set one pulse equal to a desired mass, volume or distance.

For example:

1 pulse = 1000lbs.

Enter 1000 for the mass.

Pulse Loop Test

FastKeys	3, 5, 3, 4

Fixed frequency mode test that checks the integrity of the pulse loop. It tests that all connections are good and that pulse output is running on the loop.

Note
The Pulse Loop Test will not check for valid pulse scaling configuration. It will set a frequency without consideration of the pulse scaling configuration.

4.2.2 Temperature Compensation

When the vortex meter is ordered with the MTA option, the transmitter is capable of dynamically compensating for changes in fluid density to provide accurate mass and corrected volumetric flow measurement. Temperature Compensation is for use with the Temperature Compensated Steam (TComp Sat Steam) or Temperature Compensated Liquids (TComp Liquid) fluid types.

Temperature Compensated Steam

FastKeys	2, 2, 1, 1, 3

To compensate for changes in saturated steam, select the Temperature Compensated Steam (TComp Sat Steam) fluid type. Choosing this fluid type automatically enables dynamic density compensation while measuring mass flow or corrected volumetric flow by using the built-in steam tables.

Temperature Compensated Liquids

FastKeys	2, 2, 1, 1, 3 (set Process Fluid Type)

Setting the Process Fluid Type to Temperature Compensated Liquids (Tcomp Liquid) directs the transmitter to dynamically compensate for changes in process density using either the built-in water density calculations per IAPWS-IF97 or the user defined temperature and density points.

Water

FastKeys	2, 2, 8, 1 (set Temp Comp Liquid to Water) 2, 2, 8, 2 (set Process Pressure)

To compensate for density changes in water, first set the Temperature Compensated Liquid (Temp Comp Liquid) fluid type to water. Then set the approximate process pressure. This will enable dynamic density compensation while measuring mass flow or corrected volumetric flow by using the built-in water density calculations.

User Defined

FastKeys	2,2,8,1 (set Temp Comp Liquid to User Defined) 2,2,8,2 (set Temperature/Density Points)

To compensate for density changes in a liquid type other than water, navigate to the Temp Comp Liquid screen using a Field Communicator and select User Defined. Next, configure the appropriate temperature and density points. Enter between 2 and 5 temperature and density points in order of ascending temperature. The transmitter will use these entered values to interpolate between and calculate the process density. This enables dynamic density compensation while measuring mass flow or corrected volumetric flow for a user defined liquid.

4.2.3 SMART Fluid Diagnostic

FastKeys	2, 2, 6

⚠ CAUTION

Due to unpredictable flow conditions and multiple potential failure modes in a process piping system, the SMART Fluid Diagnostic should not be used as a fail-safe alert when the transition from liquid to gas represents a safety hazard.

Alerts users when the fluid flow changes from liquid flow to gas flow. This is useful in oil and gas separator applications where stuck dump valves may allow gas to pass through the water leg and eventually into storage tanks. The diagnostic will alert users when gas begins flowing through the water leg. Additionally, the diagnostic can be used in blow down cycles where air, nitrogen, or steam are used to clear pipes. Once the liquid has been cleared, the meter will detect gas flow and the user can use that alert to properly time blow down cycles.

The SMART Fluid Diagnostic uses several application specific parameters to allow users to fine-tune functionality to their installation. Additionally, the diagnostic is available as a trial for 30 days on all equipped transmitters.

Control

FastKeys	2, 2, 6, 2, 1

Enables user to turn the SMART Fluid Diagnostic Functionality ON or OFF. Default is OFF unless configured for SMART Fluid Diagnostic from the factory.

Alarm Type

FastKeys	2, 2, 6, 2, 2

Enables user to select the alarm type. The alarm types are Analog, Pulse, Analog and Pulse, and Neither Analog or Pulse. This is the output that the transmitter will use to send the alarm when the meter detects a change from liquid to gas flow. In order to use the pulse output alarm, the transmitter must be equipped with the pulse output option. The default setting is Neither Analog or Pulse.

Analog Alarm

FastKeys	2, 2, 6, 2, 3

If the output type selected includes Analog, then the output level chosen here will be used for the alarm. The valid range is 3.5–22.65 mA. Default is 21.75 mA.

Pulse Alarm

FastKeys	2, 2, 6, 2, 4

If the output type selected includes pulse, then the output frequency you choose here will be used for the alarm. The valid range is 1–10,000 Hz. Default is 1 Hz.

Alarm Latch

FastKeys	2, 2, 6, 2, 5

Dictates the behavior of the alarm once gas flow is detected. If Alarm Latch is Enabled, the alarm will continue until the user resets the alarm manually (using a HART communication device such as AMS Device Manager, or handheld communicator). When Disabled, the alarm will stop once liquid flow is detected by the transmitter, at which time the meter will continue normal operation. The default is Disabled.

Optimize Gas Detection Filters

FastKeys	2, 2, 6, 2, Next

Once the gas density has been determined, optimize the gas detection filters. This consists of two parts. The first is setting the gas density and second is setting the gas detection window.

The gas density value must be selected from a list of densities. This will be used to set the detection filters for the gas flow. Choose the value from the drop down that is the closest to the process gas density without exceeding it. Default value is 0.15 lb/cu ft. After filter optimization, it is best practice to verify that your gas detection low flow cutoff is above your highest expected liquid flow rate frequency.

The Gas Detection Window specifies how long the meter will look for a gas flow event after the meter stops detecting liquid flow. Under typical conditions, the transition takes place quickly; however, if the transition is slow, then a longer window may be required. The acceptable range of values is 1 to 9 seconds and the default value is 1 second.

SMART Fluid Diagnostic Trial

FastKeys	2, 2, 7, 1

The SMART Fluid Diagnostic can be used on a trial basis for 30 days following activation of the trial. The trial period can be activated by entering "8800" in the license field. To permanently activate the diagnostic following the trial, contact Customer Support to obtain an activation code.

Licensing

FastKeys	2, 2, 7, 1, 5

Enter the license key to enable SMART Fluid Diagnostics if it was not ordered from the factory.

4.2.4 Communications

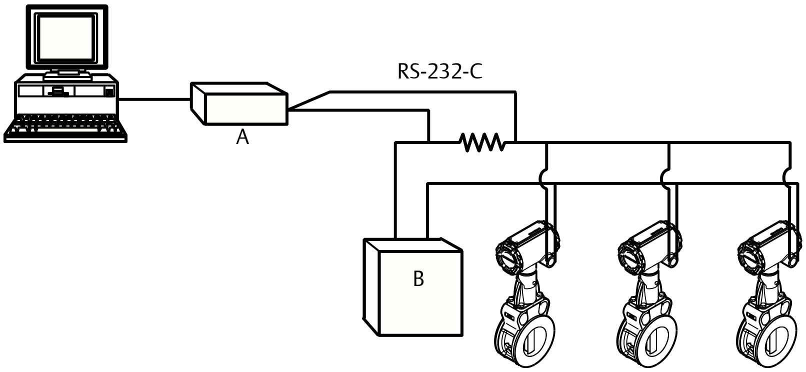
FastKeys	2, 2, HART

Multidrop configuration refers to the connection of several flowmeters to a single communications transmission line. Communication occurs digitally between a HART-based communicator or control system and the flowmeters. Multidrop mode automatically deactivates the analog output of the flowmeters. Using the HART communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased phone lines.

The use of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Multidrop installations are not recommended where intrinsic safety is a requirement. Communication with the transmitters can be accomplished with commercially available Bell 202 modems and a host implementing the HART protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol.

Figure 4-1 on page 59 shows a typical multidrop network. This figure is not intended as an installation diagram. Contact Rosemount product support with specific requirements for multidrop applications.

Figure 4-1. Typical Multi-drop Network



A. Bell 202 Modem
B. Power Supply

Note
The Rosemount 8800D is set to poll address zero at the factory, allowing it to operate in the standard point-to-point manner with a 4–20 mA output signal. To activate multidrop communication, the transmitter poll address must be changed to a number between 1 and 15. This change deactivates the 4–20 mA analog output, setting it to 4 mA, and disables the failure mode alert signal.

Poll address

FastKeys	2, 2, HART, 2, 1

Enables configuration of the poll address for a multi-dropped meter. The poll address is used to identify each meter on the multi-drop line. Follow the on-screen instructions to set the address at a number from 1 to 15. HART 7 allows an address range of 0 to 63. To set or change the flowmeter address, establish communication with the selected Rosemount 8800D in the loop.

Auto poll

FastKeys	OFF LINE FCN

When a HART-based communicator is powered up and auto polling is on, the communicator automatically polls the flowmeter addresses to which it is connected. If the address is 0, the HART-based communicator enters its normal Online mode. If it detects an address other than 0, the communicator finds each device in the loop and lists them by poll address and tag. Scroll through the list and select the meter with which you need to communicate.

If ***Auto Poll*** is off, the flowmeter must have the poll address set to 0 or the flowmeter will not be found. Additionally, if a single connected device has an address other than zero and auto polling is off, the device will not be found.

4.2.5 Burst Mode

FastKeys	2, 2, HART, 3

Burst Mode configuration

The Rosemount 8800D includes a burst mode function that broadcasts the primary variable or all dynamic variables approximately three to four times a second. The ***Burst Mode*** is a specialized function used in very specific applications. The burst mode function enables you to select the variables to broadcast while in the burst mode and to select the burst mode option. HART 7 devices offer enhanced burst mode capabilities including the ability to broadcast variable status, the ability to broadcast up to 8 variables, and the ability to trigger messages based on variable events or at defined values.

The Burst Mode variable enables you to set the burst mode to the needs of your application. Options for the burst mode setting include:

Off—Turns off the burst mode so that no data are broadcast on the loop.

On—Turns burst mode on so that the data selected under ***Burst Option*** are broadcast over the loop.

Additional command options may appear that are reserved and do not apply to the Rosemount 8800D.

Burst Option

Enables you to select the variables to broadcast over the loop:

PV—Selects the primary variable for broadcast over the loop.

Percent Range/Current—Selects the primary variable as percent of range and analog output current for broadcast over the loop.

Process vars/crnt—Selects the primary variables and analog outuput current for broadcast over the loop.

Dynamic Vars—Burst all dynamic variables in the transmitter.

Xmtr Vars—Allows the user to define custom burst variables.

4.2.6 Local Display

FastKeys	2, 2, 9

Allows user to select which variables are shown on the optional (M5) local display:

- Primary Variable
- Percent of Range
- Loop Current
- Total
- Shedding Frequency
- Process Temperature (MTA Option Only)
- Signal Strength
- Mass Flow
- Velocity Flow
- Volume Flow
- Pulse Frequency
- Electronics Temperature
- Calculated Process Density (MTA Option Only)
- Corrected Volume Flow

4.2.7 Signal Processing

FastKeys	2, 2, 5

The Rosemount 8800D and its HART-based communications feature enables the ability to filter out noise and other frequencies from the vortex signal. The four user-alterable parameters associated with the digital signal processing on the Rosemount 8800D include low-pass filter corner frequency, low-flow cutoff, trigger level, and damping. These four signal conditioning functions are configured at the factory for optimum filtering over the range of flow for a given line size, service type (liquid or gas), and process density. For most applications, leave these parameters at the factory settings. Some applications may require adjustment of the signal processing parameters.

Use signal processing only when recommended in the troubleshooting section of this manual. Some of the problems that may require signal processing include:

- High output (output saturation)
- Erratic output with or without flow present
- Incorrect output (with known flow rate)
- No output or low output with flow present
- Low total (missing pulses)
- High total (extra pulses)

If one or more of these conditions exist, and you have checked other potential sources (K-factor, service type, lower and upper range values, 4–20 mA trim, pulse scaling factor, process temperature, pipe ID), refer to Section 5: Troubleshooting. If problems persist after signal processing adjustments, consult the factory.

Optimize DSP (Digital Signal Processing

FastKeys	2, 2, 5, 5, 1

Used to optimize the range of the flowmeter based on the density of the fluid. The electronics uses process density to calculate the minimum measurable flow rate, while retaining at least a 4:1 signal to the trigger level ratio. This function will also reset all of the filters to optimize the flowmeter performance over the new range. For a stronger signal, select a density value that is lower than the actual flowing density. For dynamic process densities, select a density value that is lower than the lowest expected flowing density.

Signal Strength

FastKeys	3, 4, 2,1, 4

Variable that indicates the flow signal strength to trigger level ratio. This ratio indicates if there is enough flow signal strength for the meter to work properly. For accurate flow measurement, the value should be greater than 4. Values greater than 4 will allow increased filtering for noisy applications. For values greater than 4, with sufficient density, the Optimize DSP function can be utilized to optimize the measurable range of the flowmeter.

Values less than 4 may indicate applications with very low densities and/or applications with excessive filtering.

Manual Filter Adjust

FastKeys	2, 2, 5, 2

Allows for manual adjustment of the following settings: Low Flow Cutoff, Low Flow Cutoff Response, Low Pass Corner Frequency, and Trigger Level, while monitoring flow and or signal strength.

Low Flow Cutoff

FastKeys	2, 2, 5, 2, 2

Enables the adjustment of the filter for noise at no flow. It is set at the factory to handle most applications, but certain applications may require adjustment either to expand measurability or to reduce noise.

Low Flow Cutoff offers two modes for adjustment:

- Decrease Low Flow Cutoff
- Increase Low Flow Cutoff

It also includes a dead band such that once flow goes below the cutoff value, output does not return to the normal flow range until flow goes above the dead band. The dead band extends to approximately 20 percent above the low flow cutoff value. The dead band prevents the output from bouncing between 4 mA and normal flow range if the flow rate is near the low flow cutoff value.

LFC Response

FastKeys	2, 2, 5, 2, 3

Defines how the output of the Vortex meter will behave entering into and coming out of the Low Flow Cutoff. Options are stepped or damped. (See Technical Note 00840-0200-4004 for more information regarding Low Flow Measurement).

Low Pass Corner Frequency

FastKeys	2, 2, 5, 2, 4

Sets the low-pass filter corner frequency to minimize the effects of high frequency noise. It is factory set based on line size and service type. Adjustments may be required only if you are experiencing problems. See Section 5: Troubleshooting.

The Low Pass Filter corner frequency variable offers two modes for adjustment:

- Decrease Low Pass Corner Frequency
- Increase Low Pass Corner Frequency

Trigger Level

FastKeys	2, 2, 5, 2, 5

Configured to reject noise within the flow range while allowing normal amplitude variation of the vortex signal. Signals of amplitude lower than the Trigger Level setting are filtered out. The factory setting optimizes noise rejection in most applications. Trigger Level offers two modes for adjustment:

- Increase Trigger Level
- Decrease Trigger Level

Note

Do not adjust this parameter unless directed to do so by a Rosemount Technical Support Representative.

Restore Default Filter

FastKeys	2, 2, 5, 5, 2

Restores all of the signal conditioning variables to default values. Default values for signal conditioning variables will be set automatically depending on fluid type using the ***Optimize DSP*** function with a density setting of 40 lb/ft^3 for liquid or 0.15 lb/ft^3 for gas.

Flow Damping

FastKeys	2, 2, 5, 4

The default damping value is 2.0 seconds. ***Flow Damping*** can be reset to any value between 0.2 and 255 seconds.

Temperature Damping

FastKeys	2, 2, 5, 4 (MTA Option Only)

The default damping value is 2.0 seconds. ***Temperature Damping*** can be reset to any value between 0.4 and 32 seconds. Temperature Damping can only be configured if Temperature is assigned to be PV.

4.2.8 Device Information

FastKeys	2, 2, Device Information

Used for identification of flowmeters in the field and to store information that may be useful in service situations. Information variables have no effect on flowmeter output or process variables.

Tag

FastKeys	2, 2, Device Information, 1, 1

The quickest variable to identify and distinguish between flowmeters. Flowmeters can be tagged according to the requirements of your application. The tag may be up to eight characters long. HART 7 supports Long Tag, which allows up to 32 characters.

Long Tag

FastKeys	2, 2, Device Information, 1, 2

Available for HART® 7 and allows for up to 32 characters

Descriptor

FastKeys	2, 2, Device Information, 1, 6

Longer user-defined variable to assist with more specific identification of the particular flowmeter. It is usually used in multi-flowmeter environments and provides 16 characters.

Message

FastKeys	2, 2, Device Information, 1, 7

Provides an even longer user-defined variable for identification and other purposes. It provides 32 characters of information and is stored with the other configuration data.

Date

FastKeys	2, 2, Device Information, 1, 5

User-defined variable that provides a place to save a date, typically used to store the last date that the transmitter configuration was changed.

Write Protect

FastKeys	2, 2, Device Information, 4, 1

Read-only informational variable that reflects the setting of the hardware security switch. If Write Protect is ON, configuration data are protected and cannot be changed from a HART-based communicator or control system. If Write Protect is OFF, configuration data may be changed using the communicator or control system. For HART 7 devices, a software lock is also available.

Revision Numbers

FastKeys	2, 2, Device Information, 2

Fixed informational variables that provide the revision number for different elements of your Field Communicator and Rosemount 8800D. These revision numbers may be required when calling the factory for support. Revision numbers can only be changed at the factory and are provided for the following elements:

Universal Revision

FastKeys	2, 2, Device Information, 2, 1

Designates the HART Universal Command specification to which the transmitter is designed to conform.

Transmitter Revision

FastKeys	2, 2, Device Information, 2, 2

Designates the revision for Rosemount 8800D specific command identification for HART compatibility.

Software Revision

FastKeys	2, 2, Device Information, 2, 3

Designates the internal software revision level for the Rosemount 8800D.

Hardware Revision

FastKeys	2, 2, Device Information, 2, 4

Designates the revision level for the Rosemount 8800D hardware.

DD Revision

FastKeys	2, 2, Device Information, 2, 5

Factory-defined unique identifier for device descriptor revision identification in the software.

4.2.9 Change HART Revisions

FastKeys	2, 2, HART, 2, Change HART Rev

On enabled devices, change between HART revision 5 and 7. Configuration will be saved while switching between revisions.

4.2.10 Locate Device

FastKeys	3, 4, 4, 2

For HART 7 devices with LCD displays, enabling Locate Device displays the characters "0-0-0-0" on the LCD display. This allows for easy field identification of the device during commissioning or service.

Section 5 Troubleshooting

"Troubleshooting tables" on page 68 provides summarized troubleshooting suggestions for the most common problems that occur during operation. The symptoms of metering problems include:

- Communications problems with a HART®-based communicator
- Incorrect 4–20 mA output
- Incorrect pulse output
- Error messages on HART-based communicator
- Flow in pipe but no transmitter output
- Flow in pipe with incorrect transmitter output
- Output with no actual flow

Note
The Rosemount™ 8800D Sensor is extremely reliable and should not have to be replaced. Please consult the factory before removing the sensor.

5.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Refer to the following safety messages before performing any in this section.

⚠ WARNING

Explosions could result in death or serious injury.

- Do not remove the transmitter cover or thermocouple (MTA option only) from the electronics housing in explosive atmospheres when the circuit is alive.
- Before connecting a HART-based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.

⚠ CAUTION

The sensor cavity could contain line pressure if an abnormal failure has occurred inside the meter body. De-pressurize flow line before removing sensor nut.

5.2 Troubleshooting tables

The most common problems experienced by users of the Rosemount 8800D are listed in Table 5-1 along with potential causes of the problem and suggested corrective actions. If the problem you are experiencing is not listed here, see the Advanced Troubleshooting section.

Table 5-1. Troubleshooting Table

Symptom	Corrective action	
Communication problems with HART-based Communicator	• Check for a minimum of 10.8 Vdc at transmitter terminals. • Check communications loop with HART-based communicator. • Check for loop resistor (250 to 1000 ohms). • Measure loop resistor value (R_{loop}) and source power supply voltage (V_{ps}). Check that [V_{ps} - (R_{loop} x 0.024)] > 10.8 Vdc.	• Check for transmitter in multidrop mode. • Check for transmitter in burst mode. • Remove pulse connection if you have a three wire pulse installation. • Replace electronics.

Symptom	Corrective action	
Incorrect 4–20 mA Output	• Check for minimum 10.8 Vdc at transmitter terminals. • Check URV, LRV, Density, Special Units, LFC–compare these inputs with the sizing program results. Correct configuration. • Perform 4–20 mA loop test.	• Check for corrosion on terminal block. • Replace electronics if necessary. • Refer to Advanced troubleshooting . • See Appendix C: Electronics Verification for electronics verification procedure.
Incorrect Pulse Output	• Check that 4–20 mA output is correct. • Check pulse counter specifications. • Check pulse mode and scaling factor. (Make sure scaling factor is not inverted).	• Perform pulse test. • Select pulse scaling so that pulse output is less than 10,000Hz at URV.
Error Messages on HART-based Communicator	• See alphabetical listing in the Error Messages Table for the communicator starting at Diagnostic messages .	
Flow in Pipe, No Output	**Basics** • Check to make sure the meter is installed with the arrow in the direction of process flow. • Perform basic checks for Incorrect 4–20 mA Output Problem (see Incorrect 4–20 mA Output). • Check and correct configuration parameters in this order: Process Config - transmitter mode, process fluid, fixed process temperature, density, reference K-factor, flange type, mating pipe ID, variable mapping, PV unit, range values - (URV, LRV), PV damping, auto filter adjust, pulse mode and scaling (if used). • Check sizing. Make sure flow is within measurable flow limits. Use Instrument Toolkit for best sizing results. • Refer to Advanced troubleshooting . • See Appendix C: Electronics Verification for electronics verification procedure. **Electronics** • Run a self test with a HART-based interface tool. • Using sensor simulator, apply test signal. • Check configuration, LFC, trigger level, STD vs. actual flow units. • Replace electronics.	**Application Problems** • Calculate expected frequency (see Appendix C: Electronics Verification). If actual frequency is the same, check configuration. • Check that application meets viscosity and specific gravity requirements for the line size. • Recalculate back pressure requirement. If necessary and possible, increase back pressure, flow rate, or operating pressure. **Sensor** • Inspect coaxial sensor cable for cracks. Replace if necessary. • Check that sensor impedance at process temperature is > 1 Mega-Ohm (will function down to 0.5 Mega-Ohms). Replace sensor if necessary (Replacing the sensor). • Measure sensor capacitance at SMA connector (115-700pF). • Check torque on sensor nut (32 ft-lb). For 1-8 inch meter body with ANSI 1500 flanges torque on sensor nut should be 50 ft-lbs.

5.3 Advanced troubleshooting

The Rosemount 8800D electronics provides several advanced troubleshooting features. These features enhance your ability to look inside the electronics and can be helpful for troubleshooting inaccurate readings. As shown in Figure 5-1, there are several test points located on the electronics.

5.3.1 Diagnostic messages

The Field Communicator diagnostic messages and their corresponding descriptions are shown in Table 5-2.

Table 5-2. Field Communicator Diagnostic Messages

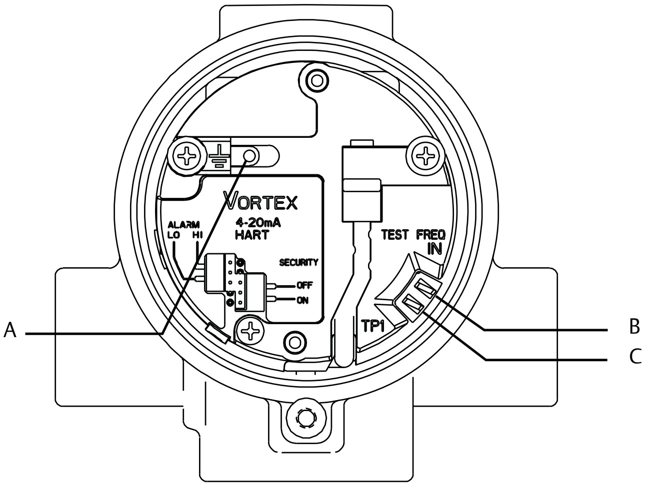
Message	Description
ROM CHECKSUM ERROR	The EPROM memory checksum test has failed. The transmitter will remain in ALARM until the ROM checksum test passes.
NV MEM CHECKSUM ERROR	The User Configuration area in Nonvolatile EEPROM memory has failed the checksum test. It is possible to repair this checksum by verifying and reconfiguring ALL transmitter parameters. The transmitter will remain in ALARM until the EEPROM checksum test passes.
RAM TEST ERROR	Transmitter RAM memory test has detected a failed RAM location. The transmitter will remain in ALARM until the RAM test passes.
DIGITAL FILTER ERROR	The digital filter in the transmitter electronics is not reporting. The transmitter will remain in ALARM until the digital signal processor resumes reporting flow data.
COPROCESSOR ERROR	If this occurs at power-up, the RAM/ROM test in the coprocessor has failed. If this occurs during normal operations, the coprocessor has reported either a math error or a negative flow. This is a FATAL error and the transmitter will remain in ALARM until reset.
SOFTWARE DETECTED ERROR	The software has detected corrupted memory. One or more of the software tasks has corrupted memory. This is a FATAL error and the transmitter will remain in ALARM until reset.
ELECTRONICS FAILURE	This is a summary error indication. This error will be reported if any of the following error conditions are present: 1. ROM Checksum Error 2. NV Memory Checksum Error 3. RAM Test Error 4. ASIC Interrupt Error 5. Digital Filter Error 6. Coprocessor Error 7. Software Detected Error
TRIGGER LEVEL OVERRANGE	The trigger level in the transmitter digital signal processing has been set beyond its limit. Use manual filter adjustment to "Increase Filtering" or "Increase Sensitivity" to bring the trigger level back within range.
LOW PASS FILT OVERRANGE	The low pass filter in the transmitter digital signal processing has been set beyond its limit. Use manual filter adjustment to "Increase Filtering" or "Increase Sensitivity" to bring the low pass filter adjustment back within range.
ELECTRONICS TEMP OUT OF LIMITS	The electronics temperature sensor within the transmitter is reporting a value out of range.
INVALID CONFIGURATION	Certain configuration parameters are out of range. Either they have not been properly configured, or they have been forced out of range as a result of a change to a related parameter. For example: When using mass flow units, changing the process density to a value too low could push the configured Upper Range Value beyond the sensor limit. In this case, the Upper Range Value would need to be reconfigured.
FACTORY EEPROM CONFIG ERROR	The factory configured values in non-volatile EEPROM memory have become corrupted. This is a FATAL error. The transmitter will remain in ALARM until reset.
LOW FLOW CUTOFF OVERRANGE	On start-up, the configured setting for the VDSP Low Flow Cutoff setting was found to be too high or too low. The increase range or decrease no flow noise command of the VDSP Low Flow Cutoff setting has not yet brought the setting into a valid range. Continue adjusting the Low Flow Cutoff to a valid value or use the Filter Restore Option.
T/C A/D ERROR	The ASIC responsible for the analog to digital conversion of the process temperature thermocouple and cold junction RTD has failed. If the problem persists, replace the transmitter electronics.
THERMOCOUPLE OPEN	The thermocouple that is used to measure the process temperature has failed. Check the connections to the transmitter electronics. If the problem persists, replace the thermocouple.
CJ RTD FAILURE	The RTD temperature sensing device for sensing the cold junction temperature has failed. If the problem persists, replace the transmitter electronics.

