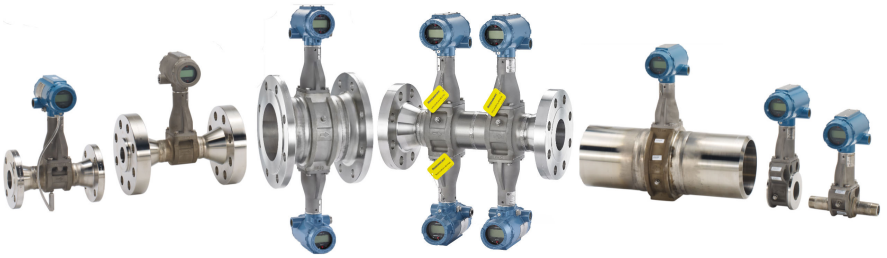


Rosemount™ 8800D Series Vortex Flow Meter



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1 About this guide

This guide provides basic installation and configuration instructions for the Rosemount™ 8800D Series Vortex Flow meters with single, dual, or quad transmitters.

For more information on installation and configuration instructions, diagnostics, maintenance, service, and troubleshooting for:

- Foundation Fieldbus devices consult 00809-0100-4772 Manual
- Non-MultiVariable meters and meters with the MTA option code for HART and all Foundation Fieldbus devices, please consult 00809-0100-4004 Manual

For more information on installation and configuration instructions, diagnostics, maintenance, service, and troubleshooting, for meters with the MPA or MCA option code, please consult 00809-1100-4004 Manual.

For hazardous location installation, including Explosion-proof, Flameproof, or Intrinsic Safety (I.S.), please consult 00825-VA00-0001 Approval Document.

1.1 Hazard messages

This document uses the following criteria for hazard messages based on ANSI standards Z535.6-2011 (R2017).

⚠ DANGER

Serious injury or death will occur if a hazardous situation is not avoided.

⚠ WARNING

Serious injury or death could occur if a hazardous situation is not avoided.

⚠ CAUTION

Minor or moderate injury will or could occur if a hazardous situation is not avoided.

NOTICE

Data loss, property damage, hardware damage, or software damage can occur if a situation is not avoided. There is no credible risk of physical injury.

Physical access

NOTICE

Unauthorized personnel can potentially cause significant damage and/or misconfiguration of end users' equipment. Protect against all intentional or unintentional unauthorized use.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access to protect users' assets. This is true for all systems used within the facility.

1.2 Safety messages

⚠ WARNING

Explosion hazards. Failure to follow these instructions could cause an explosion, resulting in death or serious injury.

- Verify the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- Installation of this transmitter in an explosive environment must be in accordance with the appropriate local, national, and international standards, codes, and practices. Review the approvals documents for any restrictions associated with a safe installation.
- Do not remove transmitter covers or thermocouple (if equipped) in explosive atmospheres when the circuit is live. Both transmitter covers must be fully engaged to meet explosion-proof requirements.
- Before connecting a hand-held 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.

⚠ WARNING

Electrical shock hazard. Failure to follow this instruction could result in death or serious injury. Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.

⚠ WARNING

General hazard. Failure to follow these instructions could result in death or serious injury.

- This product is intended to be used as a flowmeter for liquid, gas, or steam applications. Do not use for any other purpose.
 - Make sure only qualified personnel perform the installation.
-

2 Return policy

Emerson procedures must be followed when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Emerson employees. Failure to follow Emerson procedures will result in your equipment being refused delivery.

3 Emerson Flow customer service

Email:

- Worldwide: flow.support@emerson.com
- Asia-Pacific: APflow.support@emerson.com

Telephone:

North and South America		Europe and Middle East		Asia Pacific	
United States	800 522 6277	U.K.	0870 240 1978	Australia	800 158 727
Canada	+1 303 527 5200	The Netherlands	+31 (0) 704 136 666	New Zealand	099 128 804
Mexico	+41