Message	Description
FLOW SIMULATION	The transmitter flow signal is being simulated by a signal generator internal to the transmitter. The actual flow through the meter body is NOT being measured.
SENSOR SIGNAL IGNORED	The transmitter flow signal is being simulated by a signal generator external to the transmitter. The actual flow through the meter body is NOT being measured.
LOW LOOP VOLTAGE	The voltage at the transmitter terminals has dropped to a level that is causing the internal voltage supplies to drop, reducing the capability of the transmitter to accurately measure a flow signal. Check the terminal voltage and either increase the power supply voltage or reduce loop resistance.
INTERNAL COMM FAULT	After several attempts, the microprocessor failed in communication with the Sigma-Delta ASIC. A power cycle may resolve the problem. Also, check the inter-board connector. If the problem persists, replace the transmitter electronics.
INTERNAL SIGNAL FAULT	The flow data encoded on a pulse signal from the Sigma-Delta ASIC to VDSP has been lost. A power cycle may resolve the problem. Also check the inter-board connector. If the problem persists, replace the transmitter electronics.
FACTORY NV MEM CONFIG ERROR	A segment of nonvolatile memory that is written only at the factory has failed a checksum verification. This fault ***cannot*** be fixed by reconfiguring the transmitter parameters. Replace the transmitter electronics.
TEMPERATURE ELECTRONICS FAILURE	The electronics circuitry that supports the measurement of the Process Temperature has failed. The transmitter can still be used in a non-Process Temperature mode.
PROCESS TEMP OUT OF RANGE	The Process Temperature is beyond the defined sensor limits of -50 °C to 427 °C.
PROCESS TEMP ABOVE DENSITY CALCULATION LIMITS	The calculation of temperature compensated process density is no longer accurate. Reduce the process temperature or verify device configuration.
PROCESS TEMP BELOW DENSITY CALCULATION LIMITS	The calculation of temperature compensated process density is no longer accurate. Increase the process temperature or verify device configuration.
FIXED PROCESS TEMPERATURE IS ACTIVE	Due to a problem detected with the thermocouple, a configured fixed Process Temperature is being substituted for the measured Process Temperature. This fixed Process Temperature is also being used in saturated steam density calculations.
INVALID MATH COEFF	The area of nonvolatile memory used to store the curve fit coefficients for the coprocessor calculations does not contain valid data. This data can only be loaded at the factory. Replace the transmitter electronics.
CJ TEMP ABOVE SENSOR LIMITS	The temperature reported from the Cold Junction temperature sensor is above CJ sensor limits.
CJ TEMP BELOW SENSOR LIMITS	The temperature reported from the Cold Junction temperature sensor is below CJ sensor limits.

5.3.2 Electronics test points

As shown in Figure 5-1, there are several test points located on the electronics.

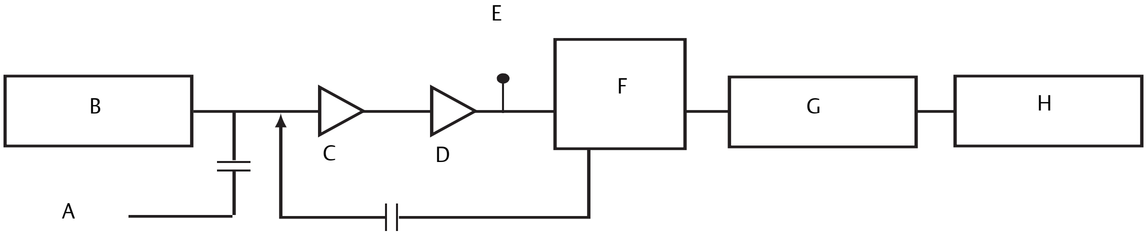
Figure 5-1. Electronics Test Points



A. Ground
B. Test Frequency IN
C. TP1

The electronics is capable of internally generating a flow signal that may be used to simulate a sensor signal to perform electronics verification with a handheld communicator or AMS™ Device Manager interface. The simulated signal amplitude is based on the transmitter required minimum process density. The signal being simulated can be one of several profiles – a simulated signal of constant frequency or a simulated signal representative of a ramping flow rate. The electronics verification procedure is described in detail in Appendix C: Electronics Verification. To verify the electronics, you can input a frequency on the “TEST FREQ IN” and “GROUND” pins to simulate flow via an external signal source such as a frequency generator. To analyze and/or troubleshoot the electronics, an oscilloscope (set for AC coupling) and a handheld communicator or AMS Device Manager interface are required. Figure 5-2 is a block diagram of the signal as it flows from the sensor to the microprocessor in the electronics.

Figure 5-2. Signal Flow



A. External Test Frequency Input
B. Sensor
C. Charge Amplifier
D. Amplifier/Low Pass Filter
E. TP1
F. A-to-D Converter/Internal Frequency Generator
G. Digital Filter
H. Microprocessor

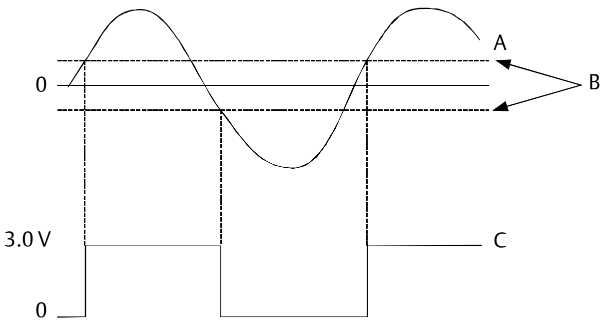
5.3.3 TP1—Test point 1

TP1 is the vortex shedding signal after it has gone through the charge amplifier and low pass filter stages and into the input of the sigma delta A-to-D converter ASIC in the electronics. The signal strength at this point will be in the mV to Volt range.

TP1 is easily measured with standard equipment.

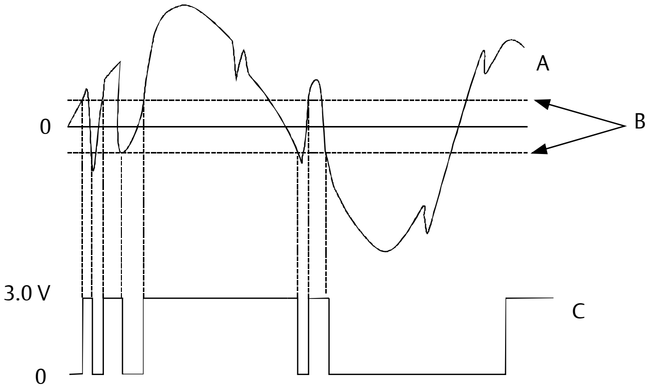
Figues 5-4, and 5-5 show waveforms that may cause the output to be inaccurate. Figure 5-3 shows an ideal (clean) waveform. Please consult the factory if the waveform you detect is not similar in principle to Figure 5-3.

Figure 5-3. Clean Signals



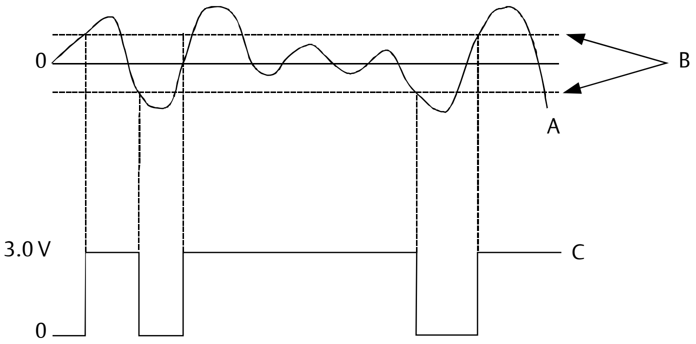
A. Vortex signal (TP1)
B. Trigger level
C. Shedding frequency output

Figure 5-4. Noisy Signals



A. Vortex signal (TP1)
B. Trigger level
C. Shedding frequency output

Figure 5-5. Improper Sizing/Filtering



A. Vortex signal (TP1)
B. Trigger level
C. Shedding frequency output

5.4 Diagnostic messages on LCD display

In addition to the output, the LCD display displays diagnostic messages for troubleshooting the flowmeter. These messages are as follows:

SELFTEST

The flowmeter is in the process of performing an electronics self test.

FAULT_ROM

The flowmeter electronics has undergone a EPROM checksum fault. Contact your Field Service Center.

FAULT_EEROM

The flowmeter electronics has undergone a EEPROM checksum fault. Contact your Field Service Center.

FAULT_RAM

The flowmeter electronics has undergone a RAM test fault. Contact your Field Service Center.

FAULT_ASIC

The flowmeter electronics has undergone a digital signal processing ASIC update fault. Contact your Field Service Center.

FAULT_CONFG

The flowmeter electronics has lost critical configuration parameters. This message will be followed by information detailing the missing configuration parameters. Contact your Field Service Center.

FAULT_COPRO

The flowmeter electronics has detected a fault in the math coprocessor. Contact your Field Service Center.

FAULT_SFTWR

The flowmeter electronics has detected a non-recoverable fault in the software operation. Contact your Field Service Center.

FAULT_BDREV

The flowmeter electronics has detected incompatible electronics hardware. Contact your Field Service Center.

FAULT_SDCOM

The flowmeter electronics has detected an unexpected sigma-delta ASIC communications fault. Contact your Field Service Center.

FAULT_SDPLS

The flowmeter electronics has detected a loss of flow data from the sigma-delta ASIC. Contact your Field Service Center.

FAULT_TASK(#)

The flowmeter electronics has detected a fatal error. Record (#) and contact your Field Service Center.

FAULT_COEFF

The area of NV memory used to store the curve fit coefficients for the coprocessor calculation does not contain valid data. This data can only be loaded at the factory. Contact your Field Service Center.

FAULT_TACO (MTA option only)

The ASIC responsible for the analog to digital conversion of the process temperature has failed. Contact your Field Service Center.

FAULT_TC (MTA option only)

The temperature sensor that is used to measure the process temperature has failed. Contact your Field Service Center.

FAULT_RTD (MTA option only)

The RTD for cold junction compensation has failed. Contact your Field Service Center.

SIGNAL_SIMUL

The transmitter flow signal is being simulated by a signal generator internal to the transmitter. The actual flow through the meter body is NOT being measured.

SENSOR_OFFLINE

The transmitter flow signal is being simulated by a signal generator external to the transmitter. The actual flow through the meter body is NOT being measured.

FAULT_LOOPV

The voltage at the transmitter terminals has dropped to a level that is causing the internal voltage supplies to drop, reducing the capability of the transmitter to accurately measure a flow signal. Check the terminal voltage and either increase the power supply voltage or reduce loop resistance.

5.5 Testing procedures

Use the test functions to verify that the flowmeter is functioning properly, or when you suspect component failure or a problem with loop performance, or when instructed to do so as part of a troubleshooting procedure. Initiate each test with a HART-based communications device. See “Diagnostics/service” on page 49 for details.

5.6 Hardware replacement

The following procedures will help you disassemble and assemble the Rosemount 8800D hardware if you have followed the troubleshooting guide earlier in this section of the manual and determined that hardware components need to be replaced.

Note
Use only the procedures and new parts specifically referenced in this manual. Unauthorized procedures or parts can affect product performance and the output signal used to control a process, and may render the instrument dangerous.

⚠ **Note**
Process should be vented before the meter body is removed from service for disassembly. Flowmeters should not be left in service once they have been determined to be inoperable.

5.6.1 Replacing the terminal block in the housing

To replace the field terminal block in the housing, you will need a small screwdriver. Use the following procedure to replace the terminal block in the housing of the Rosemount 8800D.

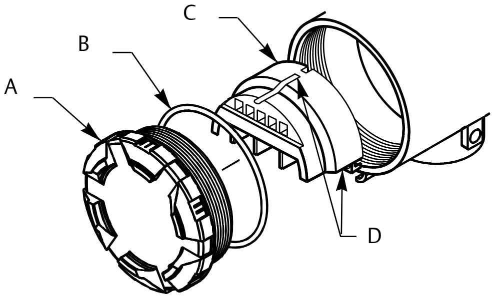
⚠ **Note**
Remove power before removing the electronics cover.

Remove the terminal block

1. Turn off the power to the Rosemount 8800D.
2. Unscrew the cover. Refer to Figure 5-6.

⚠ See "Safety messages" on page 68 for complete warning information.

Figure 5-6. Terminal Block Assembly



A. Cover
B. O-ring
C. Terminal block
D. Captive screws (3x)

3. Disconnect the wires from the field terminals. Be sure to secure them out of the way.
4. Remove the ground screw if transient protection (Option T1) is installed.
5. Loosen the three captive screws.
6. Pull outward on the terminal block to remove it from the housing.

Install the terminal block

1. Align the socketed holes on the back side of the terminal block over the pins protruding from the bottom of the housing cavity in the terminal block side of the electronics housing.
2. Slowly press the terminal block into place. Do not force the block into the housing. Check the alignment if it does not glide into place.
3. Tighten the three captive screws to anchor the terminal block.
4. Connect the wires to the appropriate field terminals.
5. Reinstall and tighten the transient ground screw if you have the transient option (Option T1).
6. Screw on and tighten the cover.

5.6.2 Replacing the electronics boards

The Rosemount 8800D electronics boards may need to be replaced if they have been damaged or otherwise become dysfunctional. Use the following procedures to replace electronics boards in the Rosemount 8800D. You will need a small Phillips head screwdriver and pliers.

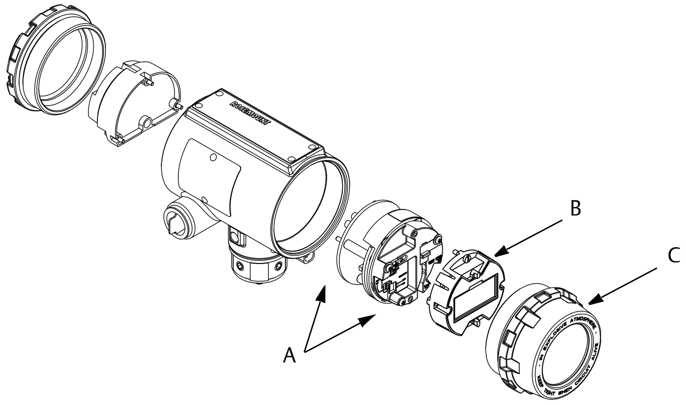
Note
The electronics boards are electrostatically sensitive. Be sure to observe handling precautions for static-sensitive components.

⚠ **Note**
Remove power before removing the electronics cover.

Remove the electronics boards

1. Turn off the power to the Rosemount 8800D.
2. Unscrew and remove the electronics board compartment cover. (Unscrew and remove the LCD display cover if you have the LCD display option).

Figure 5-7. Electronics Boards Assembly



A. Electronics boards
B. LCD display
C. LCD display cover

3. If the meter has the LCD display option, loosen the two screws. Remove the LCD display and the connector from the electronics board.
4. Loosen the three captive screws that anchor the electronics.
5. Use pliers or a flathead screwdriver to carefully remove the sensor cable clip from the electronics.
6. Remove thermocouple if MTA option installed.
7. Use the handle molded into the black plastic cover to slowly pull the electronics boards out of the housing.

Install the electronics boards

1. Verify that power to the Rosemount 8800D is off.
2. Align the sockets on the bottom of the two electronics boards over the pins protruding from the bottom of the housing cavity.
3. Carefully guide the sensor cable through the notches on the edge of the circuit boards.
4. Slowly press the boards into place. Do not force the boards down. Check the alignment if they do not glide into place.
5. Carefully insert sensor cable clip into electronics board.
6. Tighten the three captive screws to anchor the two electronics boards. Ensure that the SST washer is under the screw in the 2 o’clock position.
7. Reinsert the alarm and security jumpers into the correct location.
8. If the meter has LCD display option, insert the connector header into the LCD display board.
    a. Remove jumpers from the electronics board.
    b. Put the connector through the bezel on the electronics board.
    c. Carefully press the LCD display onto the electronics board.
    d. Tighten the two screws that retain the LCD display.
    e. Insert the alarm and security jumpers in the correct location.
9. Replace the electronics board compartment cover.

5.6.3 Replacing the electronics housing

The Rosemount 8800D electronics housing can be replaced easily when necessary. Use the following procedure:

Tools needed

- $^{5}/_{32}$-in. (4 mm) hex wrench
- $^{5}/_{16}$-in. (8 mm) open end wrench
- Screwdriver to disconnect wires
- Tools to disconnect conduit

⚠ **Note**
Remove power before removing the electronics housing.

Remove the electronics housing

1. Turn off the power to the Rosemount 8800D.
2. Remove the terminal block side cover.
3. Disconnect the wires and conduit from the housing.
4. Use a 5/32-in. (4 mm) hex wrench to loosen the housing rotation screws (at the base of the electronics housing) by turning screws clockwise (inward) until they clear the bracket.
5. Slowly pull the electronics housing no more than 1.5-in. (40 mm) from the top of the support tube.
6. Loosen the sensor cable nut from the housing with a 5/16-in. (8 mm) open end wrench.

Note
Lift the electronics housing until the sensor cable nut is exposed. Do not pull the housing more than 1.5-in. (40 mm) from the top of the support tube. Damage to the sensor may occur if this sensor cable is stressed.

Install the electronics housing

1. Verify that power to the Rosemount 8800D is off.
2. Screw the sensor cable nut onto the base of the housing.
3. Tighten the sensor cable nut with a 5/16-in. (8 mm) open end wrench.
4. Place the electronics housing into the top of the support tube.
5. Use a hex wrench to turn the three hex socket screws counterclockwise (outward) to engage support tube.
6. Place the access cover on the support tube (if applicable).
7. Tighten the screw on the access cover.
8. Connect conduit and wires.
9. Replace the terminal block cover.
10. Apply power.

5.6.4 Replacing the sensor

The sensor for the Rosemount 8800D is a sensitive instrument that should not be removed unless there is a problem with it. If you must replace the sensor, follow these procedures closely. Please consult the factory before removing the sensor.

Note
Be sure to fully check all other troubleshooting possibilities before removing the sensor.

Do not remove the sensor unless it is determined that a problem exists with the sensor itself. The sensor may not fit on the post if it is removed and replaced more than two or three times, or replaced incorrectly.

Also, please note that the sensor is a complete assembly and cannot be further disassembled.

Tools needed

- $^{5}/_{32}$-in. (4 mm) hex wrench
- $^{5}/_{16}$-in. (8 mm) open end wrench
- $^{7}/_{16}$-in. (11 mm) open end wrench
- $^{3}/_{4}$-in. (19 mm) open end wrench (for 3- and 4-in. [80 and 100 mm] SST wafers)
- 1$^{1}/_{8}$-in. (28 mm) open end wrench (for all other models)
- Suction or compressed air device
- Small, soft bristle brush
- Cotton swabs
- Appropriate cleaning liquid: water or cleaning agent

5.6.5 Replacing the sensor: removable support tube

The following procedure applies to flowmeters equipped with a removable support tube.

Note
Sensor cavity could contain line pressure if an abnormal failure has occurred inside the meter body. See "Safety messages" on page 68 for complete warning information.

---

1. If the meter body is not a CriticalProcess™ Vortex (CPA Option) proceed to step 6.
2. Welded onto the side of the meter body is a valve. Move any nearby equipment from the line of sight of the valve tube, if possible. Protect other equipment with shielding, cover, or other type of protection.
3. Position all personnel away from the line of sight of the valve tube.

Note
There are numerous tube fittings that could connect to the tube if there is a need to drain away process material. The tube on the valve has a $^3/_{16}$" OD with a 0.035" wall thickness.

4. Using a $^7/_{16}$-in. (11-mm) open end wrench, slowly loosen the valve nut. Back out the nut until it stops. There is a set screw which prevents the nut from being completely removed.

5. Process fluid venting from the valve tube indicates that there is process fluid in the sensor cavity.
   a. If there is no process fluid in the sensor cavity, continue to step 7.
   b. If there is process fluid in the sensor cavity, immediately re-tighten the valve nut until process fluid stops venting. Do NOT tighten any further. STOP and contact your Rosemount Sales Representative. The meter body may need to be replaced.

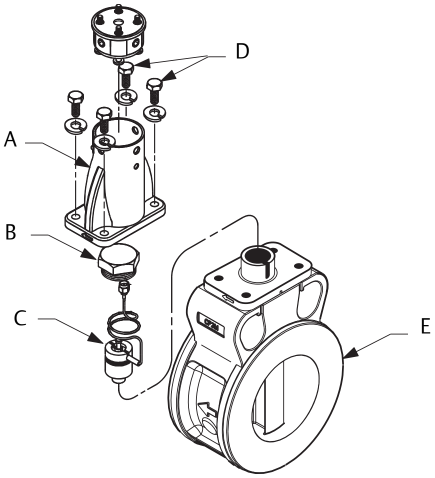
6. De-pressurize the flow line.

7. Remove the electronics housing (see "Replacing the electronics housing" on page 80).

Removable support tube

8. Loosen the four support tube anchor bolts with a $^7/_{16}$-in. open end wrench. See Figure 5-8.

Figure 5-8. Removable Support Tube Assembly



A.Removable support tube
B. Sensor nut
C. Sensor
D. Anchor bolts
E. Meter body

9. Remove the support tube.
10. Loosen and remove the sensor nut from the sensor cavity with a 1$^1/_8$-in. (28-mm) open end wrench. (Use a $^3/_4$-in. (19-mm) open end wrench for 3- and 4-in. [80 and 100 mm] SST wafers.)
11. Lift the sensor from the sensor cavity. Be very careful to lift the sensor straight up. Do not rock, twist, or tilt the sensor during removal; this will damage the engagement diaphragm.
12. If Critical Process (CPA option) is present, tighten the valve to insure it is closed after the new Vortex sensor is installed. It is recommended that the nut be torqued to 50 in-lbs (5.7 N-m). Over tightening the valve nut could compromise its ability to seal.

Cleaning the sealing surface

Before installing a sensor in the meter body, clean the sealing surface by completing the following procedure. The metal o-ring on the sensor is used to seal the sensor cavity in the event that process fluid should corrode through the meter body and enter the sensor cavity. Be sure not to scratch or otherwise damage any part of the sensor, sensor cavity, or sensor nut threads. Damage to these parts may require replacement of the sensor or meter body, or may render the flowmeter dangerous.

Note
If you are installing a sensor that has been used before, clean the metal o-ring on the sensor using the procedure below. If you are installing a newly purchased sensor, cleaning the o-ring is not necessary.

---

1. Use a suction or compressed air device to remove any loose particles from the sealing surface and other adjacent areas in the sensor cavity. See Figure 5-9.

Note
Do not scratch or deform any part of the sensor, sensor cavity, or sensor nut threads.

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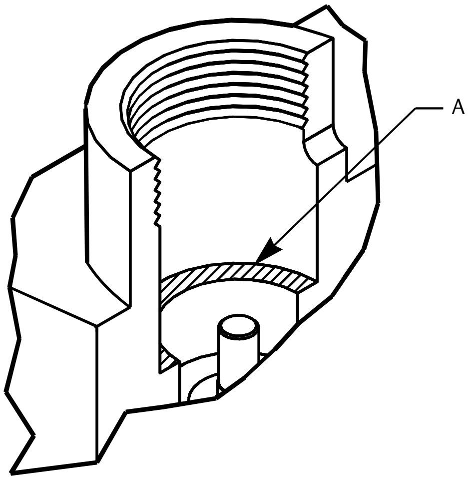
2. Carefully brush the sealing surface clean with a soft bristle brush.
3. Moisten a cotton swab with an appropriate cleaning liquid.
4. Wipe the sealing surface. Repeat several times if necessary with a clean cotton swab until there is minimal dirt residue picked up by the cotton swab.

Figure 5-9. O-Ring Sealing Surface in Sensor Cavity



A.Sealing surface

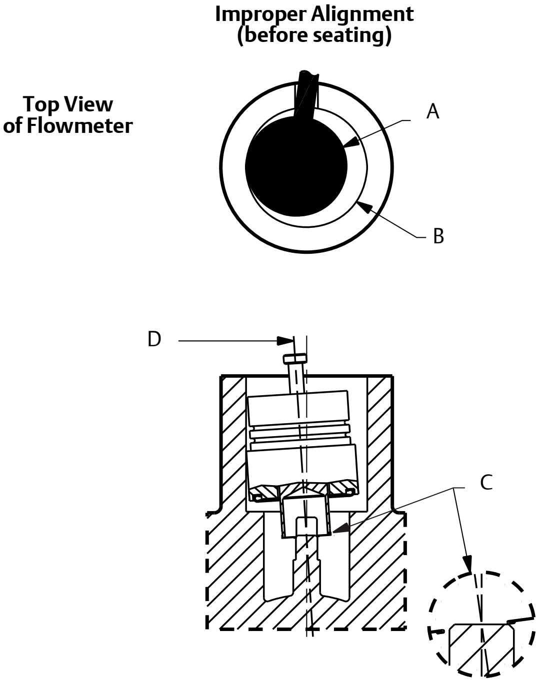
Sensor installation

1. Carefully place sensor over the post in the sensor cavity.
2. Ensure that the sensor is centered on the post. See Figure 5-10 for an example of improper installation and Figure 5-11 for an example of proper installation.

Note

If the sensor is installed in a high temperature application place the sensor in the sensor cavity and wait for it to come up to temperature before seating the sensor on the post.

Figure 5-10. Sensor Installation – Improper Alignment



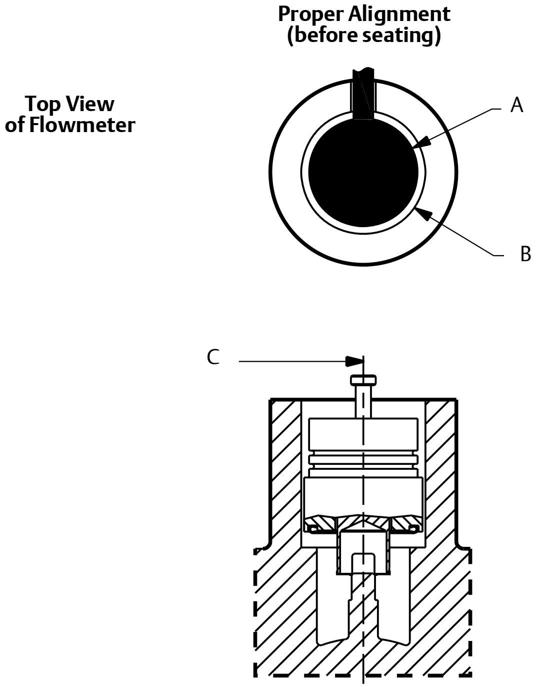
A.Sensor

B. Sensor cavity in flowmeter

C. Sensor not properly aligned

D. Sensor centerline is not aligned with flowmeter centerline. Damage to sensor will occur.

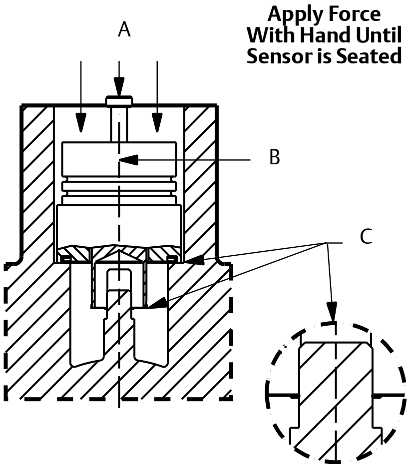
Figure 5-11. Sensor Installation – Proper Alignment



A.Sensor
B. Sensor cavity in flowmeter
C. Sensor centerline must be aligned with flowmeter centerline.

3. Sensor should remain as close to vertical as possible when applying force to seat. See Figure 5-12.

Figure 5-12. Sensor Installation – Applying Force



A.Pressure
B. Sensor centerline must be aligned with flowmeter centerline.
C. Sensor properly seated

4. Manually push down on the sensor by applying equal pressure for engagement onto the post.

5. Screw the sensor nut into the sensor cavity. Tighten the nut with a 1 1/8-in. (28 mm) open end torque wrench to 32 ft-lbs (43.4 N-m) (50 ft-lbs (67.8 N-m) for ANSI 1500 meter body). (Use a 3/4-in. (19 mm) open end wrench for 3- and 4-in. [80 and 100 mm] SST wafers). Do not over-tighten the sensor nut.

6. Replace the support tube.

7. Tighten the four bolts that anchor the support tube in place with a 7/16-in. (11 mm) open end wrench.

8. Install the flowmeter electronics housing. See“Replacing the electronics housing” on page 80.

5.6.6 Remote electronics procedure

If the Rosemount 8800D electronics housing is mounted remotely, some replacement procedures are different than for the flowmeter with integral electronics. The following procedures are exactly the same:

- Replacing the Terminal Block in the Housing (see page 77).
- Replacing the Electronics Boards (see page 78).
- Replacing the Sensor (see page 82).

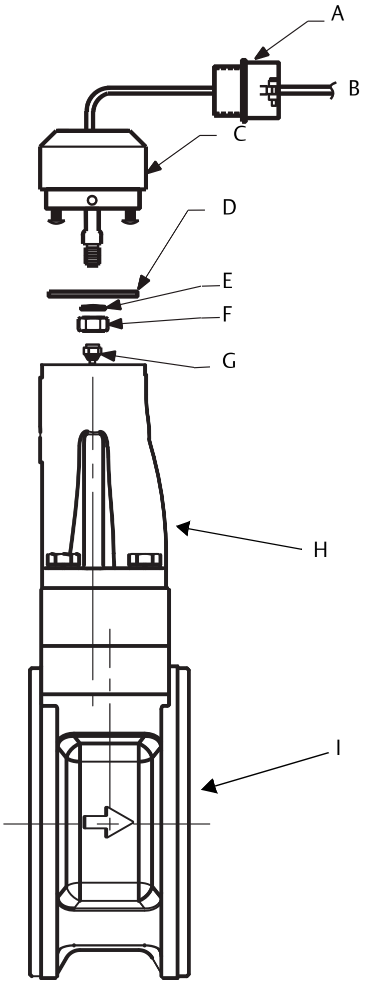
To disconnect the coaxial cable from the meter body and electronics housing, follow the instructions below.

Disconnect the coaxial cable at the meter

1. Remove the access cover on the meter body support tube if present.
2. Loosen the three housing rotation screws at the base of the meter adapter with a 5/32-in. hex wrench by turning the screws clockwise (inward) until they clear the bracket.
3. Slowly pull the meter adapter no more than 1.5-in. (40 mm) from the top of the support tube.
4. Loosen and disconnect the sensor cable nut from the union using a 5/16-in. open end wrench.

Note
Do not pull the adapter more than 1.5-in. (40 mm) from the top of the support tube. Damage to the sensor may occur if the sensor cable is stressed.

Figure 5-13. Coaxial Cable Connections



A.½ NPT conduit adapter or cable gland (supplied by customer)
B. Coaxial cable
C. Meter adapter
D. Union
E. Washer
F. Nut
G. Sensor cable nut
H. Support tube
I. Meter body

Detach the meter adapter

The above instructions will provide access to the meter body. Use the following steps if it is necessary to remove the coaxial cable:

1. Loosen and remove the two screws that hold the union onto the meter adapter and pull the union away from the adapter.
2. Loosen and remove the sensor cable nut from the other end of the union.
3. Loosen and disconnect the conduit adapter or cable gland from the meter adapter.

Attach the meter adapter

1. If you are using a conduit adapter or cable gland, slide it over the plain end of the coaxial cable (the end without a ground wire).
2. Slide the meter adapter over the coaxial cable end.
3. Use a $^{5}/_{16}$-in. (8 mm) open end wrench to securely tighten the sensor cable nut onto one end of the union.
4. Place the union onto the two screws extending out of the meter adapter and tighten the two screws.

Connect the coaxial cable at the meter body

1. Pull the sensor cable out of the support tube slightly and securely tighten the sensor cable nut onto the union.

Note
Do not stretch the sensor cable over 1.5-in. (40 mm) beyond the top of the support tube. Damage to the sensor may occur if the sensor cable is stressed.

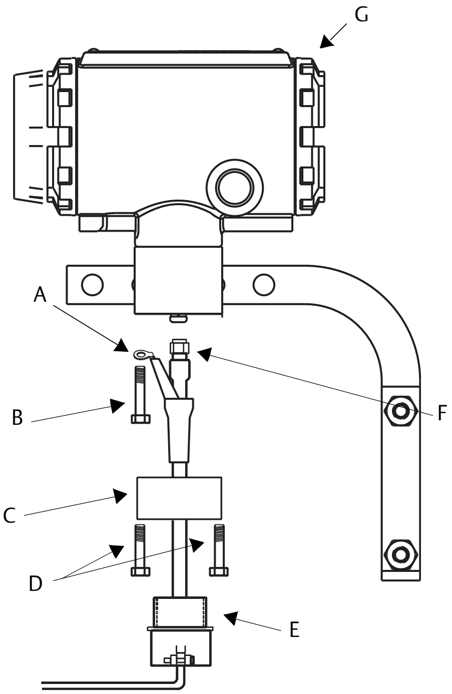
2. Place the meter adapter into the top of the support tube and line up the screw holes.
3. Use a hex wrench to turn the three adapter screws counterclockwise (outward) to engage the support tube.
4. Replace the access cover on the support tube (6-8-in. wafer style only).
5. Tighten the conduit adapter or cable gland into the meter adapter.

5.6.7 Coaxial cable at the electronics housing

Remove the coaxial cable from the electronics housing

1. Loosen the two housing screws from the housing adapter.
2. Remove the housing adapter from the housing.
3. Loosen and remove the coaxial cable nut from the base of the electronics housing.
4. Remove the coaxial cable ground connection from the housing base by loosening the housing base screw that is connecting it to the housing base.
5. Loosen the conduit adapter (or cable gland) from the housing adapter.

Figure 5-14. Remote Electronics Exploded View



A.Ground connection
B. Housing base screw
C. Housing adapter
D. Housing adapter screws
E. Conduit adapter (optional—supplied by customer)
F. Coaxial cable nut
G. Electronics housing

Attach the coaxial cable

1. Route the coaxial cable through the conduit (if you are using conduit).
2. Place a conduit adapter over the end of the coaxial cable.
3. Remove the housing adapter from the electronics housing (if attached).
4. Slide the housing adapter over the coaxial cable.
5. Remove one of the four housing base screws that is in closest proximity to the ground connection.
6. Re-install the housing base screw by passing it through the ground connection.
7. Attach and securely tighten the coaxial cable nut to the connection on the electronics housing.
8. Align the housing adapter with the housing base and attach with the two housing adapter screws.
9. Tighten the conduit adapter to the housing adapter.

5.6.8 Changing the housing orientation

The entire electronics housing may be rotated in 90 degree increments for better wiring access or improved viewing of the display:

1. Loosen the screw on the access cover on the support tube (if present) and remove the cover.
2. Loosen the three housing rotation set screws at the base of the electronics housing with a 5/32-in. hex wrench by turning the screws clockwise (inward) until they clear the support tube.
3. Slowly pull the electronics housing out of the support tube.
4. Unscrew the sensor cable from the housing with a 5/16-in. open end wrench.

Note
Do not pull the housing more than 1.5-in. (40 mm) from the top of the support tube until the sensor cable is disconnected. Damage to the sensor may occur if this sensor cable is stressed.

5. Rotate the housing to the desired orientation.
6. Hold it in this orientation while you screw the sensor cable onto the base of the housing.

Note
Do not rotate the housing while the sensor cable is attached to the base of the housing. This will stress the cable and may damage the sensor.

7. Place the electronics housing into the top of the support tube.
8. Use a hex wrench to turn the three housing rotation screws counterclockwise to engage the support tube.
9. Replace the access cover on the support tube (if present).
10. Tighten the screw on the access cover (if present).

5.6.9 Temperature sensor replacement (MTA option only)

Replacement of the temperature sensor should only be necessary in the event of a failure. Use the following procedure for replacement.

Note
Disconnect power before replacing temperature sensor.

1. Turn off power to Rosemount 8800D.
2. Remove temperature sensor from meter body by using a 1/2-in. open end wrench.

Note
Use plant approved procedure for removing a temperature sensor from a thermowell.

3. Remove temperature sensor from electronics by using a 2.5 mm hex wrench to remove hex socket screw from electronics.
4. Gently pull temperature sensor from electronics.

Note
This will expose the electronics to the atmosphere.

5. Insert new temperature sensor into electronics housing using care to align pin and cap head screw to align connector pins.
6. Tightening cap head screw with 2.5 mm hex wrench.
7. Slide bolt and ferrule assembly onto temperature sensor and hold into place.
8. Insert temperature sensor into hole in bottom of meter body until it reaches the bottom of the hole. Hold it in place and tighten bolt with 1/2-in. open end wrench until 3/4 turns past finger tight to seat ferrule.
9. Reapply power to Rosemount 8800D.

5.7 Return of material

To expedite the return process, call the Rosemount North American Response Center at 800-654-RSMT (7768) toll-free number. This center, available 24 hours a day, will assist you with any needed information or materials.

The center will ask for product model and serial numbers, and will provide a Return Material Authorization (RMA) number. The center will also ask for the name of the process material to which the product was last exposed.

Caution

People who handle products exposed to a hazardous substance can avoid injury if they are informed and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by OSHA, a copy of the required Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned goods.

The Rosemount North American Response Center will detail the additional information and procedures necessary to return goods exposed to hazardous substances.

Toll-free assistance numbers

Within the United States, Emerson™ Process Management has two toll-free assistance numbers:

Technical support, quoting, and order-related questions:

1-800-522-6277 (7:00 am to 7:00 pm CST)

North American Response Center—Equipment service needs:

1-800-654-7768 (24 hours—includes Canada)

Outside of the United States, contact your local Emerson Process Management representative.

Appendix A Specifications and Reference Data

A.1 Specifications

The following specifications are for the Rosemount™ 8800D, Rosemount 8800DR, Rosemount 8800DD, and Rosemount 8800DW, except where noted.

A.2 Functional specifications

Process fluids

Liquid, gas, and steam applications. Fluids must be homogeneous and single-phase.

Line sizes

Wafer

$^1/_2$, 1, 1$^1/_2$, 2, 3, 4, 6, and 8 inches
(DN 15, 25, 40, 50, 80, 100, 150, and 200)

Flanged and dual-sensor style

$^1/_2$, 1, 1$^1/_2$, 2, 3, 4, 6, 8, 10, and 12 inches
(DN 15, 25, 40, 50, 80, 100, 150, 200, 250, and 300)

Reducer

1, 1$^1/_2$, 2, 3, 4, 6, 8, 10, and 12 inches
(DN 25, 40, 50, 80, 100, 150, 200, 250, and 300)

Pipe schedules

Process piping Schedules 10, 40, 80, and 160.

Note
The appropriate bore diameter of the process piping must be entered using the Field Communicator or AMS™ Device Manager. Meters will be shipped from the factory at the Schedule 40 default value unless otherwise specified.

Measurable flow rates

Capable of processing signals from flow applications which meet the sizing requirements below.

To determine the appropriate flowmeter size for an application, process conditions must be within the Reynolds number and velocity limitations for the desired line size provided in Table A-1, Table A-2, and Table A-3.

Note

Consult your local sales representative to obtain a computer sizing program that describes in greater detail how to specify the correct flowmeter size for an application.

The Reynolds number equation shown below combines the effects of density (ρ), viscosity **(μ_{cp})**, pipe inside diameter **(*D*)**, and flow velocity (V). $R_D = \frac{VD\rho}{\mu_{cp}}$

Table A-1. Minimum Measurable Meter Reynolds Numbers

Meter Sizes (Inches / DN)	Reynolds Number Limitations
$^1/_2$ through 4/15 through 100	5000 minimum
6 through 12/150 through 300	

Table A-2. Minimum Measurable Meter Velocities[1]

	Feet per second	Meters per second
Liquids[2]	$\sqrt{36/\rho}$	$\sqrt{54/\rho}$
Gases	$\sqrt{36/\rho}$	$\sqrt{54/\rho}$
The ρ is the process fluid density at flowing conditions in lb/ft^3 for ft/s and kg/m^3 for m/s.		

1. Velocities are referenced to schedule 40 pipe.
2. This minimum measurable meter velocity is based on default filter settings.

Table A-3. Maximum Measurable Meter Velocities[1] (Use smaller of two values)

	Feet per second	Meters per second
Liquids	$\sqrt{90{,}000/\rho}$ or 30	$\sqrt{134{,}000/\rho}$ or 9.1
Gases[2]	$\sqrt{90{,}000/\rho}$ or 300	$\sqrt{134{,}000/\rho}$ or 91.2
The ρ is the process fluid density at flowing conditions in lb/ft^3 for ft/s and kg/m^3 for m/s.		

1. Velocities are referenced to schedule 40 pipe.
2. Accuracy limitations for gas and steam for Dual-style meters ($^1/_2$-in. to 4-in.): max velocity of 100 ft/s (30.5 m/s).

Process temperature limits

Standard

–40 to 450 °F (–40 to 232 °C)

Extended

–330 to 800 °F (–200 to 427 °C)

Severe

–330 to 842 °F (–200 to 450 °C)

- - 157 to 800 °F (-105 to 427 °C) for European Pressure Equipment Directive (PED), consult factory for lower operating temperatures.
- The flowtube and sensor, in remote mount configurations, is functionally rated to 842 °F (450 °C) process temperature. Process temperature may be further restricted depending on hazardous area options and PED certificates. Consult applicable certificates for particular installation limits.

Multivariable (MTA option)

–50 to 800 °F (–40 to 427 °C)

- Use above 450 °F (232 °C) requires Extended Sensor

Output signals

4–20 mA digital HART® signal

Superimposed on 4–20 mA signal

Optional scalable pulse output

0 to 10000 Hz; transistor switch closure with adjustable scaling via HART communications; capable of switching up to 30 Vdc, 120 mA maximum.

Analog output adjustment

Engineering units and lower and upper range values are user-selected. Output is automatically scaled to provide 4 mA at the selected lower range value, 20 mA at the selected upper range value. No frequency input is required to adjust the range values.

Scalable frequency adjustment

The scalable pulse output can be set to a specific velocity, volume, or mass (i.e. 1 pulse = 1 lb). The scalable pulse output can also be scaled to a specific rate of volume, mass, or velocity (i.e. 100 Hz = 500 lb/hr).

Ambient temperature limits

Operating

–58 to 185 °F (–50 to 85 °C)
–4 to 185 °F (–20 to 85 °C) for flowmeters with local indicator

Storage

−58 to 250 °F (−50 to 121 °C)
−50 to 185 °F (−46 to 85 °C) for flowmeters with local indicator

Pressure limits

Flange style meter

Rated for ASME B16.5 (ANSI) Class 150, 300, 600, 900, and 1500, EN 1092-1, PN 10, 16, 25, 40, 63, 100, and 160, and JIS 10K, 20K, and 40K

Reducer style meter

Rated for ASME B16.5 (ANSI) Class 150, 300, 600, 900, and 1500, EN 1092-1, PN 10, 16, 25, 40, 63, 100, and 160.

Dual sensor style meter

Rated for ASME B16.5 (ANSI) Class 150, 300, 600, 900, and 1500, EN 1092-1, PN 10, 16, 25, 40, 63, 100, and 160, and JIS 10K, 20K, and 40K

Wafer style meter

Rated for ASME B16.5 (ANSI) Class 150, 300, and 600, EN 1092-1, PN 10, 16, 25, 40, 63, and 100, and JIS 10K, 20K, and 40K

Note
All Wafer Style Meters are pressure rated and labeled at 1500 PSI/10.34 MPa at 100 °F/38 °C regardless of Alignment Ring Size code ordered.

Weld-end style meter

W1 Welds to Schedule 10 mating pipe
Max Working Pressure 720 psig (4.96 MPa-g)

W4 Welds to Schedule 40 mating pipe
Max Working Pressure 1440 psig (9.93 MPa-g)

W8 Welds to Schedule 80 mating pipe
Max Working Pressure 2160 psig (14.9 MPa-g)

W9 Welds to Schedule 160 mating pipe
Max Working Pressure 3600 psig (24.8 MPa-g)

Note
1-in. (25 mm), and 1.5-in. (40 mm) weld to Schedule 80 mating pipe

HART analog

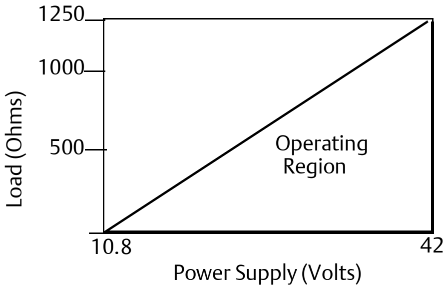
External power supply required. Flowmeter operates on 10.8 to 42 Vdc terminal voltage (with 250Ω minimum load required for HART communications, 16.8 Vdc power supply is required)

Power consumption

One watt maximum

Load limitations (HART analog)

Maximum loop resistance is determined by the voltage level of the external power supply, as described by:



R_{max} = 41.7(V_{ps} – 10.8)
V_{ps} = Power Supply Voltage (Volts)
R_{max} = Maximum Loop Resistance (Ohms)

Note
HART Communication requires a minimum loop resistance of 250 ohms.

Optional LCD display

The optional LCD display is capable of displaying:

- Analog Output
- Calculated Process Density (MTA only)
- Corrected Volumetric Flow
- Electronics Temperature
- Mass Flow
- Percent of Range
- Primary Variable
- Process Temperature (MTA only)
- Pulse Output Frequency
- Shedding Frequency
- Signal Strength
- Totalizer
- Velocity Flow
- Volumetric Flow

If more than one item is selected, the display will scroll through all items selected.

Enclosure rating

FM Type 4X; CSA Type 4X; IP66

Permanent pressure loss

The approximate permanent pressure loss (PPL) from the Rosemount 8800D flowmeter is calculated for each application in the Vortex sizing software available from your local Rosemount representative. The PPL is determined using the equation:

$$\text{PPL} = \frac{A \times \rho_f \times Q^2}{D^4}$$

where:

PPL = Permanent Pressure Loss (psi or kPa)

Where:

ρ_f = Density at operating conditions (lb/ft^3 or kg/m^3)

Q = Actual volumetric flow rate (Gas = ft^3/min or m^3/hr; Liquid = gal/min or l/min)

D = Flowmeter bore diameter (in. or mm)

A = Constant depending on meter style, fluid type and flow units. Determined per following table:

Table A-4. Determining the PPL

Meter style	English units		SI units	
	A_{Liquid}	A_{Gas}	A_{Liquid}	A_{Gas}
8800DF/W	3.4×10^{-5}	1.9×10^{-3}	0.425	118
8800DR	3.91×10^{-5}	2.19×10^{-3}	0.489	136
8800DD(1)	6.12×10^{-5}	3.42×10^{-3}	0.765	212

1. For all 6-in. thru 12-in. line sizes, A is the same for 8800DD and 8800DF.

Minimum downstream pressure (liquids)

Flow metering conditions that would allow cavitation, the release of vapor from a liquid, should be avoided. This flow condition can be avoided by remaining within the proper flow range of the meter and by following appropriate system design.

For some liquid applications, incorporation of a back pressure valve should be considered. To prevent cavitation, the minimum downstream pressure should be:

P = $2.9*\Delta P + 1.3*p_v$ or $P = 2.9*\Delta P + p_v + 0.5$ psia (3.45 kPa) (use the smaller of the two results)

P = Line pressure five pipe diameters downstream of the meter (psia or kPa abs)

ΔP = Pressure loss across the meter (psi or kPa)

p_v = Liquid vapor pressure at operating conditions (psia or kPa abs)

Failure mode alarm

HART analog

If self-diagnostics detect a gross flowmeter failure, the analog signal will be driven to the values below:

Low	3.75 mA
High	21.75 mA
NAMUR Low	3.60 mA
NAMUR High	22.6 mA

High or low alarm signal is user-selectable through the fail mode alarm jumper on the electronics. NAMUR-compliant alarm limits are available through the C4 or CN Option. Alarm type is field configurable also.

Saturation output values

When the operating flow is outside the range points, the analog output continues to track the operating flow until reaching the saturation value listed below; the output does not exceed the listed saturation value regardless of the operating flow. The NAMUR-Compliant Saturation Values are available through the C4 or CN option. Saturation type is field configurable.

Low	3.9 mA
High	20.8 mA
NAMUR Low	3.8 mA
NAMUR High	20.5 mA

Damping

Flow Damping adjustable between 0.2 and 255 seconds.

Process Temperature Damping adjustable between 0.4 and 32.0 seconds (MTA Option Only).

Response time

Three vortex shedding cycles or 300 ms, whichever is greater, maximum required to reach 63.2% of actual input with the minimum damping (0.2 seconds).

Turn-on time

HART analog

Less than six (6) seconds plus the response time to rated accuracy from power up (less than 8 seconds with the MTA Option).

Transient protection

The optional transient terminal block prevents damage to the flowmeter from transients induced by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are located in the terminal block.

The transient terminal block meets the following specifications:
IEEE C62.41 - 2002 Category B
3 kA crest (8 X 20 μs)
6 kV crest (1.2 X 50 μs)
6 kV/0.5 kA (0.5 μs, 100 kHz, ring wave)

Security lockout

When the security lockout jumper is enabled, the electronics will not allow you to modify parameters that affect flowmeter output.

Output testing

Current source

Flowmeter may be commanded to set the electrical current to a specified value between 4 and 20 mA.

Frequency source

Flowmeter may be commanded to set the frequency to a specified value between 0 and 10000 Hz.

Low flow cutoff

Adjustable over entire flow range. Below selected value, output is driven to 4 mA and zero pulse output frequency.

Humidity limits

Operates in 0–95% relative humidity under non-condensing conditions (tested to IEC 60770, Section 6.2.11).

Over-range capability

HART analog

Analog signal output continues to 105 percent of span, then remains constant with increasing flow. The digital and pulse outputs will continue to indicate flow up to the upper sensor limit of the flowmeter and a maximum pulse output frequency of 10400 Hz.

Flow calibration

Meter bodies are flow-calibrated and assigned a unique calibration factor (K-factor) at the factory. The calibration factor is entered into the electronics, enabling interchangeability of electronics and/or sensors without calculations or compromise in accuracy of the calibrated meter body.

Table A-5. Typical Pipe Velocity Ranges for 8800D and 8800DR[1]

Process line size		Liquid velocity ranges		Gas velocity ranges	
(Inches/ DN)	Vortex meter [2]	(ft/s)	(m/s)	(ft/s)	(m/s)
0.5/ 15	8800DF005	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
1/ 25	8800DF010	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR010	0.25 to 8.8	0.08 to 2.7	2.29 to 87.9	0.70 to 26.8
1.5/ 40	8800DF015	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR015	0.30 to 10.6	0.09 to 3.2	2.76 to 106.1	0.84 to 32.3
2/ 50	8800DF020	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR020	0.42 to 15.2	0.13 to 4.6	3.94 to 151.7	1.20 to 46.2
3/ 80	8800DF030	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR030	0.32 to 11.3	0.10 to 3.5	2.95 to 113.5	0.90 to 34.6
4/ 100	8800DF040	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR040	0.41 to 14.5	0.12 to 4.4	3.77 to 145.2	1.15 to 44.3
6/ 150	8800DF060	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR060	0.31 to 11.0	0.09 to 3.4	2.86 to 110.2	0.87 to 33.6
8/ 200	8800DF080	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR080	0.40 to 14.4	0.12 to 4.4	3.75 to 144.4	1.14 to 44.0
10/ 250	8800DF100	0.90 to 25.0	0.27 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR100	0.44 to 15.9	0.13 to 4.8	4.12 to 158.6	1.26 to 48.3
12/ 300	8800DF120	1.10 to 25.0	0.34 to 7.6	6.50 to 250.0	1.98 to 76.2
	8800DR120	0.63 to 17.6	0.19 to 5.4	4.58 to 176.1	1.40 to 53.7

1. Table A-5 is a reference of pipe velocities that can be measured for the standard Rosemount 8800D and the reducer Rosemount 8800DR Vortex Meters. It does not consider density limitations, as described in Table A-2 and Table A-3. Velocities are referenced in schedule 40 pipe.
2. Velocity range of the Rosemount 8800DW is the same as Rosemount 8800DF.

Table A-6. Water Flow Rate Limits for the Rosemount 8800D and 8800DR[1]

Process line size		Minimum and maximum measurable water flow rates[3]	
(Inches/ DN)	Vortex meter [2]	Gallons/minute	Cubic meters/hour
0.5/ 15	8800DF005	1.76 to 23.7	0.40 to 5.4
1/ 25	8800DF010	2.96 to 67.3	0.67 to 15.3
	8800DR010	1.76 to 23.7	0.40 to 5.4
1.5/ 40	8800DF015	4.83 to 158	1.10 to 35.9
	8800DR015	2.96 to 67.3	0.67 to 15.3
2/ 50	8800DF020	7.96 to 261	1.81 to 59.4
	8800DR020	4.83 to 158.0	1.10 to 35.9
3/ 80	8800DF030	17.5 to 576	4.00 to 130
	8800DR030	7.96 to 261.0	1.81 to 59.3
4/ 100	8800DF040	30.2 to 992	6.86 to 225
	8800DR040	17.5 to 576	4.00 to 130
6/ 150	8800DF060	68.5 to 2251	15.6 to 511
	8800DR060	30.2 to 992	6.86 to 225
8/ 200	8800DF080	119 to 3898	27.0 to 885
	8800DR080	68.5 to 2251	15.6 to 511
10/ 250	8800DF100	231 to 6144	52.2 to 1395
	8800DR100	119 to 3898	27.0 to 885
12/ 300	8800DF120	391 to 8813	88.8 to 2002
	8800DR120	231 to 6144	52.2 to 1395

1. Table A-6 is a reference of flow rates that can be measured for the standard Rosemount 8800D and the reducer 8800DR Vortex Meters. It does not consider density limitations, as described in Table A-2 and Table A-3.
2. Velocity range of the 8800DW is the same as 8800DF.
3. Conditions: 77 °F (25 °C) and 14.7 psia (1.01 bar absolute)

Table A-7. Air Flow Rate Limits at 59 °F (15 °C)

Process pressure[1]	Flow rate limits	Minimum and maximum air flow rates for line sizes 1/2 inch/DN 15 through 1 inch/DN 25							
		1/2 Inch/DN 15				1 Inch/DN 25			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		ACFM	ACMH	ACFM	ACMH	ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max min	27.9 4.62	47.3 7.84	N/A	N/A	79.2 9.71	134 16.5	27.9 4.62	47.3 7.84
50 psig (3,45 bar G)	max min	27.9 1.31	47.3 2.22	N/A	N/A	79.2 3.72	134 6.32	27.9 1.31	47.3 2.22
100 psig (6,89 bar G)	max min	27.9 0.98	47.3 1.66	N/A	N/A	79.2 2.80	134 4.75	27.9 0.98	47.3 1.66
150 psig (10,3 bar G)	max min	27.9 0.82	47.3 1.41	N/A	N/A	79.2 2.34	134 3.98	27.9 0.82	47.3 1.41
200 psig (13,8 bar G)	max min	27.9 0.82	47.3 1.41	N/A	N/A	79.2 2.34	134 3.98	27.9 0.82	47.3 1.41
300 psig (20,7 bar G)	max min	27.9 0.82	47.3 1.41	N/A	N/A	79.2 2.34	134 3.98	27.9 0.82	47.3 1.41
400 psig (27,6 bar G)	max min	25.7 0.82	43.9 1.41	N/A	N/A	73.0 2.34	124 3.98	25.7 0.82	43.9 1.41
500 psig (34,5 bar G)	max min	23.0 0.82	39.4 1.41	N/A	N/A	66.0 2.34	112 3.98	23.0 0.82	39.4 1.41

1. Barometric pressure of 14.7 psia (1.01 bar-a).

Table A-8. Air Flow Rate Limits at 59 °F (15 °C)

Process pressure[1]	Flow rate limits	Minimum and maximum air flow rates for line sizes 1½ inch/DN 40 through 2 inch/DN 50							
		1½ Inch/DN 40				2 Inch/DN 50			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		ACFM	ACMH	ACFM	ACMH	ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max	212	360	79.2	134	349	593	212	360
	min	18.4	31.2	9.71	16.5	30.3	51.5	18.4	31.2
50 psig (3,45 bar G)	max	212	360	79.2	134	349	593	212	360
	min	8.76	14.9	3.72	6.32	14.5	24.6	8.76	14.9
100 psig (6,89 bar G)	max	212	360	79.2	134	349	593	212	360
	min	6.58	11.2	2.80	4.75	10.8	18.3	6.58	11.2
150 psig (10,3 bar G)	max	212	360	79.2	134	349	593	212	360
	min	5.51	9.36	2.34	3.98	9.09	15.4	5.51	9.36
200 psig (13,8 bar G)	max	212	360	79.2	134	349	593	212	360
	min	5.51	9.36	2.34	3.98	9.09	15.4	5.51	9.36
300 psig (20,7 bar G)	max	198	337	79.2	134	326	554	198	337
	min	5.51	9.36	2.34	3.98	9.09	15.4	5.51	9.36
400 psig (27,6 bar G)	max	172	293	73.0	124	284	483	172	293
	min	5.51	9.36	2.34	3.98	9.09	15.4	5.51	9.36
500 psig (34,5 bar G)	max	154	262	66.0	112	254	432	154	262
	min	5.51	9.36	2.34	3.98	9.09	15.4	5.51	9.36

[1] Barometric pressure of 14.7 psia (1.01 bar-a).

Table A-9. Air Flow Rate Limits at 59 °F (15 °C), 14.7 psia (1.01 bar-a)

		Minimum and maximum air flow rates for line sizes 3 inch/DN 80 through 4 inch/DN 100							
		3 Inch/DN 80				4 Inch/DN 100			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
Process pressure[1]	**Flow rate limits**	**ACFM**	**ACMH**	**ACFM**	**ACMH**	**ACFM**	**ACMH**	**ACFM**	**ACMH**
0 psig (0 bar G)	max	770	1308	349	593	1326	2253	770	1308
	min	66.8	114	30.3	51.5	115	195	66.8	114
50 psig (3,45 bar G)	max	770	1308	349	593	1326	2253	770	1308
	min	31.8	54.1	14.5	24.6	54.8	93.2	31.8	54.1
100 psig (6,89 bar G)	max	770	1308	349	593	1326	2253	770	1308
	min	23.9	40.6	10.8	18.3	41.1	69.8	23.9	40.6
150 psig (10,3 bar G)	max	770	1308	349	593	1326	2253	770	1308
	min	20.0	34.0	9.09	15.4	34.5	58.6	20.0	34.0
200 psig (13,8 bar G)	max	770	1308	349	593	1326	2253	770	1308
	min	20.0	34.0	9.09	15.4	34.5	58.6	20.0	34.0
300 psig (20,7 bar G)	max	718	1220	326	554	1237	2102	718	1220
	min	20.0	34.0	9.09	15.4	34.5	58.6	20.0	34.0
400 psig (27,6 bar G)	max	625	1062	284	483	1076	1828	625	1062
	min	20.0	34.0	9.09	15.4	34.5	58.6	20.0	34.0
500 psig (34,5 bar G)	max	560	951	254	432	964	1638	560	951
	min	20.0	34.0	9.09	15.4	34.5	58.6	20.0	34.0

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1. Barometric pressure of 14.7 psia (1.01 bar-a).

Table A-10. Air Flow Rate Limits at 59 °F (15 °C), 14.7 psia (1.01 bar-a)

Process pressure[1]	Flow rate limits	Minimum and maximum air flow rates for line sizes 6 inch/DN 150 through 8 inch/DN 200							
		6 Inch/DN 150				8 Inch/DN 200			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		ACFM	ACMH	ACFM	ACMH	ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max min	3009 261	5112 443	1326 115	2253 195	5211 452	8853 768	3009 261	5112 443
50 psig (3,45 bar G)	max min	3009 124	5112 211	1326 54.8	2253 93.2	5211 215	8853 365	3009 124	5112 211
100 psig (6,89 bar G)	max min	3009 93.3	5112 159	1326 41.1	2253 69.8	5211 162	8853 276	3009 93.3	5112 159
150 psig (10,3 bar G)	max min	3009 78.2	5112 133	1326 34.5	2253 58.6	5211 135	8853 229	3009 78.2	5112 133
200 psig (13,8 bar G)	max min	3009 78.2	5112 133	1326 34.5	2253 58.6	5211 135	8853 229	3009 78.2	5112 133
300 psig (20,7 bar G)	max min	2807 78.2	4769 133	1237 34.5	2102 58.6	4862 135	8260 229	2807 78.2	4769 133
400 psig (27,6 bar G)	max min	2442 78.2	4149 133	1076 34.5	1828 58.6	4228 136	7183 229	2442 78.2	4149 133
500 psig (34,5 bar G)	max min	2188 78.2	3717 133	964 34.5	1638 58.6	3789 136	6437 229	2188 78.2	3717 133

1. Barometric pressure of 14.7 psia (1.01 bar-a).

Table A-11. Air Flow Rate Limits at 59 °F (15 °C), 14.7 psia (1.01 bar-a)

Process pressure[1]	Flow rate limits	Minimum and maximum air flow rates for line sizes 10 inch/DN 250 through 12 inch/DN 300							
		10 Inch/DN 250				12 Inch/DN 300			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		ACFM	ACMH	ACFM	ACMH	ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max	8214	13956	5211	8853	11781	20016	8214	13956
	min	712.9	1211	452	768	1022	1736	712.9	1211
50 psig (3,45 bar G)	max	8214	13956	5211	8853	11781	20016	8214	13956
	min	339.5	577	215	365	486.9	827	339.5	577
100 psig (6,89 bar G)	max	8214	13956	5211	8853	11781	20016	8214	13956
	min	254.7	433	162	276	365.4	621	254.7	433
150 psig (10,3 bar G)	max	8214	13956	5211	8853	11781	20016	8214	13956
	min	213.6	363	135	229	306.3	520	213.6	363
200 psig (13,8 bar G)	max	8214	13956	5211	8853	11781	20016	8214	13956
	min	213.6	363	135	229	306.3	520	213.6	363
300 psig (20,7 bar G)	max	7664	13021	4862	8260	10992	18675	7664	13021
	min	213.6	363	135	229	306.3	520	213.6	363
400 psig (27,6 bar G)	max	6664	11322	4228	7183	9559	16241	6664	11322
	min	213.6	363	136	229	306.3	520	213.6	363
500 psig (34,5 bar G)	max	5972	10146	3789	6437	8565	14552	5972	10146
	min	213.6	363	136	229	306.3	520	213.6	363

[1] Barometric pressure of 14.7 psia (1.01 bar-a).

Notes

The Rosemount 8800D measures the volumetric flow under operating conditions (i.e. the actual volume at the operating pressure and temperature–acfm or acmh), as shown above. However, gas volumes are strongly dependent on pressure and temperature. Therefore, gas quantities are typically stated in standard or normal conditions (e.g. SCFM or NCMH). (Standard conditions are typically 59 °F and 14.7 psia. Normal conditions are typically 0 °C and 1.01 bar abs.)

The flow rate limits in standard conditions are found using the equations below:

Standard Flow Rate = Actual Flow Rate X Density Ratio

Density Ratio = Density at Actual (Operating) Conditions / Density at Standard Conditions

Table A-12. Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 1/2 inch/DN 15 through 1 inch/DN 25							
		½ Inch/DN 15				1 Inch/DN 25			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1,03 bar G)	max	120	54.6	N/A	N/A	342	155	120	54.6
	min	12.8	5.81			34.8	15.8	12.8	5.81
25 psig (1,72 bar G)	max	158	71.7	N/A	N/A	449	203	158	71.7
	min	14.0	6.35			39.9	18.1	14.0	6.35
50 psig (3,45 bar G)	max	250	113	N/A	N/A	711	322	250	113
	min	17.6	8.00			50.1	22.7	17.6	8.00
100 psig (6,89 bar G)	max	429	194	N/A	N/A	1221	554	429	194
	min	23.1	10.5			65.7	29.8	23.1	10.5
150 psig (10,3 bar G)	max	606	275	N/A	N/A	1724	782	606	275
	min	27.4	12.5			78.1	35.4	27.4	12.5
200 psig (13,8 bar G)	max	782	354	N/A	N/A	2225	1009	782	354
	min	31.2	14.1			88.7	40.2	31.2	14.1
300 psig (20,7 bar G)	max	1135	515	N/A	N/A	3229	1464	1135	515
	min	37.6	17.0			107	48.5	37.6	17.0
400 psig (27,6 bar G)	max	1492	676	N/A	N/A	4244	1925	1492	676
	min	44.1	20.0			125	56.7	44.1	20.0
500 psig (34,5 bar G)	max	1855	841	N/A	N/A	5277	2393	1855	841
	min	54.8	24.9			156	70.7	54.8	24.9

Table A-13. Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 1½ inch/DN 40 through 2 inch/DN 50							
		1½ Inch/DN 40				2 Inch/DN 50			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1,03 bar G)	max	917	416	342	155	1511	685	917	416
	min	82.0	37.2	34.8	15.8	135	61.2	82.0	37.2
25 psig (1,72 bar G)	max	1204	546	449	203	1983	899	1204	546
	min	93.9	42.6	39.9	18.1	155	70.2	93.9	42.6
50 psig (3,45 bar G)	max	1904	864	711	322	3138	1423	1904	864
	min	118	53.4	50.1	22.7	195	88.3	118	53.4
100 psig (6,89 bar G)	max	3270	1483	1221	554	5389	2444	3270	1483
	min	155	70.1	65.7	29.8	255	116	155	70.1
150 psig (10,3 bar G)	max	4616	2094	1724	782	7609	3451	4616	2094
	min	184	83.2	78.1	35.4	303	137	184	83.2
200 psig (13,8 bar G)	max	5956	2702	2225	1009	9818	4453	5956	2702
	min	209	94.5	88.7	40.2	344	156	209	94.5
300 psig (20,7 bar G)	max	8644	3921	3229	1464	14248	6463	8644	3921
	min	252	114	107	48.5	415	189	252	114
400 psig (27,6 bar G)	max	11362	5154	4244	1925	18727	8494	11362	5154
	min	295	134	125	56.7	487	221	295	134
500 psig (34,5 bar G)	max	14126	6407	5277	2393	23284	10561	14126	6407
	min	367	167	156	70.7	605	274	367	167

Table A-14. Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 3 inch/DN 80 through 4 inch/DN 100							
		3 Inch/DN 80				4 Inch/DN 100			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1,03 bar G)	max	3330	1510	1511	685	5734	2601	3330	1510
	min	298	135	135	61.2	513	233	298	135
25 psig (1,72 bar G)	max	4370	1982	1983	899	7526	3414	4370	1982
	min	341	155	155	70.2	587	267	341	155
50 psig (3,45 bar G)	max	6914	3136	3138	1423	11905	5400	6914	3136
	min	429	195	195	88.3	739	335	429	195
100 psig (6,89 bar G)	max	11874	5386	5389	2444	20448	9275	11874	5386
	min	562	255	255	116	968	439	562	255
150 psig (10,3 bar G)	max	16763	7603	7609	3451	28866	13093	16763	7603
	min	668	303	303	137	1150	522	668	303
200 psig (13,8 bar G)	max	21630	9811	9818	4453	37247	16895	21630	9811
	min	759	344	344	156	1307	593	759	344
300 psig (20,7 bar G)	max	31389	14237	14248	6463	54052	24517	31389	14237
	min	914	415	415	189	1574	714	914	415
400 psig (27,6 bar G)	max	41258	18714	18727	8494	71047	32226	41258	18714
	min	1073	487	487	221	1847	838	1073	487
500 psig (34,5 bar G)	max	51297	23267	23284	10561	88334	40068	51297	23267
	min	1334	605	605	274	2297	1042	1334	605

Table A-15. Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 6 inch/DN 150 through 8 inch/DN 200							
		6 Inch/DN 150				8 Inch/DN 200			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1,03 bar G)	max min	13013 1163	5903 528	5734 513	2601 233	22534 2015	10221 914	13013 1163	5903 528
25 psig (1,72 bar G)	max min	17080 1333	7747 605	7526 587	3414 267	29575 2308	13415 1047	17080 1333	7747 605
50 psig (3,45 bar G)	max min	27019 1676	12255 760	11905 739	5400 335	46787 2903	21222 1317	27019 1676	12255 760
100 psig (6,89 bar G)	max min	46405 2197	21049 996	20448 968	9275 439	80356 3804	36449 1725	46405 2197	21049 996
150 psig (10,3 bar G)	max min	65611 2610	29761 1184	28866 1150	13093 522	113440 4520	51455 2050	65611 2610	29761 1184
200 psig (13,8 bar G)	max min	84530 2965	38342 1345	37247 1307	16895 593	146375 5134	66395 2329	84530 2965	38342 1345
300 psig (20,7 bar G)	max min	122666 3572	55640 1620	54052 1574	24517 714	212411 6185	96348 2805	122666 3572	55640 1620
400 psig (27,6 bar G)	max min	161236 4192	73135 1901	71047 1847	32226 838	279200 7259	126643 3293	161236 4192	73135 1901
500 psig (34,5 bar G)	max min	200468 5212	90931 2364	88334 2297	40068 1042	347134 9025	157457 4094	200468 5212	90931 2364

Table A-16. Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 10 inch/DN 250 through 12 inch/DN 300							
		10 Inch/DN 250				12 Inch/DN 300			
		Rosemount 8800D		Rosemount 8800DR		Rosemount 8800D		Rosemount 8800DR	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1,03 bar G)	max	35519	16111	22534	10221	50994	23130	35519	16111
	min	3175	1440	2015	914	4554	2066	3175	1440
25 psig (1,72 bar G)	max	46618	21146	29575	13415	66862	30328	46618	21146
	min	4570	2073	2308	1047	5218	2367	4570	2073
50 psig (3,45 bar G)	max	73748	33452	46787	21222	105774	47978	73748	33452
	min	4575	2075	2903	1317	6562	2976	4575	2075
100 psig (6,89 bar G)	max	126660	57452	80356	36449	181663	82401	126660	57452
	min	5996	2720	3804	1725	8600	3901	5996	2720
150 psig (10,3 bar G)	max	178808	81106	113440	51455	256457	116327	178808	81106
	min	7125	3232	4520	2050	10218	4635	7125	3232
200 psig (13,8 bar G)	max	230722	104654	146375	66395	330915	150101	230722	104654
	min	8092	3670	5134	2329	11607	5265	8092	3670
300 psig (20,7 bar G)	max	334810	151867	212411	96348	480203	217816	334810	151867
	min	9749	4422	6185	2805	13983	6343	9749	4422
400 psig (27,6 bar G)	max	440085	199619	279200	126643	631195	286305	440085	199619
	min	11442	5190	7259	3293	16411	7444	11442	5190
500 psig (34,5 bar G)	max	547165	248190	347134	157457	784775	355968	547165	248190
	min	14226	6453	9025	4094	20404	9255	14226	6453

A.3 Performance specifications

The following performance specifications are for all Rosemount models except where noted. Digital performance specifications applicable to Digital HART output.

Flow accuracy

Includes linearity, hysteresis, and repeatability.

Liquids—for Reynolds Numbers over 20000

Digital and Pulse Output

±0.65% of rate

Note
The accuracy for the 8800DR, line sizes 6 to 12 inch (150 to 300mm), is ±1.0% of rate.

Analog output

Same as pulse output plus an additional 0.025% of span

Gas and steam— for Reynolds Numbers over 15,000

Digital and Pulse Output

±1.0% of rate

Note
The accuracy for the 8800DR, line sizes 6 to 12 inch (150 to 300mm), is ±1.35% of rate.

Analog Output

Same as pulse output plus an additional 0.025% of span.

Accuracy limitations for gas and steam:

- For 1/2- and 1-in. (DN 15 and DN 25): max velocity of 220 ft/s (67.06 m/s)
- For all dual shedder bar design meters: max velocity of 100ft/s (30.5 m/s). For velocities higher than 100ft/s (30.5 m/s), please consult the factory for accuracy limitations.

Note
As the meter Reynolds Numbers decreases below the stated limit to 10,000 the accuracy error band will increase linearly to +/-2.0%. For Reynolds Numbers down to 5,000 the accuracy error band will increase linearly from +/-2.0% to +/-6.0%.

Process temperature accuracy

2.2 °F (1.2 °C) or 0.4% of reading (in °C), whichever is greater.

Note

For remote mount installations, add ±0.018 °F/ft. (±0.03 °C/m) of uncertainty to the temperature measurement.

Mass flow accuracy for temperature compensated steam mass flow

2.0% of rate (Typical)

Repeatability

± 0.1% of actual flow rate

Mass flow accuracy for temperature compensated liquid mass flow (water)

± .70% of rate (Typical) between 32 and 500°F (0 to 260 °C)

± .85% of rate (Typical) between 500 and 600°F (260 and 316 °C)

Pressure Range Limits : 10 psia to 6264 psia

Repeatability

± 0.1% of actual flow rate

Mass flow accuracy for temperature compensated liquid mass flow (user-defined)

Dependent on user inputs

Repeatability

± 0.1% of actual flow rate

Stability

±0.1% of rate over one year

Process temperature effect

Automatic K-factor correction with user-entered process temperature.

Table A-17 indicates the percent change in K-factor per 100 °F (55.6 °C) in process temperature from reference temperature of 77 °F (25 °C).

Table A-17. Process Temperature Effect

Material	Percent change in K-factor per 100 °F (55.6 °C)
316L @ < 77 °F (25 °C)	+ 0.23
316L @ > 77 °F (25 °C)	- 0.27
Nickel Alloy ***C*** < 77 °F (25 °C)	+ 0.22
Nickel Alloy ***C*** > 77 °F (25 °C)	- 0.22

Ambient temperature effect

Digital and pulse outputs

No effect

Analog output

±0.1% of span from –58 to 185 °F (–50 to 85 °C)

Vibration effect

An output with no process flow may be detected if sufficiently high vibration is present.

The meter design will minimize this effect, and the factory settings for signal processing are selected to eliminate these errors for most applications.

If an output error at zero flow is still detected, it can be eliminated by adjusting the low flow cutoff, trigger level, or low-pass filter.

As the process begins to flow through the meter, most vibration effects are quickly overcome by the flow signal.

Vibration specifications

Integral aluminum housings, remote aluminum housings, and remote SST housings

At or near the minimum liquid flow rate in a normal pipe mounted installation, the maximum vibration should be 0.087-in. (2,21 mm) double amplitude displacement or 1 g acceleration, whichever is smaller. At or near the minimum gas flow rate in a normal pipe mounted installation, the maximum vibration should be 0.043-in. (1,09 mm) double amplitude displacement or $^1/_2$ g acceleration, whichever is smaller.

Integral SST housing

At or near the minimum liquid flow rate in a normal pipe mounted installation, the maximum vibration should be 0.044-in. (1,11 mm) double amplitude displacement or $^1/_3$ g acceleration, whichever is smaller. At or near the minimum gas flow rate in a normal pipe mounted installation, the maximum vibration should be 0.022-in. (0,55 mm) double amplitude displacement or $^1/_6$ g acceleration, whichever is smaller.

Mounting position effect

Meter will meet accuracy specifications when mounted in horizontal, vertical, or inclined pipelines. Best practice for mounting in a horizontal pipe is to orient the shedder bar in the horizontal plane. This will prevent solids in liquid applications and liquid in gas/steam applications from disrupting the shedding frequency.

EMI/RFI effect

Meets EMC requirements to EU Directive 2004/108/EC.

HART analog

Output error less than ±0.025% of span with twisted pair from 80-1000 MHz for radiated field strength of 10 V/m; 1.4 - 2.0 GHz for radiated field strength of 3 V/m; 2.0 - 2.7 GHz for radiated field strength of 1 V/m. Tested per EN61326.

HART digital

No affect on the values that are being given if using HART digital signal. Tested per EN61326.

Magnetic-field interference

HART analog

Output error less than ±0.025% of span at 30 A/m (rms). Tested per EN61326.

Series mode noise rejection

HART analog

Output error less than ±0.025% of span at 1 V rms, 60 Hz.

Common mode noise rejection

HART analog

Output error less than ±0.025% of span at 30 V rms, 60 Hz.

Power supply effect

HART analog

Less than 0.005% of span per volt

A.4 Physical specifications

NACE compliance

Materials of Construction meet NACE material recommendations per MR0175/ISO15156 for use in H_2S containing environments in oil field production. Materials of construction also meet NACE recommendations per MR0103-2003 for corrosive petroleum refining environments. MR0103 compliance requires Q25 option in model code.

Note
Certificate of compliance for MR0175/ISO15156 requires Q15 as a separate line item.

Electrical connections

$^1/_2$–14 NPT or M20 X 1.5 conduit threads; screw terminals provided for 4–20 mA and pulse output connections; communicator connections permanently fixed to terminal block.

Non-wetted materials

Housing

Low-copper aluminum (FM Type 4X, CSA Type 4X, IP66)

Optional SST housing

Paint

Polyurethane

Cover O-rings

Buna-N

Flanges

316/316L lap joint

Temperature sensor (MTA option)

Type-N Thermocouple

Process-wetted materials

Meter body

CF-3M cast stainless, N06022 wrought Nickel Alloy and CW2M cast Nickel Alloy. Also available in WCB and LCC cast carbon steel and 6A duplex stainless steel.

Flanges

316/316L stainless steel

Nickel Alloy N06022 Weld Neck

A105 forged carbon steel

LF2 forged carbon steel

UNS S32760 wrought duplex stainless steel

Collars

Nickel Alloy N06022

316/316L Stainless Steel

Surface finish of flanges and collars

Standard: To the requirements of the applicable flange standard.

Smooth: 63 to 125 μ inches
(1.6 to 3.1 μ meters) Ra roughness

Process connections

Mounts between the following flange configurations:

ASME B16.5 (ANSI): Class 150, 300, 600, 900, 1500

EN 1092-1: PN 10, 16, 25, 40, 63, 100, 160

JIS: 10K, 20K, and 40K

Weld-end: Schedule 10, Schedule 40, Schedule 80, Schedule 160

Mounting

Integral (standard)

Electronics are mounted on meter body.

Remote (optional)

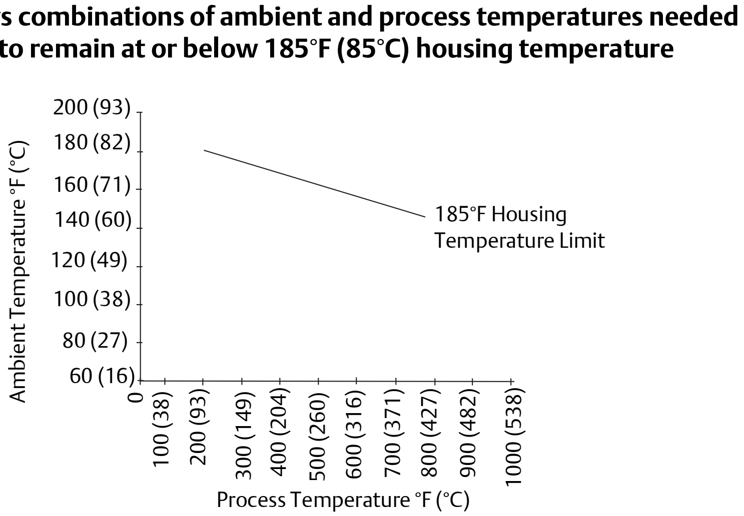
Electronics may be mounted remote from the meter body. Interconnecting coaxial cable available in nonadjustable 10, 20, 30, 33, and 50 ft (3.0, 6.1, 9.1, 10, and 15.2 m) lengths. Consult factory for non-standard lengths up to 75 ft (22,9 m). Remote mounting hardware includes a pipe mount bracket with one u-bolt.

Armored remote cables are also available in lengths of 10, 20, 33, 50 and 75 feet. The armored remote option comes standard with an aluminum gland to connect the cable to the meter and electronics. A stainless steel gland is provided when ordered in conjunction with a stainless steel electronics housing.

Temperature limitations for integral mounting

The maximum process temperature for integral mount electronics is dependent on the ambient temperature where the meter is installed. The electronics must not exceed 185 °F (85 °C). Refer to Figure A-1.

Figure A-1. Rosemount 8800 Vortex Flowmeter Ambient/Process Temperature Limits



Note

The indicated limits are for horizontal pipe and vertical meter position, with meter and pipe insulated with three inches of ceramic fiber insulation.

Pipe length requirements

The vortex meter may be installed with a minimum of ten diameters (D) of straight pipe length upstream and five diameters (D) of straight pipe length downstream.

Rated Accuracy is based on the number of pipe diameter from an upstream disturbance. No K-factor correction is required if the meter is installed with 35D upstream and 5D downstream. The value of the K-factor may shift up to 0.5% when the upstream straight pipe length is between 10D and 35D. Please see Technical Data Sheet (00816-0100-3250) on Installation Effects for optional K-factor corrections. This effect can be corrected in the electronics.

Tagging

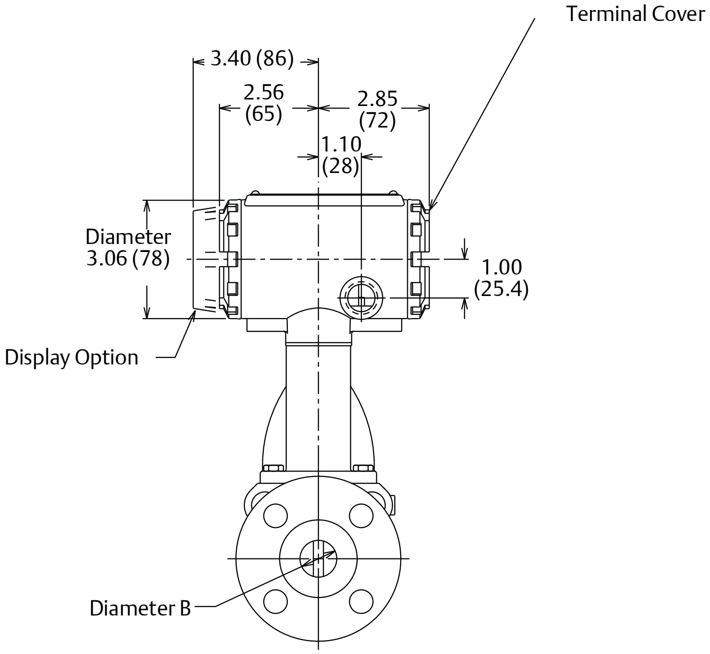
The flowmeter will be tagged at no charge, according to customer requirements. All tags are stainless steel. The standard tag is permanently attached to the flowmeter. Character height is 1/16-in. (1,6 mm). A wired-on tag is available on request. Wire on tags can contain five lines with up to 28 characters per line.

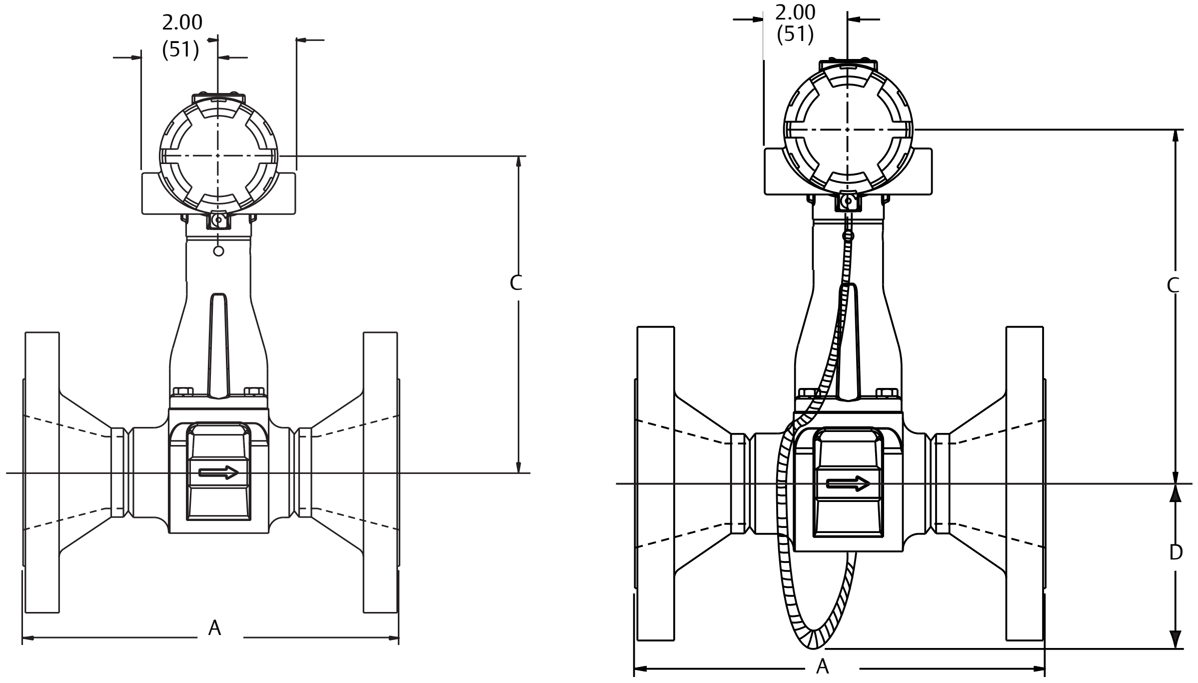
Flow calibration information

Flowmeter calibration and configuration information is provided with every flowmeter. For a certified copy of flow calibration data, Option Q4 must be ordered in the model number.

A.5 Dimensional drawings

Figure A-2. Flanged-Style Flowmeter—Line Sizes $^1/_2$- through 12-in. (15 through 300 mm)




Without MTA option

With MTA option

Dimensions are in inches (millimeters).

Table A-18. Flanged-Style Flowmeter—Line Sizes 1/2- through 2-in. (15 through 50 mm)

Nominal Size Inch (mm)	Flange Rating	Face-to-face A Inch (mm)	A-ANSI RTJ Inch (mm)	Diameter B Inch (mm)	C Inch (mm)	Weight lb (kg)
½ (15)	Class 150	6.8 (173)	N/A	0.54 (13,7)	7.6 (193)	9.1 (4,1)
	Class 300	7.2 (183)	7.6 (193)	0.54 (13,7)	7.6 (193)	10.4 (4,7)
	Class 600	7.7 (196)	7.6 (193)	0.54 (13,7)	7.6 (193)	10.8 (4,9)
	Class 900	8.3 (211)	8.3 (211)	0.54 (13,7)	7.6 (193)	15.3 (6,9)
	PN 16/40	6.1 (155)	N/A	0.54 (13,7)	7.6 (193)	10.4 (4,7)
	PN 100	6.6 (168)	N/A	0.54 (13,7)	7.6 (193)	12.4 (5,6)
	JIS 10K/20K	6.3 (160)	N/A	0.54 (13,7)	7.6 (193)	10.2 (4,6)
	JIS 40K	7.3 (185)	N/A	0.54 (13,7)	7.6 (193)	13.7 (6,2)
1 (25)	Class 150	7.5 (191)	8.0 (203)	0.95 (24,1)	7.7 (196)	12.3 (5,6)
	Class 300	8.0 (203)	8.5 (216)	0.95 (24,1)	7.7 (196)	15.0 (6,8)
	Class 600	8.5 (216)	8.5 (216)	0.95 (24,1)	7.7 (196)	15.8 (7,2)
	Class 900	9.4 (239)	9.4 (239)	0.95 (24,1)	7.7 (196)	24.1 (11,1)
	Class 1500	9.4 (239)	9.4 (239)	0.95 (24,1)	7.7 (196)	24.4 (11,1)
	PN 16/40	6.2 (157)	N/A	0.95 (24,1)	7.7 (196)	13.6 (6,2)
	PN 100	7.7 (196)	N/A	0.95 (24,1)	7.7 (196)	19.6 (8,9)
	PN 160	7.7 (196)	N/A	0.95 (24,1)	7.7 (196)	19.6 (8,9)
	JIS 10K/20K	6.5 (165)	N/A	0.95 (24,1)	7.7 (196)	14.0 (6,3)
	JIS 40K	7.8 (198)	N/A	0.95 (24,1)	7.7 (196)	17.7 (7,9)
1 ½ (40)	Class 150	8.2 (208)	8.7 (221)	1.49 (37,8)	8.1 (206)	17.6 (8,0)
	Class 300	8.7 (221)	9.2 (234)	1.49 (37,8)	8.1 (206)	23.0 (10,4)
	Class 600	9.3 (236)	9.3 (236)	1.49 (37,8)	8.1 (206)	25.5 (11,6)
	Class 900	10.3 (262)	10.3 (262)	1.49 (37,8)	8.1 (206)	36.6 (16,6)
	Class 1500	10.3 (262)	10. 3(262)	1.49 (37,8)	8.1 (206)	36.6 (16,6)
	PN 16/40	6.9 (175)	N/A	1.49 (37,8)	8.1 (206)	19.4 (8,8)
	PN 100	8.2 (208)	N/A	1.49 (37,8)	8.1 (206)	28.0 (12,7)
	PN 160	8.4 (213)	N/A	1.49 (37,8)	8.1 (206)	29.5 (13,4)
	JIS 10K/20K	7.3 (185)	N/A	1.49 (37,8)	8.1 (206)	18.6 (8,4)
	JIS 40K	8.4 (213)	N/A	1.49 (37,8)	8.1 (206)	25.5 (11,6)
2 (50)	Class 150	9.2 (234)	9.7(246)	1.92 (48,8)	8.5 (216)	22.0 (10,0)
	Class 300	9.7 (246)	10.4 (264)	1.92 (48,8)	8.5 (216)	26.1 (11,8)
	Class 600	10.5 (267)	10.6 (269)	1.92 (48,8)	8.5 (216)	29.8 (13,5)
	Class 900	12.7 (323)	12.9 (328)	1.92 (48,8)	8.5 (216)	59.5 (27,0)
	Class 1500	12.7 (323)	12.9 (328)	1.79 (45,5)	8.5 (216)	59.5 (27,0)
	PN 16/40	8.0 (203)	N/A	1.92 (48,8)	8.5 (216)	23.2 (10,5)
	PN 63/64	9.1 (231)	N/A	1.92 (48,8)	8.5 (216)	30.8 (13,9)
	PN 100	9.6 (244)	N/A	1.92 (48,8)	8.5 (216)	36.5 (16,6)
	PN 160	10.2 (259)	N/A	1.92 (48,8)	8.5 (216)	38.8 (17,6)
	JIS 10K	7.7 (195)	N/A	1.92 (48,8)	8.5 (216)	19.5 (8,8)
	JIS 20K	8.3 (210)	N/A	1.92 (48,8)	8.5 (216)	20.4 (9,3)
	JIS 40K	9.8 (249)	N/A	1.92 (48,8)	8.5 (216)	28.5 (12,9)

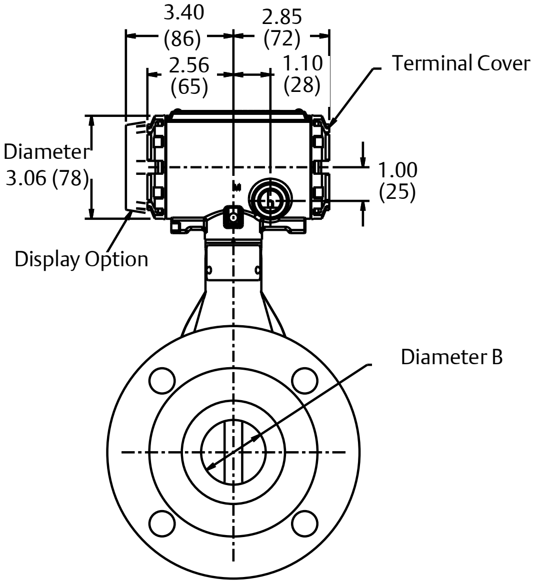
Table A-19. Flanged-Style Flowmeter—Line Sizes 3- through 6-in. (80 through 150mm) (refer to Figure A-2)

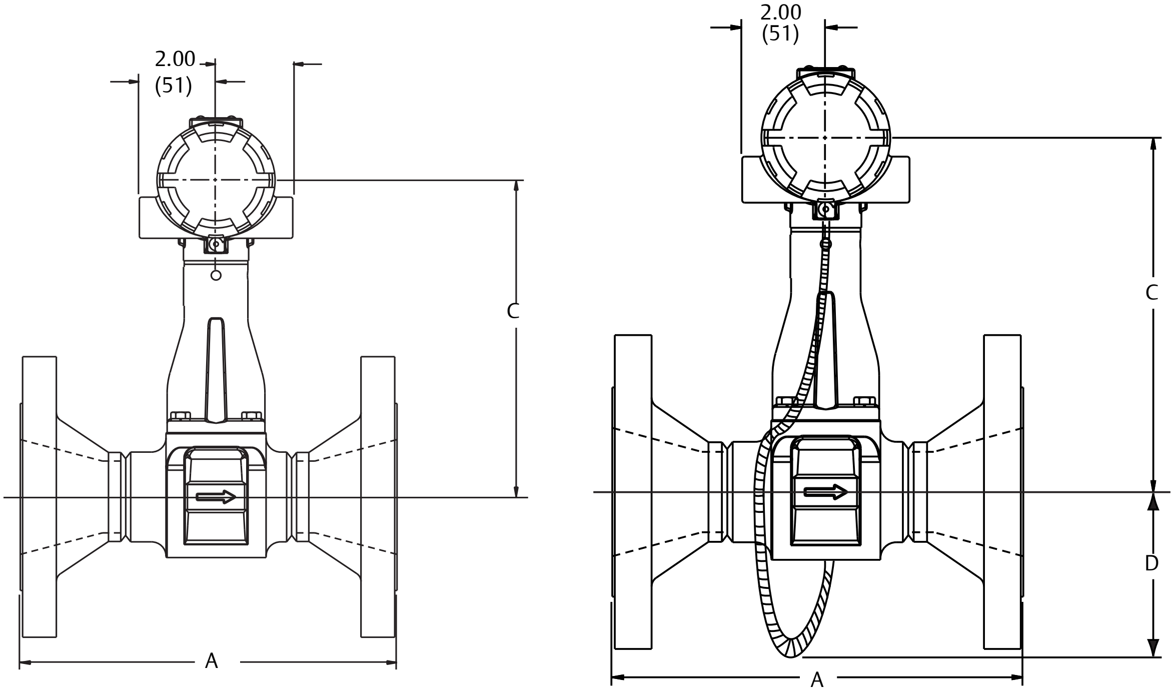
Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
3 (80)	Class 150	9.9 (251)	10.4 (264)	2.87 (72,9)	9.1 (231)	37.2 (16,9)
	Class 300	10.6 (269)	11.2 (284)	2.87 (72,9)	9.1 (231)	46.5 (21,1)
	Class 600	11.4 (290)	11.5 (292)	2.87 (72,9)	9.1 (231)	52.6 (23,8)
	Class 900	12.9 (328)	13.0 (330)	2.87 (72,9)	9.1 (231)	76.1 (34,5)
	Class 1500	14.1 (358)	14.2 (361)	2.60 (66)	9.1 (231)	108.9 (49,4)
	PN 16/40	8.9 (226)	N/A	2.87 (72,9)	9.1 (231)	36.6 (16,6)
	PN 63/64	10.0 (254)	N/A	2.87 (72,9)	9.1 (231)	45.3 (20,6)
	PN 100	10.5 (267)	N/A	2.87 (72,9)	9.1 (231)	54.7 (24,8)
	PN 160	11.1 (282)	N/A	2.87 (72,9)	9.1 (231)	59.6 (27,0)
	JIS 10K	7.9 (201)	N/A	2.87 (72,9)	9.1 (231)	28.0 (12,7)
	JIS 20K	9.3 (236)	N/A	2.87 (72,9)	9.1 (231)	35.4 (16,1)
	JIS 40K	11.0 (279)	N/A	2.87 (72,9)	9.1 (231)	50.3 (22,8)
4 (100)	Class 150	10.3 (262)	10.8 (274)	3.79 (96,3)	9.6 (244)	51.3 (23,3)
	Class 300	11.0 (279)	11.6 (295)	3.79 (96,3)	9.6 (244)	71.5 (32,4)
	Class 600	12.8 (325)	12.9 (328)	3.79 (96,3)	9.6 (244)	97.5 (44,2)
	Class 900	13.8 (351)	13.9 (353)	3.79 (96,3)	9.6 (244)	120.8 (54,8)
	Class 1500	14.5 (368)	14.6 (371)	3.40 (86,4)	9.6 (244)	162.6 (73,8)
	PN 16	8.4 (213)	N/A	3.79 (96,3)	9.6 (244)	40.4 (18,3)
	PN 40	9.4 (239)	N/A	3.79 (96,3)	9.6 (244)	49.5 (22,4)
	PN 63/64	10.4 (264)	N/A	3.79 (96,3)	9.6 (244)	62.5 (28,3)
	PN 100	11.3 (287)	N/A	3.79 (96,3)	9.6 (244)	78.9 (35,8)
	PN 160	12.1 (307)	N/A	3.79 (96,3)	9.6 (244)	86.2 (39,1)
	JIS 10K	8.7 (220)	N/A	3.79 (96,3)	9.6 (244)	37.5 (17,0)
	JIS 20K	8.7 (220)	N/A	3.79 (96,3)	9.6 (244)	45.4 (20,6)
	JIS 40K	11.8 (300)	N/A	3.79 (96,3)	9.6 (244)	75.8 (34,4)
6 (150)	Class 150	11.6 (295)	12.1 (307)	5.7 (144,8)	10.8 (274)	81 (37)
	Class 300	12.3 (312)	13.0 (330)	5.7 (144,8)	10.8 (274)	120 (55)
	Class 600	14.3 (363)	14.4 (366)	5.7 (144,8)	10.8 (274)	187 (55)
	Class 900	16.1 (409)	16.2 (411)	5.14 (130,6)	10.8 (274)	277.9 (126,0)
	Class 1500	18.6 (472)	18.8 (478)	5.14 (130,6)	10.8 (274)	375.8 (170.4)
	PN 16	8.9 (226)	N/A	5.7 (144,8)	10.8 (274)	66 (30)
	PN 40	10.5 (267)	N/A	5.7 (144,8)	10.8 (274)	86 (39)
	PN 63/64	12.1 (307)	N/A	5.7 (144,8)	10.8 (274)	130 (59)
	PN 100	13.6 (345)	N/A	5.7 (144,8)	10.8 (274)	160 (73)
	JIS 10K	10.6 (270)	N/A	5.7 (144,8)	10.8 (274)	70 (32)
	JIS 20K	10.6 (270)	N/A	5.7 (144,8)	10.8 (274)	88 (40)
	JIS 40K	14.2 (361)	N/A	5.7 (144,8)	10.8 (274)	166 (75)

Table A-20. Flanged-Style Flowmeter—Line Sizes 8- through 12-in. (200 through 300mm) (refer to Figure A-2)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
8 (200)	Class 150	13.5 (343)	14.0 (356)	7.55 (191,8)	11.7 (297)	141.6 (64,2)
	Class 300	14.3 (363)	14.9 (378)	7.55 (191,8)	11.7 (297)	198.7 (90,1)
	Class 600	16.5 (419)	16.7 (424)	7.55 (191,8)	11.7 (297)	298.6 (135,4)
	Class 900	18.8 (478)	18.9 (480)	6.62 (168,1)	11.7 (297)	479.2 (217,4)
	Class 1500	22.8 (579)	23.2 (589)	6.62 (168,1)	11.7 (297)	652.4 (295,9)
	PN 10	10.4 (264)	N/A	7.55 (191,8)	11.7 (297)	110.5 (50,1)
	PN 16	10.4 (264)	N/A	7.55 (191,8)	11.7 (297)	109.4 (49,6)
	PN 25	11.8 (300)	N/A	7.55 (191,8)	11.7 (297)	137.7 (62,5)
	PN 40	12.5 (318)	N/AN/A	7.55 (191,8)	11.7 (297)	156.5 (71,0)
	PN 63/64	14.2 (361)	N/A	7.55 (191,8)	11.7 (297)	217.1 (98,5)
	PN 100	15.8 (401)	N/A	7.55 (191,8)	11.7 (297)	282.7 (128,2)
	JIS 10K	12.2 (310)	N/A	7.55 (191,8)	11.7 (297)	110.1 (49,9)
	JIS 20K	12.2 (310)	N/A	7.55 (191,8)	11.7 (297)	134.5 (61,0)
	JIS 40K	16.5 (419)	N/A	7.55 (191,8)	11.7 (297)	255.7 (116)
10 (250)	Class 150	14.5 (368)	15.0 (381)	9.56 (243)	12.8 (325)	197.7 (89,7)
	Class 300	15.8 (401)	16.4 (417)	9.56 (243)	12.8 (325)	286.2 (129,8)
	Class 600	19.0 (483)	19.2 (488)	9.56 (243)	12.8 (325)	477.9 (219,9)
	PN 10	11.9 (302)	N/A	9.56 (243)	12.8 (325)	157.1 (71,3)
	PN 16	12.0 (305)	N/A	9.56 (243)	12.8 (325)	161.9 (73,5)
	PN 25	13.5 (343)	N/A	9.56 (243)	12.8 (325)	198.6 (90,1)
	PN 40	14.8 (376)	N/A	9.56 (243)	12.8 (325)	246.8 (111,9)
	PN 63/64	16.4 (417)	N/A	9.56 (243)	12.8 (325)	308.2 (139,8)
	PN 100	18.9 (480)	N/A	9.56 (243)	12.8 (325)	445.2 (201,9)
	JIS 10K	14.5 (368)	N/A	9.56 (243)	12.8 (325)	174.5 (79,1)
	JIS 20K	14.5 (368)	N/A	9.56 (243)	12.8 (325)	221.8 (100,6)
	JIS 40K	18.1 (460)	N/A	9.56 (243)	12.8 (325)	378.5 (171,7)
12 (300)	Class 150	16.8 (427)	17.3 (439)	11.38 (289)	13.7 (348)	297.5 (134,9)
	Class 300	18.0 (457)	18.6 (472)	11.38 (289)	13.7 (348)	415.7 (188,6)
	Class 600	20.5 (521)	20.6 (523)	11.38 (289)	13.7 (348)	595.4 (270,1)
	PN 10	13.1 (333)	N/A	11.38 (289)	13.7 (348)	204.1 (92,6)
	PN 16	13.9 (353)	N/A	11.38 (289)	13.7 (348)	224.6 (101,9)
	PN 25	15.0 (381)	N/A	11.38 (289)	13.7 (348)	269.4 (122,2)
	PN 40	16.8 (427)	N/A	11.38 (289)	13.7 (348)	347.9 (157,8)
	PN 63/64	18.8 (478)	N/A	11.38 (289)	13.7 (348)	431.2 (195,6)
	PN 100	21.2 (538)	N/A	11.38 (289)	13.7 (348)	644.1 (292,2)
	JIS 10K	15.7 (399)	N/A	11.38 (289)	13.7 (348)	222.9 (101,1)
	JIS 20K	15.7 (399)	N/A	11.38 (289)	13.7 (348)	284.2 (128,9)
	JIS 40K	19.6 (498)	N/A	11.38 (289)	13.7 (348)	493.8 (224,0)

Figure A-3. Rosemount 8800DR Reducer™ Vortex Flowmeter—Line Sizes 1- through 12-in. (25 through 300 mm




Without MTA option

With MTA option

Dimensions are in inches (millimeters).

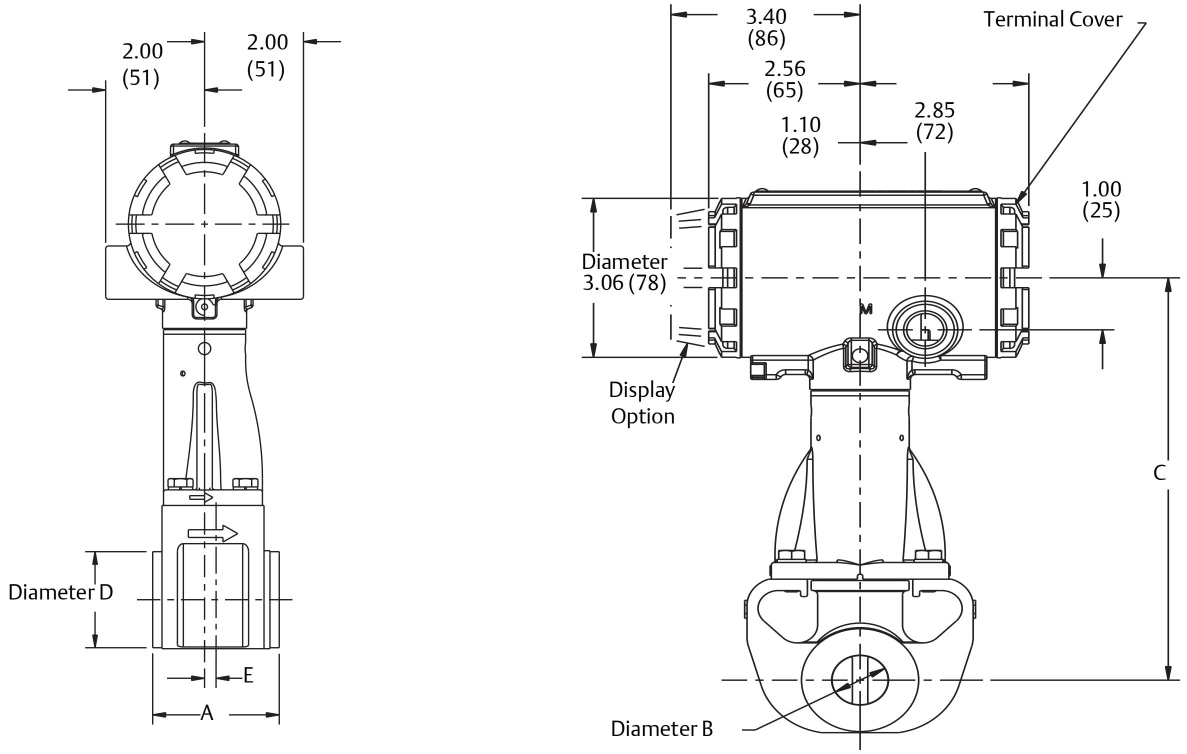
Table A-21. Reducer Flowmeter—Line Sizes 1- through 3-in. (25 through 80 mm)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A-ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
1 (25)	Class 150	7.5 (191)	8.0 (203)	0.54 (13,7)	7.6 (193)	11.56 (5,24)
	Class 300	8.0 (203)	8.5 (216)	0.54 (13,7)	7.6 (193)	14.22 (6,45)
	Class 600	8.5 (216)	8.5 (216)	0.54 (13,7)	7.6 (193)	15.11 (6,85)
	Class 900	9.4 (239)	9.4 (239)	0.54 (13,7)	7.6 (193)	20.70 (9.40)
	PN 16/40	6.2 (157)	N/A	0.54 (13,7)	7.6 (193)	12.64 (5,73)
	PN 100	7.7 (196)	N/A	0.54 (13,7)	7.6 (193)	18.44 (8,36)
1 ½ (40)	Class 150	8.2 (208)	8.7 (221)	0.95 (24,1)	7.7 (196)	15.81 (7,17)
	Class 300	8.7 (221)	9.2 (234)	0.95 (24,1)	7.7 (196)	21.20 (9,62)
	Class 600	9.3 (236)	9.3 (236)	0.95 (24,1)	7.7 (196)	23.77 (10,78)
	Class 900	10.3 (262)	10.3 (262)	0.95 (24,1)	7.7 (196)	34.98 (15,87)
	PN 16/40	6.9 (175)	N/A	0.95 (24,1)	7.7 (196)	17.50 (7,94)
	PN 100	8.2 (208)	N/A	0.95 (24,1)	7.7 (196)	26.20 (11,88)
	PN 160	8.4 (213)	N/A	0.95 (24,1)	7.7 (196)	27.67 (12,55)
2 (50)	Class 150	9.2 (234)	9.7 (246)	1.49 (37,8)	8.1 (206)	22.61 (10,26)
	Class 300	9.7 (246)	10.4 (264)	1.49 (37,8)	8.1 (206)	26.76 (12,14)
	Class 600	10.5 (267)	10.6 (269)	1.49 (37,8)	8.1 (206)	30.59 (13,88)
	Class 900	12.7 (323)	12.9 (328)	1.49 (37,8)	8.1 (206)	60.76 (27,56)
	PN 16/40	8.0 (203)	N/A	1.49 (37,8)	8.1 (206)	23.52 (10,67)
	PN 63/64	9.1 (231)	N/A	1.49 (37,8)	8.1 (206)	31.28 (14,19)
	PN 100	9.6 (244)	N/A	1.49 (37,8)	8.1 (206)	37.25 (16,90)
	PN 160	10.2 (259)	N/A	1.49 (37,8)	8.1 (206)	39.64 (17,98)
3 (80)	Class 150	9.9 (251)	10.4 (264)	1.92 (48,8)	8.5 (216)	33.15 (15,04)
	Class 300	10.6 (269)	11.2 (284)	1.92 (48,8)	8.5 (216)	42.66 (19,35)
	Class 600	11.4 (290)	11.5 (292)	1.92 (48,8)	8.5 (216)	49.46 (22,43)
	Class 900	12.9 (328)	13.0 (330)	1.92 (48,8)	8.5 (216)	73.28 (33,24)
	PN 16/40	8.9 (226)	N/A	1.92 (48,8)	8.5 (216)	33.30 (15,10)
	PN 63/64	10.0 (254)	N/A	1.92 (48,8)	8.5 (216)	42.45 (19,25)
	PN 100	10.5 (267)	N/A	1.92 (48,8)	8.5 (216)	52.21 (23,68)
	PN 160	11.1 (282)	N/A	1.92 (48,8)	8.5 (216)	57.94 (26,28)

Table A-22. Reducer Flowmeter—Line Sizes 4- through 12-in. (100 through 300mm) (refer to Figure A-3)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
4 (100)	Class 150	10.3 (262)	10.8 (274)	2.87 (72,9)	9.1 (231)	46.33 (21,01)
	Class 300	11.0 (279)	11.6 (295)	2.87 (72,9)	9.1 (231)	67.04 (30,41)
	Class 600	12.8 (325)	12.9 (328)	2.87 (72,9)	9.1 (231)	94.26 (42,76)
	Class 900	13.8 (351)	13.9 (353)	2.87 (72,9)	9.1 (231)	118.04 (53,54)
	PN 16	8.4 (213)	N/A	2.87 (72,9)	9.1 (231)	36.36 (16,49)
	PN 40	9.4 (239)	N/A	2.87 (72,9)	9.1 (231)	45.89 (20,81)
	PN 63/64	10.4 (264)	N/A	2.87 (72,9)	9.1 (231)	59.72 (27,09)
	PN 100	11.3 (287)	N/A	2.87 (72,9)	9.1 (231)	76.73 (34,80)
	PN 160	12.1 (307)	N/A	2.87 (72,9)	9.1 (231)	84.73 (38,43)
6 (150)	Class 150	11.6 (295)	12.1 (307)	3.79 (96,3)	9.6 (244)	70.27 (31,87)
	Class 300	12.3 (312)	13.0 (330)	3.79 (96,3)	9.6 (244)	113.09 (51,30)
	Class 600	14.3 (363)	14.4 (366)	3.79 (96,3)	9.6 (244)	185.13 (83,97)
	Class 900	16.1 (409)	16.2 (411)	3.79 (96,3)	9.6 (244)	246.33 (111,73)
	PN 16	8.9 (226)	N/A	3.79 (96,3)	9.6 (244)	59.20 (26,85)
	PN 40	10.5 (267)	N/A	3.79 (96,3)	9.6 (244)	81.94 (37,17)
	PN 63/64	12.1 (307)	N/A	3.79 (96,3)	9.6 (244)	125.36 (56,86)
	PN 100	13.6 (345)	N/A	3.79 (96,3)	9.6 (244)	162.29 (73,61)
	PN 160	14.7 (373)	N/A	3.79 (96,3)	9.6 (244)	187.91 (85,23)
8 (200)	Class 150	13.5 (343)	14.0 (356)	5.70 (144,8)	10.8 (274)	124 (56)
	Class 300	14.3 (363)	14.9 (378)	5.70 (144,8)	10.8 (274)	186 (84)
	Class 600	16.5 (419)	16.7 (424)	5.70 (144,8)	10.8 (274)	295 (134)
	PN 10	10.4 (264)	N/A	5.70 (144,8)	10.8 (274)	91 (41)
	PN 16	10.4 (264)	N/A	5.70 (144,8)	10.8 (274)	91 (41)
	PN 25	11.8 (300)	N/A	5.70 (144,8)	10.8 (274)	124 (56)
	PN 40	12.5 (318)	N/A	5.70 (144,8)	10.8 (274)	145 (66)
	PN 63/64	14.2 (361)	N/A	5.70 (144,8)	10.8 (274)	211 (96)
	PN 100	15.8 (401)	N/A	5.70 (144,8)	10.8 (274)	283 (128)
10 (250)	Class 150	14.5 (368)	15.0 (381)	7.55 (191,8)	11.7 (297)	182.45 (82,76)
	Class 300	15.8 (401)	16.4 (417)	7.55 (191,8)	11.7 (297)	281.66 (127,76)
	Class 600	19.0 (483)	19.2 (488)	7.55 (191,8)	11.7 (297)	489.89 (222,21)
	PN 10	11.9 (302)	N/A	7.55 (191,8)	11.7 (297)	138.63 (62,88)
	PN 16	12.0 (305)	N/A	7.55 (191,8)	11.7 (297)	148.58 (67,39)
	PN 25	13.5 (343)	N/A	7.55 (191,8)	11.7 (297)	191.00 (86,64)
	PN 40	14.8 (376)	N/A	7.55 (191,8)	11.7 (297)	245.85 (111,52)
	PN 63/64	16.4 (417)	N/A	7.55 (191,8)	11.7 (297)	314.13 (142,49)
	PN 100	18.9 (480)	N/A	7.55 (191,8)	11.7 (297)	463.49 (210,24)
12 (300)	Class 150	16.8 (427)	17.3 (439)	9.56 (242,8)	12.8 (325)	281.98 (127,90)
	Class 300	18.0 (457)	18.6 (472)	9.56 (242,8)	12.8 (325)	412.18 (186,96)
	Class 600	20.5 (521)	20.6 (523)	9.56 (242,8)	12.8 (325)	609.89 (296,64)
	PN 10	13.1 (333)	N/A	9.56 (242,8)	12.8 (325)	188.28 (85,40)
	PN 16	13.9 (353)	N/A	9.56 (242,8)	12.8 (325)	211.79 (96,07)
	PN 25	15.0 (381)	N/A	9.56 (242,8)	12.8 (325)	262.45 (119,05)
	PN 40	16.8 (427)	N/A	9.56 (242,8)	12.8 (325)	349.92 (158,72)
	PN 63/64	18.8 (478)	N/A	9.56 (242,8)	12.8 (325)	444.21 (201,49)
	PN 100	21.2 (538)	N/A	9.56 (242,8)	12.8 (325)	672.07 (304,85)

Figure A-4. Wafer-Style—Line Sizes ½- through 8-in. (15 through 200 mm)



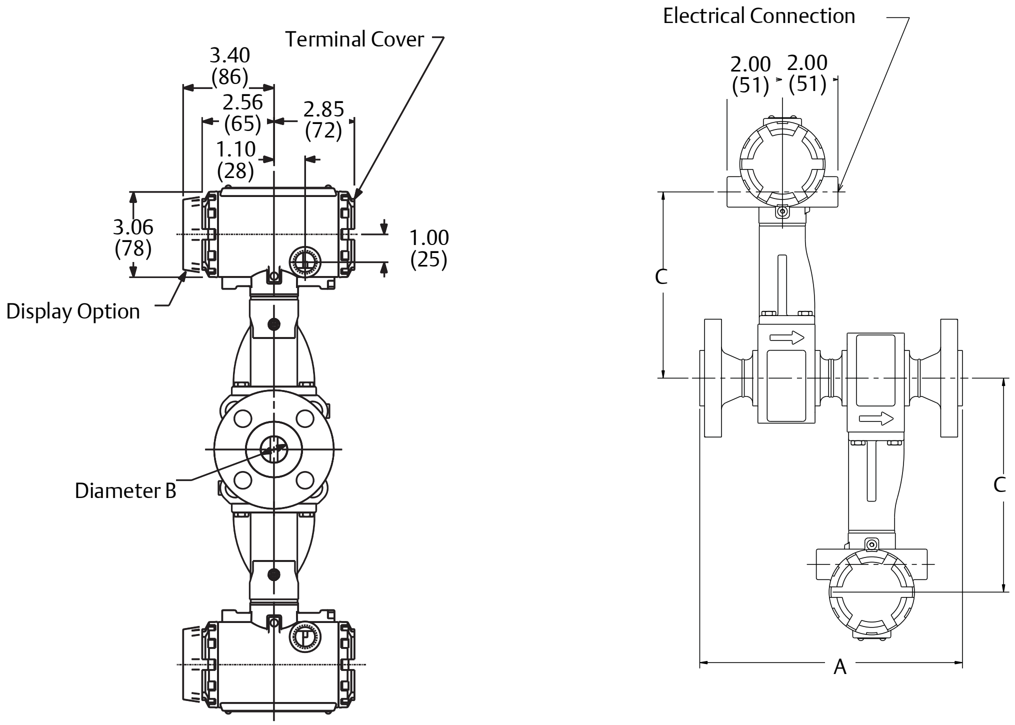
Dimensions are in inches (millimeters).
Electronics housing may be rotated in 90 degree increments.

Table A-23. Rosemount 8800D Wafer-Style Meter

Nominal size inch (mm)	Face-to-face A inch (mm)	Diameter B inch (mm)	C inch (mm)	E inch (mm)	Weight lb (kg)(1)
½ (15)	2.56 (65)	0.52 (13,2)	7.63 (194)	0.17 (4,3)	6.8 (3,1)
1 (25)	2.56 (65)	0.95 (24,1)	7.74 (197)	0.23 (5,9)	7.4 (3,4)
1½ (40)	2.56 (65)	1.49 (37,8)	8.14 (207)	0.18 (4,6)	10.0 (4,5)
2 (50)	2.56 (65)	1.92 (49)	8.85 (225)	0.12 (3)	10.6 (4,8)
3 (80)	2.56 (65)	2.87 (73)	9.62 (244)	0.25 (6)	13.6 (6,2)
4 (100)	3.42 (87)	3.79 (96)	10.48 (266)	0.44 (11)	21.4 (9,7)
6 (150)	5.00 (127)	5.70 (145)	10.29 (261)	0.30 (7,6)	36 (16)
8 (200)	6.60 (168)	7.55 (192)	11.22 (285)	0.70 (17,8)	62 (28)

1. Add 0.2 lb (0,1 kg) for display option.

Figure A-5. Vortex Dual-Sensor Style Flowmeter—Line Sizes $^1/_2$- through 3-in. (15 through 80 mm)



Dimensions are in inches (millimeters).

Table A-24. Vortex Dual-Sensor Style Flowmeter—Line Sizes $^1/_2$- through 3-in. (15 through 80 mm)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
½ (15)	Class 150	11.9 (302)	N/A	0.54 (13,7)	7.6 (193)	16.2 (7,4)
	Class 300	12.3 (312)	12.7 (323)	0.54 (13,7)	7.6 (193)	17.4 (7,9)
	Class 600	12.8 (325)	12.7 (323)	0.54 (13,7)	7.6 (193)	17.9 (8,1)
	Class 900	13.4 (340)	13.4 (340)	0.54 (13,7)	7.6 (193)	22.7 (10,3)
	PN 16/40	11.2 (284)	N/A	0.54 (13,7)	7.6 (193)	17.4 (7,9)
	PN 100	11.7 (297)	N/A	0.54 (13,7)	7.6 (193)	19.4 (8,8)
	JIS 10K/20K	11.4 (290)	N/A	0.54 (13,7)	7.6 (193)	17.3 (7.8)
	JIS 40K	12.4 (315)	N/A	0.54 (13,7)	7.6 (193)	20.8 (9.4)
1 (25)	Class 150	15.0 (381)	15.6 (396)	0.95 (24,1)	7.7 (196)	20.7 (9,4)
	Class 300	15.6 (396)	16.1 (409)	0.95 (24,1)	7.7 (196)	23.3 (10,6)
	Class 600	16.1 (409)	16.1 (409)	0.95 (24,1)	7.7 (196)	24.2 (11,0)
	Class 900	16.9 (429)	16.9 (429)	0.95 (24,1)	7.7 (196)	32.8 (14,9)
	Class 1500	16.9 (429)	16.9 (429)	0.95 (24,1)	7.7 (196)	32.8 (14,9)
	PN 16/40	13.8 (351)	N/A	0.95 (24,1)	7.7 (196)	21.9 (9,9)
	PN 100	15.3 (389)	N/A	0.95 (24,1)	7.7 (196)	28.0 (12,7)
	PN 160	15.3 (389)	N/A	0.95 (24,1)	7.7 (196)	28.0 (12,7)
	JIS 10K/20K	14.0 (356)	N/A	0.95 (24,1)	7.7 (196)	22.3 (10.1)
	JIS 40K	15.4 (391	N/A	0.95 (24,1)	7.7 (196)	26.08 (11,8)

Table A-24. Vortex Dual-Sensor Style Flowmeter—Line Sizes 1/2- through 3-in. (15 through 80 mm)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
1 ½ (40)	Class 150	11.3 (287)	11.8 (300)	1.49 (37,8)	8.1 (206)	27.0 (12,3)
	Class 300	11.8 (300)	12.3 (312)	1.49 (37,8)	8.1 (206)	32.4 (14,7)
	Class 600	12.4 (315)	12.4 (315)	1.49 (37,8)	8.1 (206)	34.8 (15,8)
	Class 900	13.4 (340)	13.4 (340)	1.49 (37,8)	8.1 (206)	45.9 (20.8)
	Class 1500	13.4 (340)	13.4 (340)	1.49 (37,8)	8.1 (206)	45.9 (20.8)
	PN 16/40	9.9 (251)	N/A	1.49 (37,8)	8.1 (206)	28.7 (13,0)
	PN 100	11.3 (287)	N/A	1.49 (37,8)	8.1 (206)	37.4 (17,0)
	PN 160	11.4 (290)	N/A	1.49 (37,8)	8.1 (206)	38.8 (17,6)
	JIS 10K/20K	10.3 (262)	N/A	1.49 (37,8)	8.1 (206)	27.9 (12,6)
	JIS 40K	11.5 (292)	N/A	1.49 (37,8)	8.1 (206)	34.9 (15,8)
2 (50)	Class 150	13.0 (330)	13.5 (343)	1.92 (48,8)	8.5 (216)	31.9 (14,5)
	Class 300	13.5 (343)	14.0 (356)	1.92 (48,8)	8.5 (216)	35.9 (16,3)
	Class 600	14.3 (363)	14.3 (363)	1.92 (48,8)	8.5 (216)	39.4 (17,9)
	Class 900	16.5 (419)	16.7 (424)	1.92 (48,8)	8.5 (216)	69.1 (31,4)
	Class 1500	15.6 (396)	15.7 (399)	1.67 (42.4)	8.5 (216)	72.4 (32,9)
	PN 16/40	11.8 (300)	N/A	1.92 (48,8)	8.5 (216)	32.8 (14,9)
	PN 63/64	12.9 (328)	N/A	1.92 (48,8)	8.5 (216)	40.4 (18,3)
	PN 100	13.4 (340)	N/A	1.92 (48,8)	8.5 (216)	46.2 (20,9)
	PN 160	13.9 (353)	N/A	1.92 (48,8)	8.5 (216)	48.4 (21,9)
	JIS 10K	11.5 (292)	N/A	1.92 (48,8)	8.5 (216)	29.1 (13,2)
	JIS 20K	12.0 (305)	N/A	1.92 (48,8)	8.5 (216)	30.0 (13,6)
	JIS 40K	13.6 (345)	N/A	1.92 (48,8)	8.5 (216)	38.1 (13,6
3 (80)	Class 150	14.3 (363)	14.8 (376)	2.87 (72,9)	9.1 (231)	50.6 (23,0)
	Class 300	15.0 (381)	15.7 (399)	2.87 (72,9)	9.1 (231)	59.9 (27,2)
	Class 600	15.8 (401)	15.9 (404)	2.87 (72,9)	9.1 (231)	65.9 (29,9)
	Class 900	17.3 (439)	17.4 (442)	2.87 (72,9)	9.1 (231)	88.4 (40.8)
	Class 1500	18.5 (470)	18.7 (475)	2.60 (66.0)	9.1 (231)	123.8 (56,2)
	PN 16/40	13.4 (340)	N/A	2.87 (72,9)	9.1 (231)	50.0 (22,7)
	PN 63/64	14.5 (367)	N/A	2.87 (72,9)	9.1 (231)	58.7 (26,6)
	PN 100	14.9 (378)	N/A	2.87 (72,9)	9.1 (231)	68.0 (30,9)
	PN 160	15.6 (396)	N/A	2.87 (72,9)	9.1 (231)	73.4 (33,3)
	JIS 10K	12.3 (312)	N/A	2.87 (72,9)	9.1 (231)	41.4 (18,8)
	JIS 20K	13.7 (348)	N/A	2.87 (72,9)	9.1 (231)	48.8 (22,1)
	JIS 40K	15.5 (394)	N/A	2.87 (72,9)	9.1 (231)	63.7 (28,9)

Figure A-6. Vortex Dual-Sensor Style Flowmeter—Line Sizes 4- through 12-in. (100 through 300 mm)

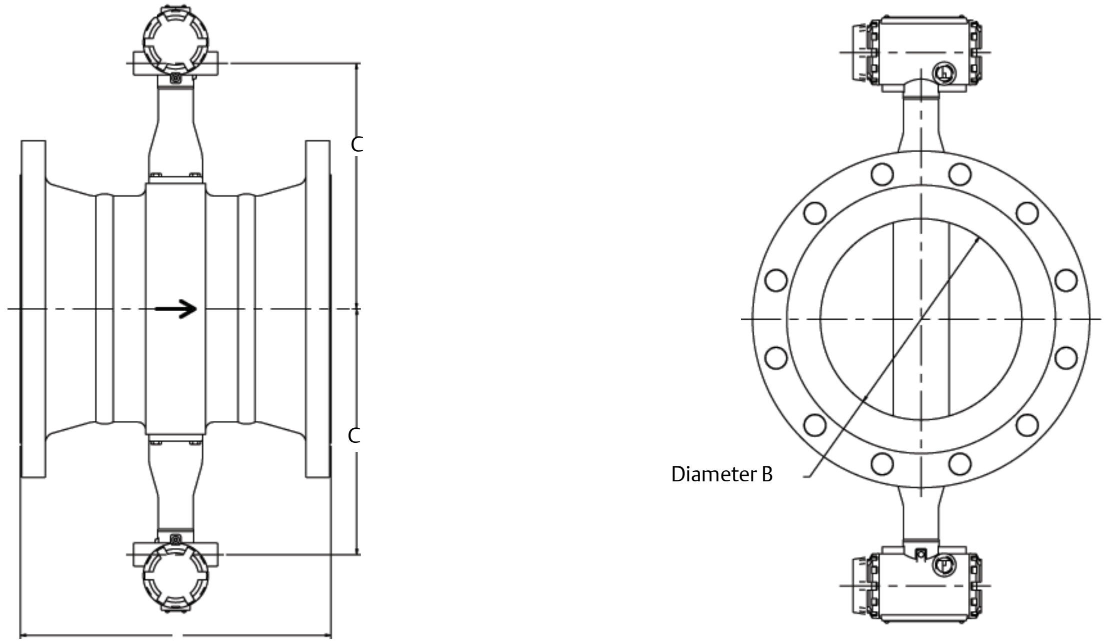


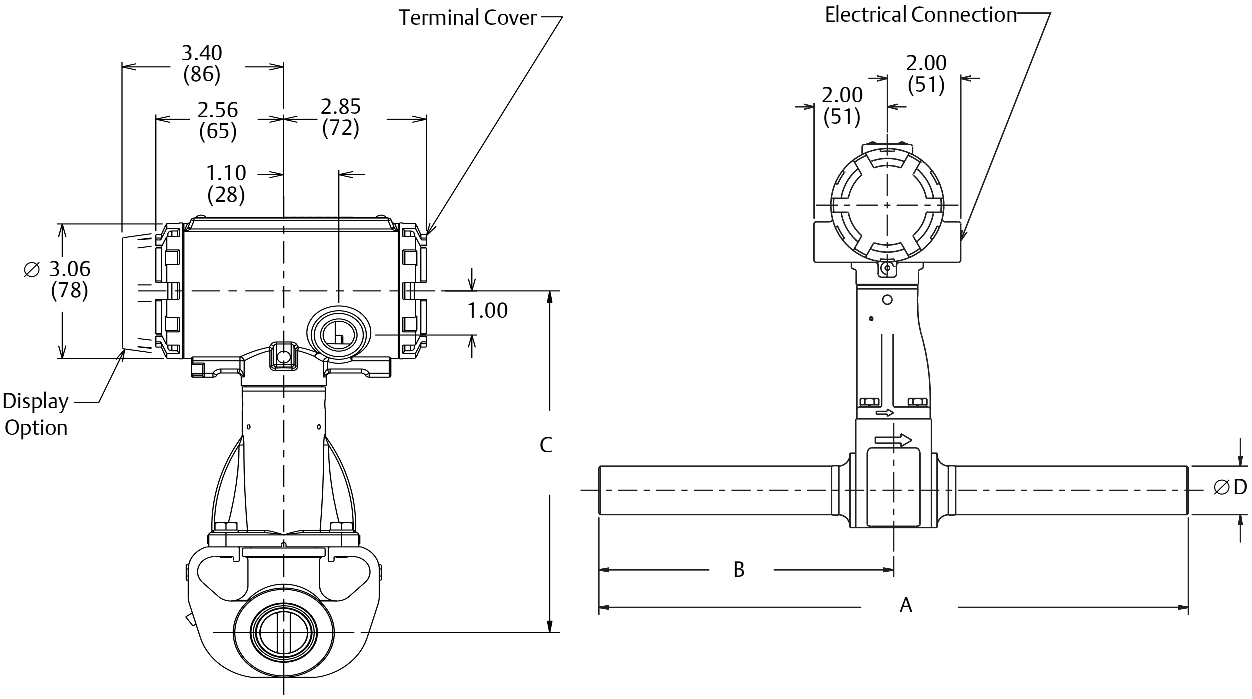
Table A-25. Vortex Dual-Sensor Style Flowmeter—Line Sizes 4- through 12-in. (100 through 300 mm)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
4 (100)	Class 150	15.2 (386)	15.7 (399)	3.79 (96,3)	9.6 (244)	69.7 (31.6)
	Class 300	16.0 (406)	16.6 (422)	3.79 (96,3)	9.6 (244)	88.9 (40.8)
	Class 600	17.7 (450)	17.9 (454)	3.79 (96,3)	9.6 (244)	116 (52.5)
	Class 900	18.7 (475)	18.9 (480)	3.79 (96,3)	9.6 (244)	139 (63.1)
	Class 1500	20.0 (509)	20.2 (512)	3.40 (86.4)	9.6 (244)	184 (83,3)
	PN 16	13.3 (338)	N/A	3.79 (96,3)	9.6 (244)	58.7 (26,6)
	PN 40	14.4 (366)	N/A	3.79 (96,3)	9.6 (244)	67.8 (30,8)
	PN 63/64	15.4 (391)	N/A	3.79 (96,3)	9.6 (244)	80.8 (36,7)
	PN 100	16.3 (414)	N/A	3.79 (96,3)	9.6 (244)	97.2 (44,1)
	PN 160	17.1 (434)	N/A	3.79 (96,3)	9.6 (244)	104 (47,4)
	JIS 10K	13.6 (345)	N/A	3.79 (96,3)	9.6 (244)	55.8 (25,3)
	JIS 20K	13.6 (345)	N/A	3.79 (96,3)	9.6 (244)	63.8 (28,9)
	JIS 40K	16.8 (427)	N/A	3.79 (96,3)	9.6 (244)	94.2 (42,7)
6 (150)	Class 150	11.6 (295)	12.1 (307)	5.7 (144,8)	10.8 (274)	85 (39)
	Class 300	12.3 (312)	13.0 (330)	5.7 (144,8)	10.8 (274)	124 (57)
	Class 600	14.3 (363)	14.4 (366)	5.7 (144,8)	10.8 (274)	191 (87)
	Class 900	16.1 (409)	16.2 (411)	5.14 (130.6)	10.8 (274)	282 (128)
	Class 1500	18.6 (472)	18.8 (478)	5.14 (130.6)	10.8 (274)	380 (173)
	PN 16	8.9 (226)	N/A	5.7 (144,8)	10.8 (274)	70 (32)
	PN 40	10.5 (267)	N/A	5.7 (144,8)	10.8 (274)	90 (41)
	PN 63/64	12.1 (307)	N/A	5.7 (144,8)	10.8 (274)	134 (61)
	PN 100	13.6 (345)	N/A	5.7 (144,8)	10.8 (274)	164 (75)
	JIS 10K	10.6 (269)	N/A	5.7 (144,8)	10.8 (274)	74 (34)
	JIS 20K	10.6 (269)	N/A	5.7 (144,8)	10.8 (274)	92 (42)
	JIS 40K	14.2 (361)	N/A	5.7 (144,8)	10.8 (274)	170 (77)

Table A-25. Vortex Dual-Sensor Style Flowmeter—Line Sizes 4- through 12-in. (100 through 300 mm)

Nominal size inch (mm)	Flange rating	Face-to-face A inch (mm)	A ANSI RTJ inch (mm)	Diameter B inch (mm)	C inch (mm)	Weight lb (kg)
8 (200)	Class 150	13.5 (343)	14.0 (356)	7.55 (191,8)	11.7 (297)	146 (66)
	Class 300	14.3 (363)	14.9 (378)	7.55 (191,8)	11.7 (297)	203 (92)
	Class 600	16.5 (419)	16.7 (424)	7.55 (191,8)	11.7 (297)	303 (138)
	Class 900	18.8 (478)	18.9 (480)	6.62 (168,1)	11.7 (297)	484 (220)
	Class 1500	22.8 (580)	23.2 (589)	6.62 (168,1)	11.7 (297)	657 (299)
	PN 10	10.4 (264)	N/A	7.55 (191,8)	11.7 (297)	115 (52)
	PN 16	10.4 (264)	N/A	7.55 (191,8)	11.7 (297)	114 (52)
	PN 25	11.8 (300)	N/A	7.55 (191,8)	11.7 (297)	142 (65)
	PN 40	12.5 (318)	N/A	7.55 (191,8)	11.7 (297)	161 (73)
	PN 63/64	14.2 (361)	N/A	7.55 (191,8)	11.7 (297)	221 (101)
	PN 100	15.8 (401)	N/A	7.55 (191,8)	11.7 (297)	287 (130)
	JIS 10K	12.2 (310)	N/A	7.55 (191,8)	11.7 (297)	114 (52)
	JIS 20K	12.2 (310)	N/A	7.55 (191,8)	11.7 (297)	139 (63)
	JIS 40K	16.5 (419)	N/A	7.55 (191,8)	11.7 (297)	260 (118)
10 (250)	Class 150	14.5 (368)	15.0 (381)	9.56 (243)	12.8 (325)	202 (91,6)
	Class 300	15.8 (401)	16.4 (417)	9.56 (243)	12.8 (325)	290 (132)
	Class 600	19.1 (485)	19.2 (488)	9.56 (243)	12.8 (325)	482 (219)
	PN 10	11.9 (302)	N/A	9.56 (243)	12.8 (325)	161 (73,2)
	PN 16	12.1 (307)	N/A	9.56 (243)	12.8 (325)	166 (75,4)
	PN 25	13.5 (343)	N/A	9.56 (243)	12.8 (325)	203 (92,0)
	PN 40	14.8 (376)	N/A	9.56 (243)	12.8 (325)	251 (114)
	PN 63/64	16.4 (417)	N/A	9.56 (243)	12.8 (325)	312 (142)
	PN 100	18.9 (480)	N/A	9.56 (243)	12.8 (325)	450 (204)
	JIS 10K	14.6 (371)	N/A	9.56 (243)	12.8 (325)	179 (81,1)
	JIS 20K	14.6 (371)	N/A	9.56 (243)	12.8 (325)	226 (103)
	JIS 40K	18.1 (460)	N/A	9.56 (243)	12.8 (325)	383 (174)
12 (300)	Class 150	16.8 (427)	17.3 (439)	11.38 (289)	13.7 (348)	302 (137)
	Class 300	18.0 (457)	18.7 (475)	11.38 (289)	13.7 (348)	420 (191)
	Class 600	20.5 (521)	20.7 (526)	11.38 (289)	13.7 (348)	600 (272)
	PN 10	13.2 (335)	N/A	11.38 (289)	13.7 (348)	208 (94,5)
	PN 16	13.9 (353)	N/A	11.38 (289)	13.7 (348)	229 (104)
	PN 25	15.0 (381)	N/A	11.38 (289)	13.7 (348)	274 (124)
	PN 40	16.9 (429)	N/A	11.38 (289)	13.7 (348)	352 (160)
	PN 63/64	18.8 (478)	N/A	11.38 (289)	13.7 (348)	435 (198)
	PN 100	21.2 (538)	N/A	11.38 (289)	13.7 (348)	648 (294)
	JIS 10K	15.7 (399)	N/A	11.38 (289)	13.7 (348)	227 (103)
	JIS 20K	15.7 (399)	N/A	11.38 (289)	13.7 (348)	288 (131)
	JIS 40K	19.7 (500)	N/A	11.38 (289)	13.7 (348)	498 (226)

Figure A-7. Vortex Weld-End Style Flowmeter—Line Sizes 1/2- through 4-in. (15 through 100 mm)

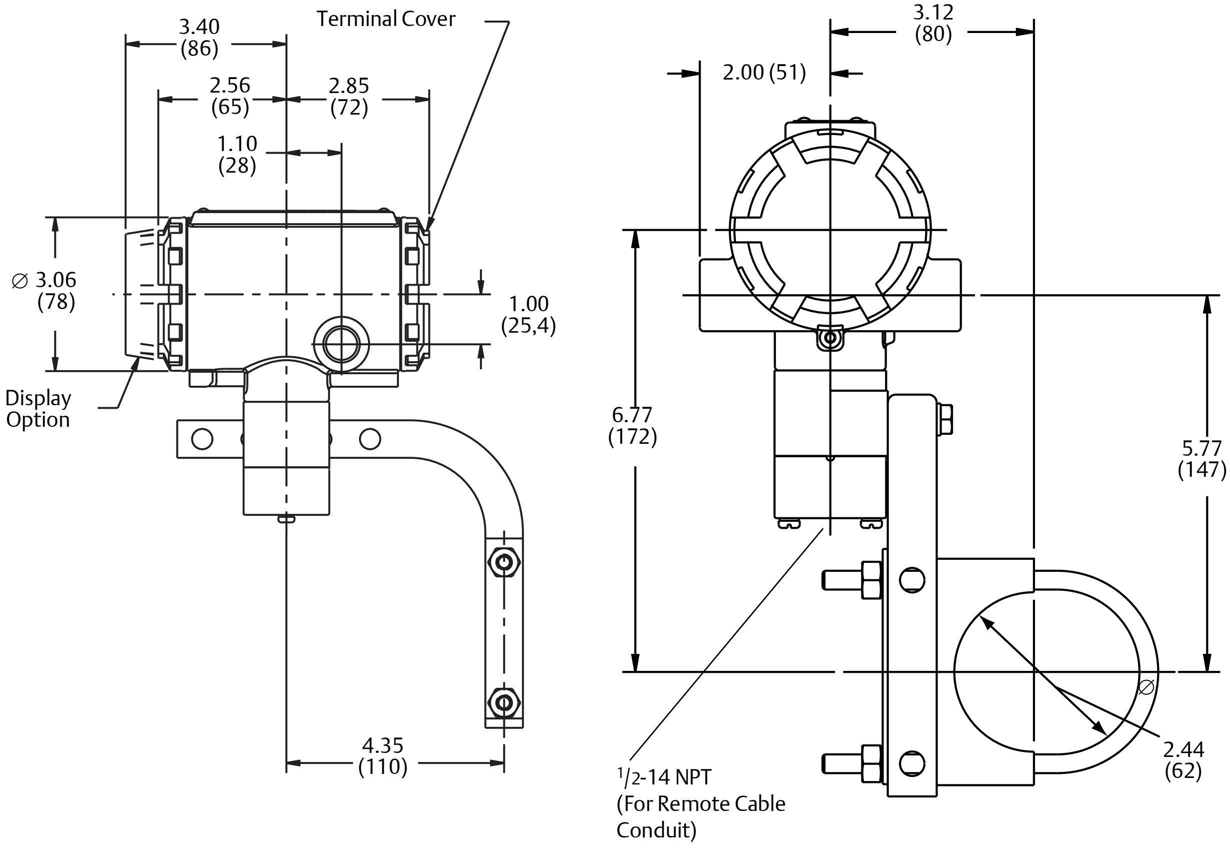


Dimensions are in inches (millimeters).

Table A-26. Vortex Weld-End Style Flowmeter—Line Sizes 1/2- through 4-in. (15 through 100 mm)

Nominal size in. (mm)	A in. (mm)	B in. (mm)	C ± 0.20 in. (5.1 mm)	Diameter D ± 0.031 in. (0.79 mm)
0.5	16.0 (406)	8.0 (203)	7.63 (194)	.840 (21.34)
1	16.0 (406)	8.0 (203)	7.74 (197)	1.315 (33.40)
1.5	16.0 (406)	8.0 (203)	8.14 (207)	1.900 (48.26)
2	16.0 (406)	8.0 (203)	8.49 (216)	2.375 (60.33)
3	16.0 (406)	8.0 (203)	9.05 (230)	3.500 (88.90)
4	16.0 (406)	8.0 (203)	9.60 (244)	4.500 (114.30)

Figure A-8. Remote Mount Transmitters



Note

Consult factory for SST installation. Dimensions are in inches (millimeters).

Figure A-9. Remote Mount Wafer-Style Flowmeters—Line Sizes 1/2- through 8-in. (15 through 200 mm)

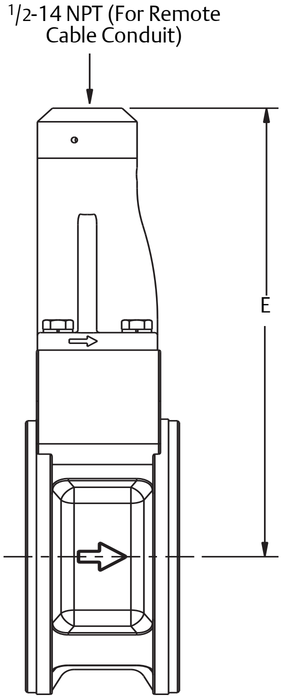
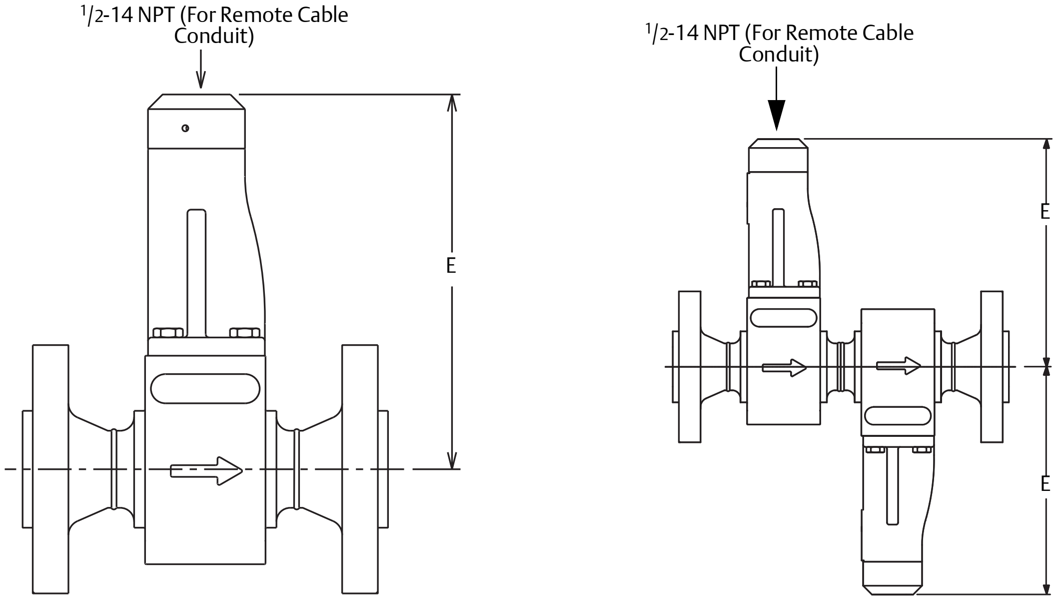


Table A-27. Rosemount 8800D Wafer-Style Meter

Nominal size inch (mm)	E Wafer style inch (mm)
½ (15)	6.3 (160)
1 (25)	6.5 (165)
1½ (40)	6.7 (191)
2 (50)	7.5 (191)
3 (80)	8.3 (211)
4 (100)	9.2 (234)
6 (150)	9.5 (241)
8 (200)	10.4 (264)

Figure A-10. Flanged-and Dual Sensor Flanged-Style Remote Mount Flowmeters—Line Sizes 1/2- through 12-in. (15 through 300 mm)



Flanged Flowmeter

Dual-Sensor Style Flowmeter

Dimensions are in inches (millimeters).

Table A-28. Remote Mount, Flanged-and Dual Sensor Flowmeter Dimensions

Nominal size inch (mm)	E Flange style inch (mm)
½ (15)	6.4 (162)
1 (25)	6.5 (165)
1½ (40)	6.8 (173)
2 (50)	7.2 (183)
3 (80)	7.8 (198)
4 (100)	8.3 (211)
6 (150)	9.5 (241)
8 (200)	10.4 (264)
10 (250)	11.4 (290)
12 (300)	12.3 (313)

Appendix B Product Certifications

For detailed approval certification information and installation drawings, please see document number 00825-VA00-0001: ***Rosemount™ 8800D Series Vortex Flowmeter Approval Document***.

Appendix C Electronics Verification

C.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing any operation in this section.

⚠WARNING

Explosions could result in death or serious injury.

- Do not remove the transmitter cover in explosive atmospheres when the circuit is alive.
- Before connecting a HART®-based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

Failure to follow these installation guidelines could result in death or serious injury.

- Make sure only qualified personnel perform the installation.

⚠CAUTION

Remove power before removing the electronics housing.

C.2 Electronics verification

Electronics verification of the Model 8800D can be done by either utilizing the internal signal simulation capability or by applying an external signal source to the “TEST FREQ IN” and “GROUND” pins.

Electronics functionality can be verified via two different verification methods:

- Flow Simulation Mode
- Using an External Frequency Generator

Both methods require the use of a Field Communicator or AMS™ Device Manager. It is not required to disconnect the sensor to perform the electronics verification since the transmitter is capable of disconnecting the sensor signal at the input to the electronics. Should the user choose to physically disconnect the sensor from the electronics, refer to Replacing the electronics boards on page 5-78.

Note
When the process fluid is set to Tcomp Saturated Steam, and the Primary Variable is mass flow, the simulation is based on the configured fixed process density. The best method for flow simulation in this case is to change the process fluid to gas/steam.

Flow simulation cannot be enabled when the primary variable is Process Temperature.

C.2.1 Electronics verification using flow simulation mode

FastKeys	3, 5, 1, 2, 1

Electronics verification can be done by utilizing the internal flow simulation functionality. The Rosemount™ 8800D is capable of simulating either a fixed flow rate or a varying flow rate. The amplitude of the simulated flow signal is based on the minimum required process density for the given line size and service type. Either type of simulation (fixed or varying) will effectively disconnect the Rosemount 8800D sensor from the electronics charge amplifier input (see Figure 5-3 on page 5-73) and replace it with the simulated flow signal.

C.2.2 Fixed flow rate simulation

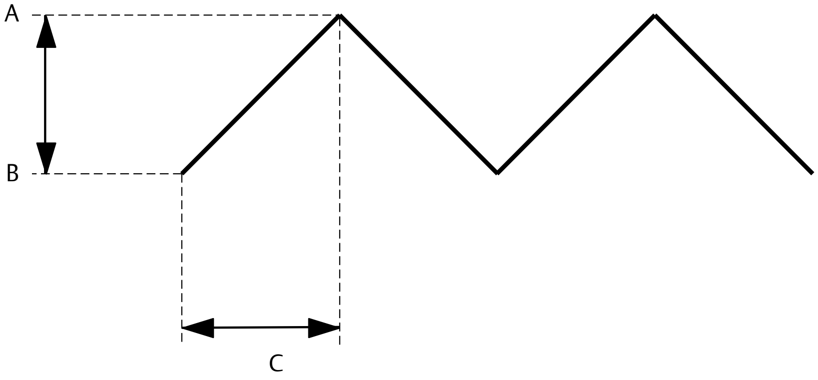
The fixed flow simulation signal can be entered in either percent of range or flow rate in engineering units. The resulting flow rate and/or shedding frequency can be continuously monitored via a Field Communicator or AMS Device Manager.

C.2.3 Varying flow rate simulation

The profile of the varying flow simulation signal is a repetitive triangular waveform as illustrated in Figure C-1. The minimum and maximum flowrate can be entered in either percent of range or entered as a flow rate in engineering units. The ramp time can be entered in seconds from a minimum of 0.6 seconds to a maximum of 34951 seconds. The resulting flow rate and/or shedding frequency can be continuously monitored via a Field Communicator or AMS Device Manager.

Note
To manually disconnect the sensor for precautionary measures, see Replacing the electronics housing on page 5-80 for details.

Figure C-1. Profile of Varying Flow Simulation Signal



A. Max Flow Rate
B. Min Flow Rate
C. Ramp Time

C.2.4 Electronics verification using an external frequency generator

If an external frequency source is desirable, then test points on the electronics are available (see Figure C-2).

Tools needed

- Field Communicator or AMS Device Manager
- Standard sinewave function generator

1. Remove the electronics compartment cover.
2. Remove the two screws and the LCD indicator if applicable.
3. Connect a Field Communicator or AMS Device Manager to the loop.

FastKeys	3, 5, 1, 2, 1, 3

4. Access the flow simulation menu on the communicator and select “Sim Flow External.” This item is used with an External Frequency Generator. This will effectively disconnect the Rosemount 8800D sensor input from the charge amplifier input of the electronics (see Figure 5-3 on page 5-73). The simulated flow and/or the shedding frequency values will now be accessible via the Field Communicator or AMS Device Manager.
5. Connect the sinewave generator to the “TEST FREQ IN” and “GROUND” points as shown in Figure C-2.
6. Set the sinewave generator amplitude to 2Vpp±10%.

7. Select the desired sinewave generator frequency.

8. Verify the generator frequency against the frequency displayed on the Field Communicator or AMS Device Manager.

FastKeys	2, 2, 5, 1, 2

9. Exit the Flow Simulation Mode.

10. Reconnect the LCD indicator option (if applicable) to the electronics board by replacing and tightening the two screws.

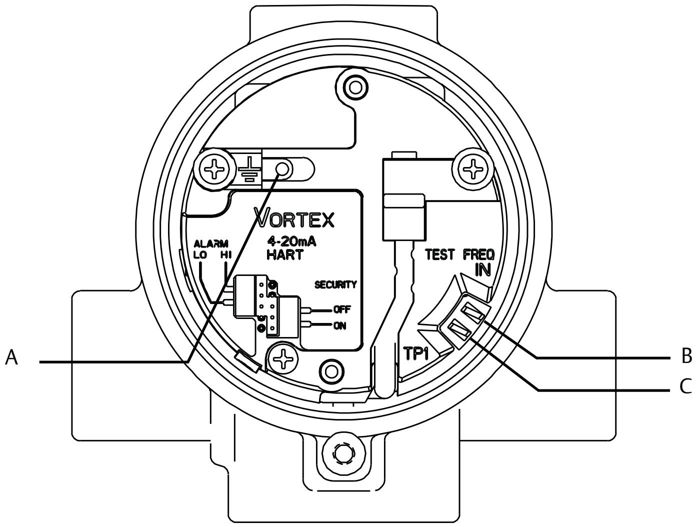
11. Replace and tighten the electronics compartment cover.

Note

To manually disconnect the sensor for precautionary measures, see Replacing the electronics housing on page 5-80 for details.

The procedure described above is intended for verifying functionality when the flow sensor is still connected to the transmitter. If the flow sensor is not connected to the transmitter then it may be necessary to attach the sine wave generator to the sensor header (the same connection point use by the flow sensor during normal installation).

Figure C-2. Test Frequency Output and Chassis Ground Points



A. Ground connection
B. Test frequency input
C. Test point 1

C.2.5 Calculating output variables with known input frequency

Use the following equations with a known input frequency for verification of a flow rate or 4–20 mA output within a given calibrated range. Select the proper equation depending on if you are verifying a flow rate, mass flow rate, 4–20 mA output, or special units. Example calculations starting on page 149 may clarify how these equations are used.

To verify a flow rate

For a given input frequency F (Hz), and K-factor (compensated), find the flow rate Q:

$$Q = F(Hz)/(K \times C_X)$$

where C_x is the unit conversion (Table C-1 on page 148) and K is the compensated K-factor in units of pulses/gallon.

To verify a standard or normal flow rate

$$Q = F(Hz) \times ((DensityRatio)/(K \times C_X))$$

To verify a mass flow rate

For a given mass frequency F (Hz), and K-factor (compensated), find the mass flow rate M:

$$M = \frac{F}{(K/\rho) \cdot C}$$

where C is the unit conversion and ρ is density at operating conditions:

$$M = F(Hz)/(KC_X)$$

where C_x is the unit conversion using density (ρ) (Table C-1 on page 148).

To verify a 4–20 mA output

For a given input frequency F (Hz), and K-factor (compensated), find output electrical current I:

$$I = \left(\left[\frac{F/(K \times C_X) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

where C_x is the unit conversion (Table C-1 on page 148), URV is the upper range value (user units), and LRV is the lower range value (user units).

To verify a special units output

For special units, first divide the special unit-conversion factor into the base unit factor C_x.

C_{20} = C_x/special units conversion factor (Table C-1 on page 148).

Unit conversion table (user units to GPS)

UseTable C-1 when converting units of measure.

Table C-1. Unit Conversions

C_x	Units (actual)	Conversion factor
C_1	gal/s	1.00000E+00
C_2	gal/m	1.66667E-02
C_3	gal/h	2.77778E-04
C_4	Impgal/s	1.20095E+00
C_5	Impgal/m	2.00158E-02
C_6	Impgal/h	3.33597E-04
C_7	L/s	2.64172E-01
C_8	L/m	4.40287E-03
C_9	L/h	7.33811E-05
C_{10}	CuMtr/m	4.40287E+00
C_{11}	CuMtr/h	7.33811E-02
C_{12}	CuFt/m	1.24675E-01
C_{13}	CuFt/h	2.07792E-03
C_{14}	bbl/h	1.16667E-02
C_{15}	kg/s	C_{10} x 60/ρ (kg/m^3)
C_{16}	kg/h	C_{11}/ρ (kg/m^3)
C_{17}	lb/h	C_{13}/ρ (lb/ft^3)
C_{18}	shTon/h	C_{17}?2000
C_{19}	mTon/h	C_{16}?1000
C_{20}	SPECIAL	C_x/(special units conversion factor)

ρ=operating density

C.3 Examples

The following examples illustrate the flowrate calculations that may be necessary for your application. There are water, saturated steam, and natural gas applications represented in the examples. The first set of three examples is in English units. The second set of three examples is in SI units.

C.3.1 English units

Example 1 (English units)

Fluid = Water

URV= 500 gpm

Line size = 3 inch

LRV= 0 gpm

Line pressure= 100 psi

C_2 = 1.66667E-02 (from Table C-1 on page 148)

Vortex Frequency = 75 Hz

K-factor (compensated) = 10.79 pulses/gallon (via Field Communicator or AMS Device Manager)

$$Q = F/(K \times C_2)$$

= 75/(10.79 × 0.0166667)

= 417.1 gpm

Therefore, an input frequency of 75 Hz represents a flow rate of 417.1 gpm in this application.

For a given input frequency, you may also determine the electrical current output. Use the above example with an input frequency of 75 Hz:

URV= 500 gpm

LRV= 0 gpm

F_{in} = 75 Hz

$$I = \left(\left[\frac{F/(K \times C_2) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

$$I = \left(\left[\frac{75/(10.79 \times 0.0166667) - 0}{500 - 0}\right] \times (16)\right) + 4$$

= 17.35 mA

Therefore, an input frequency of 75 Hz represents an electrical current output of 17.35 mA.

Example 2 (English units)

Fluid = Saturated Steam

Line size = 3 inch

Line pressure = 500 psia

Operating Temperature = 467 °F

Viscosity = 0.017 cp

URV = 40000 lb/hr

LRV = 0 lb/hr

C_{17} = C_{13}/ρ (Table C-1 on page 148)

Density (ρ) = 1.078 lb/cu-ft

Vortex Frequency = 400 Hz

K-factor (compensated) = 10.678 pulses/gallon (via Field Communicator or AMS Device Manager)

M = $F/(K \times C_{17})$

= $400/\{10.678 \times (C_{13}/\rho)\}$

= $400/\{10.678 \times (0.00207792/1.078)\}$

= $400/(10.678 \times 0.0019276)$

= 19433.6 lb/hr

Therefore, an input frequency of 400 Hz represents a flow rate of 19433.6 lb/hr in this application.

For a given input frequency, you may also determine the electrical current output. Use the Example 2 on page 150 with an input frequency of 300 Hz:

URV= 40000 lb/hr LRV= 0 lb/hr F_{in} = 300 Hz

$$I = \left(\left[\frac{F/(K \times C_{17}) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

$$I = \left(\left[\frac{300/(10.678 \times 0.0019276) - 0}{40000 - 0}\right] \times (16)\right) + 4$$

I = 9.83 mA

Therefore, an input frequency of 300 Hz represents an electrical current output of 9.83 mA.

Example 3 (English units)

Fluid	= Natural gas	URV	= 5833 SCFM
Line size	= 3 inch	LRV	= 0 SCFM
Line pressure	= 140 psig	C_{20}	= C_x/sp. units factor (from Table C-1 on page 148)
Operating Temperature	= 50 °F	Density (ρ)	= 0.549 lb/cu-ft (operating)
Viscosity	= 0.01 cp	Input Frequency	= 700 Hz

K-factor (compensated) = 10.678 pulses/gallon (via Field Communicator or AMS Device Manager)

Q = $F/(K \times C_{20})$ where: $C_{20} = C_{12}/10.71$ (Density Ratio)

= 700/{10.797 x (0.124675/10.71)}

= 5569.4 SCFM

Therefore, an input frequency of 700 Hz represents a flow rate of 5569.4 SCFM in this application.

For a given input frequency, you may also determine the electrical current output. Use the above example with an input frequency of 200 Hz.

URV= 5833 SCFM LRV= 0 SCFM F_{in} = 200 Hz

$$I = \left(\left[\frac{F/(K \times C_{20}) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

$$I = \left(\left[\frac{200/(10.797 \times 0.011641) - 0}{5833 - 0}\right] \times (16)\right) + 4$$

I = 8.36 mA

Therefore, an input frequency of 200 Hz represents an electrical current output of 8.36 mA.

C.3.2 SI units

Example 1 (SI units)

Fluid = Water

Line size = 80 mm

Line pressure = 700 kPas

Operating Temperature = 60 °F

Input Frequency = 80 Hz

K-factor (compensated) = 10.772 pulses/gallon (via Field Communicator or AMS Device Manager)

URV = 2000 lpm

LRV = 0 lpm

C_8 = 4.40287E-03 (from Table C-1 on page 148)

M = $F/(K \text{ x } C_8)$

= 80/(10.722 x 0.00440287)

= 1694.6 lpm

Therefore, an input frequency of 80 Hz represents a flow rate of 1694.6 lpm in this application.

For a given input frequency, you may also determine the electrical current output. Use the above example with an input frequency of 80 Hz:

URV= 2000 lpm LRV= 0 lpm F_{in} = 80 Hz

$$I = \left(\left[\frac{F/(K \times C_8) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

$$I = \left(\left[\frac{80/(10.772 \times 0.00440287) - 0}{2000 - 0}\right] \times (16)\right) + 4$$

I = 17.49 mA

Therefore, an input frequency of 80 Hz represents an electrical current output of 17.49 mA.

Example 2 (SI units)

Fluid	= Saturated Steam	URV	= 3600 kg/hr
Line size	= 80 mm	LRV	= 0 kg/hr
Line pressure	= 700 kPas	C_{16}	= C_{11}/ρ (from Table C-1 on page 148)
Operating Temperature	= 170 °F	Density(ρ)	= 4.169 kg/cu-mtr (operating)
Viscosity	= 0.015 cp		
Input Frequency	= 650 Hz		
K-factor (compensated)	= 10.715 pulses/gallon (via Field Communicator or AMS Device Manager)		
M	= F(Hz) /(K x C_{16}) = 650/{10.715 x (C_{11}/ρ)} = 650/{10.715 x (0.0733811/4.169)} = 650/(10.715 x 0.017602) = 3446.4 kg/hr		

Therefore, an input frequency of 650 Hz represents a flow rate of 3446.4 kg/hr in this application.

For a given input frequency, you may also determine the electrical current output. Use the prior example with an input frequency of 275 Hz:

URV= 3600 kg/hr LRV= 0 kg/hr F_{in} = 275 Hz

$$I = \left(\left[\frac{F/(K \times C_{16}) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

$$I = \left(\left[\frac{275/(10.715 \times 0.017602) - 0}{3600 - 0}\right] \times (16)\right) + 4$$

I = 10.48 mA

Therefore, an input frequency of 275 Hz represents an output electrical current of 10.48 mA.

Example 3 (SI units)

Fluid	= Natural gas	URV	= 10,000 NCMH
Line size	= 80 mm	LRV	= 0 NCMH
Line pressure	= 1000 KPas	C_{20}	= C_x/sp. units factor (from Table C-1 on page 148)
Operating Temperature	= 10 °F	Density (ρ)	= 9.07754 kg/cu-mtr (operating)
Viscosity	= 0.01 cp	Density ratio	= 10.48
Input Frequency	= 700 Hz		
K-factor (compensated)	= 10.797 pulses/gallon (via Field Communicator or AMS Device Manager)		

Q = $F/(K \times C_{20})$ where: $C_{20} = C_{11}$/(Density Ratio)

= 700/{10.797 x (.0733811/10.48)}

= 9259.2 NCMH

Therefore, an input frequency of 700 Hz represents a flow rate of 9259.2 NCMH in this application.

For a given input frequency, you may also determine the electrical current output. Use the prior example with an input frequency of 375 Hz.

URV= 10000 NCMH LRV= 0 NCMH F_{in} = 375 Hz

$$I = \left(\left[\frac{F/(K \times C_{20}) - LRV}{URV - LRV}\right] \times (16)\right) + 4$$

$$I = \left(\left[\frac{375/(10.797 \times 0.0070020) - 0}{10000 - 0}\right] \times (16)\right) + 4$$

I = 11.94 mA

Therefore, an input frequency of 375 Hz represents an electrical current output of 11.94 mA.

Appendix D HART® Fast Keys

Table D-1. Fast Keys for the Rosemount™ 8800D HART 5 Device Revision 1 and Device Revision 2 (DD Revision 1)

Function	Fast Keys
Alarm Jumper	1, 4, 2, 1, 3
Analog Output	1, 4, 2, 1
Auto Adjust Filter	1, 4, 3, 1, 4
Base Time Unit	1, 1, 4, 1, 3, 2
Base Volume Unit	1, 1, 4, 1, 3, 1
Burst Mode	1, 4, 2, 3, 4
Burst Option	1, 4, 2, 3, 5
Burst Variable 1	1, 4, 2, 3, 6, 1
Burst Variable 2	1, 4, 2, 3, 6, 2
Burst Variable 3	1, 4, 2, 3, 6, 3
Burst Variable 4	1, 4, 2, 3, 6, 4
Burst Xmtr Variables	1, 4, 2, 3, 6
Conversion Number	1, 1, 4, 1, 3, 4
D/A Trim	1, 2, 5
Date	1, 4, 4, 5
Descriptor	1, 4, 4, 3
Density Ratio	1, 3, 2, 4, 1, 1
Device ID	1, 4, 4, 7, 6
Electronics Temp	1, 1, 4, 7, 1
Electronics Temp Units	1, 1, 4, 7, 2
Filter Restore	1, 4, 3, 3
Final Assembly Number	1, 4, 4, 7, 5
Fixed Process Density	1, 3, 2, 4, 2
Fixed Process Temperature	1, 3, 2, 3
Flange Type	1, 3, 4
Flow Simulation	1, 2, 4
Installation Effects	1, 4, 1, 6
K-Factor (reference)	1, 3, 3
Local Display	1, 4, 2, 4
Loop Test	1, 2, 2
Low Flow Cutoff	1, 4, 3, 2, 3
Low Pass Filter	1, 4, 3, 2, 4
LRV	1, 3, 8, 2
LSL	1, 3, 8, 5
Manufacturer	1, 4, 4, 1
Mass Flow	1, 1, 4, 2, 1
Mass Flow Units	1, 1, 4, 2, 2
Mating Pipe ID (Inside Diameter)	1, 3, 5
Message	1, 4, 4, 4
Meter Body Number	1, 4, 1, 5
Minimum Span	1, 3, 8, 3
Num Req Preams	1, 4, 2, 3, 2

Function	Fast Keys
Poll Address	1, 4, 2, 3, 1
Process Fluid Type	1, 3, 2, 2
Process Variables	1, 1
Pulse Output	1, 4, 2, 2, 1
Pulse Output Test	1, 4, 2, 2, 2
PV Damping	1, 3, 9
PV Mapping	1, 3, 6, 1
PV Percent Range	1, 1, 2
QV Mapping	1, 3, 6, 4
Range Values	1, 3, 8
Review	1, 5
Revision Numbers	1, 4, 4, 7
Scaled D/A Trim	1, 2, 6
Self Test	1, 2, 1, 5
Signal to Trigger Ratio	1, 4, 3, 2, 2
STD/Nor Flow Units	1, 1, 4, 1, 2
Special Units	1, 1, 4, 1, 3
Status	1, 2, 1, 1
SV Mapping	1, 3, 6, 2
Tag	1, 3, 1
Total	1, 1, 4, 4, 1
Totalizer Control	1, 1, 4, 4
Transmitter Mode	1, 3, 2, 1
TV Mapping	1, 3, 6, 3
Trigger Level	1, 4, 3, 2, 5
URV	1, 3, 8, 1
User Defined Units	1, 1, 4, 1, 3, 3
USL	1, 3, 8, 4
Shedding Frequency	1, 1, 4, 6
Variable Mapping	1, 3, 6
Velocity Flow	1, 1, 4, 3
Velocity Flow Base	1, 1, 4, 3, 3
Volumetric Flow	1, 1, 4, 1
Wetted Material	1, 4, 1, 4
Write Protect	1, 4, 4, 6

Figure D-1. Rosemount 8800D HART 5 Menu Tree for Device Revision 1 and Device Revision 2 (DD Revision 1)

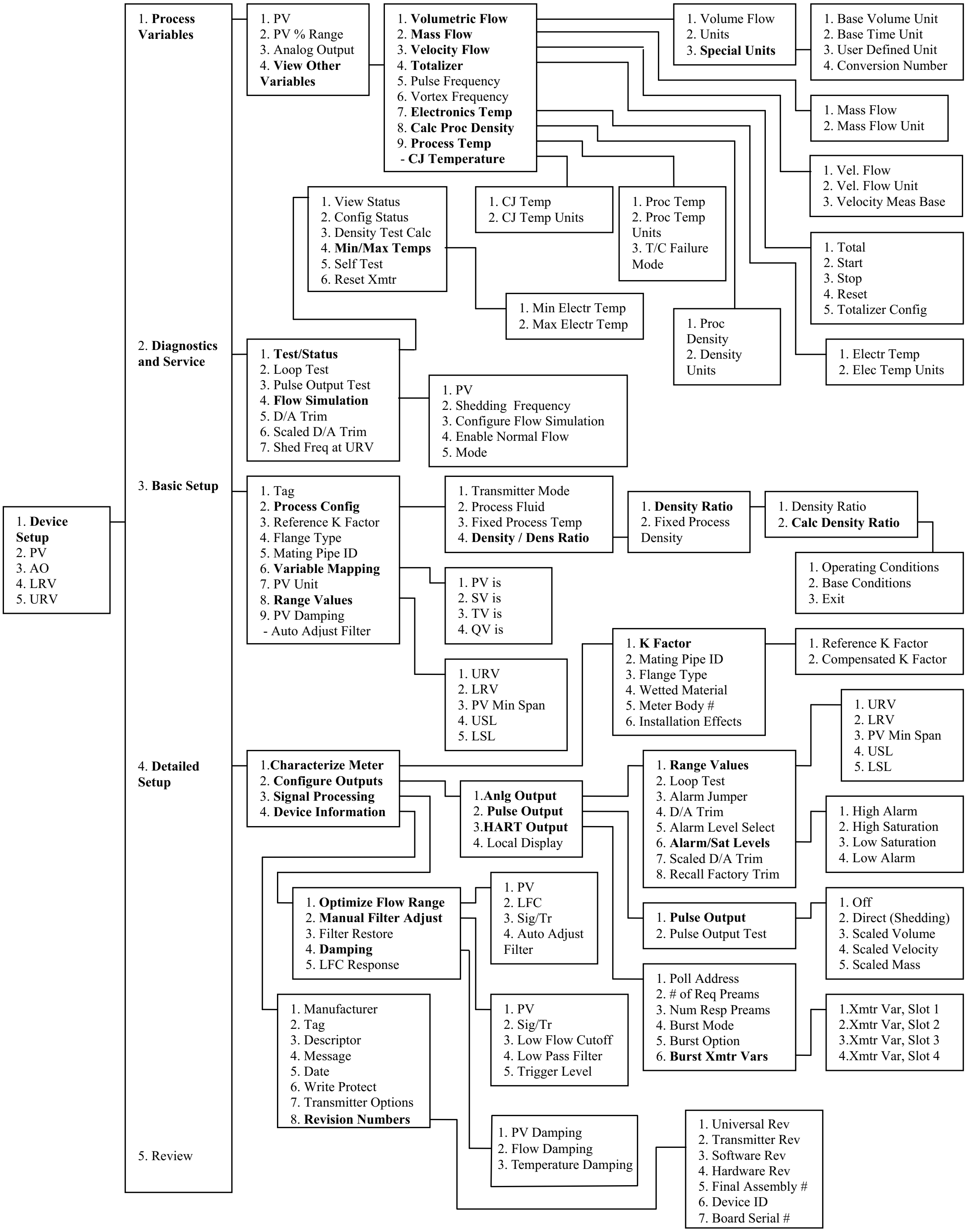


Table D-2. Fast Keys for Rosemount 8800D HART 5 Device Revision 2. (DD Revision 3)

Function	Fast Key
Alarm Direction	1, 3, 1, 3, 2
Analog Output	3, 4, 3, 1
Analog Trim	3, 4, 3, 6
Base Time Unit	2, 2, 2, 3, 2
Base Volume Unit	2, 2, 2, 3, 1
Burst Mode	2, 2, 7, 2
Burst Option	2, 2, 7, 3
Burst Slot 0	2, 2, 7, 4, 1
Burst Slot 1	2, 2, 7, 4, 2
Burst Slot 2	2, 2, 7, 4, 3
Burst Slot 3	2, 2, 7, 4, 4
Burst Variable Mapping	2, 2, 7, 4, 5
Compensated K-Factor	2, 2, 1, 2, 2
Conversion Number	2, 2, 2, 3, 4
Date	2, 2, 8, 2, 1
Descriptor	2, 2, 8, 2, 2
Density Ratio	2, 2, 3, 3, 2
Device ID	2, 2, 8, 1, 5
Display	2, 1, 1, 2
Electronics Temp	3, 2, 5, 4
Electronics Temp Units(2)	2, 2, 2, 2, 5
Final Assembly Number	2, 2, 8, 1, 4
Fixed Process Density	2, 2, 1, 1, 5
Fixed Process Temperature	2, 2, 1, 1, 4
Flange Type	2, 2, 1, 4, 2
Flow Simulation	3, 5, 1
4th Variable	2, 2, 2, 1, 4
Installation Effects	2, 2, 1, 1, 7
Lower Range Value	2, 2, 4, 1, 4
Lower Sensor Limit	2, 2, 4, 1, 5, 2
Loop Test	3, 5, 2, 6
Low Flow Cutoff	2, 1, 4, 3
Low-pass Corner Frequency	2, 1, 4, 4
Manufacturer	2, 2, 8, 1, 2
Mass Flow	3, 2, 3, 6
Mass Flow Units	2, 2, 2, 2, 4
Mating Pipe ID (Inside Diameter)	2, 2, 1, 1, 6
Message	2, 2, 8, 2, 3
Meter Body Number	2, 2, 1, 4, 5
Minimum Span	2, 2, 4, 1, 6
Optimize DSP	2, 1, 1, 3
Percent of Range	3, 4, 3, 2
Polling Address	2, 2, 7, 1
Primary Variable Damping	2, 1, 4, 1
Primary Variable	2, 2, 2, 1, 1
Process Density Units(2)	2, 2, 2, 2, 6
Process Fluid Type	2, 2, 1, 1, 2
Process Temp Units(1)	2, 2, 2, 2, 5
Process Variables	3, 2, 1
Pulse Output	3, 2, 4, 4
Pulse Output Test	3, 5, 3, 4
Recall Factory Calibration	3, 4, 3, 8
Reference K-Factor	2, 2, 1, 2, 1
Reset Transmitter	3, 4, 1, 2
Restore Default Filters	2, 1, 4, 6
Revision Numbers	2, 2, 8, 3
Scaled Analog Trim	3, 4, 3, 7
2nd Variable	2, 2, 2, 1, 2
Self Test	3, 4, 1, 1
Set Variable Mapping	2, 2, 2, 1, 5
Shedding Frequency	3, 2, 4, 2
Signal Strength	3, 2, 5, 2
Special Flow Unit	2, 2, 2, 3, 5
Special Volume Unit	2, 2, 2, 3, 3
Status	1, 1, 1
Tag	2, 2, 8, 1, 1
3rd Variable	2, 2, 2, 1, 3
Total	1, 3, 6, 1
Totalizer Configuration	1, 3, 6, 3
Totalizer Control	1, 3, 6, 2
Transmitter Mode	2, 2, 1, 1, 1
Trigger Level	2, 1, 4, 5
Upper Range Value	2, 2, 4, 1, 3
Upper Sensor Limit	2, 2, 4, 1, 5, 1
Velocity Flow	3, 2, 3, 4
Velocity Flow Units	2, 2, 2, 2, 2
Velocity Measurement Base	2, 2, 2, 2, 3
Volume Flow	3, 2, 3, 2
Volume Flow Units	2, 2, 2, 2, 1
Wetted Material	2, 2, 1, 4, 1
Write Protect	2, 2, 8, 1, 6

1. Process Temp Units is available for units with the MTA option only.
2. For units with the MTA option: Electronics Temp Units (2, 2, 2, 2, 6) and Process Density Units (2, 2, 2, 2, 7).

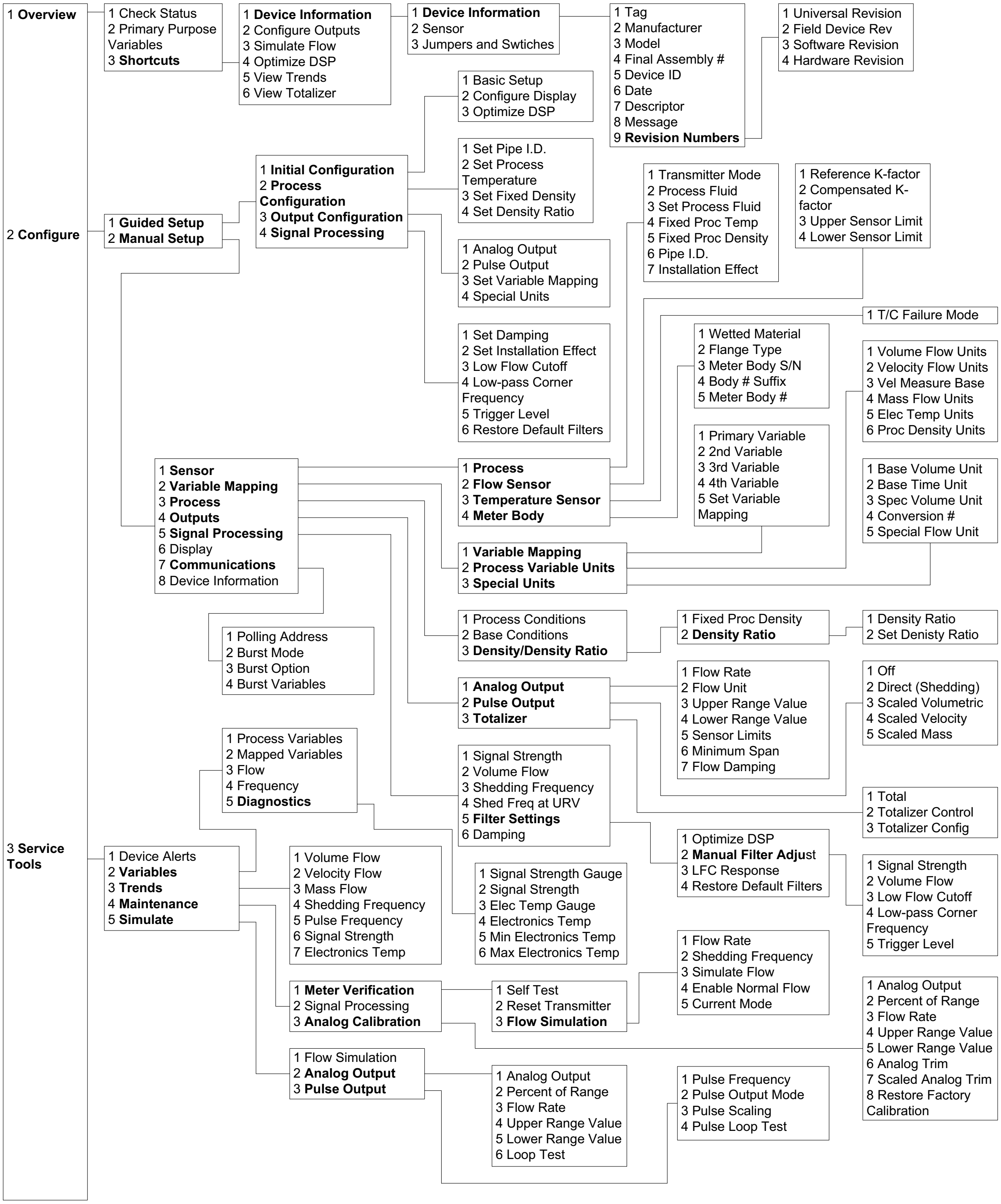


Figure D-2. Menu Tree for the Rosemount 8800D HART 5 Device Revision 2 (DD Revision 3)

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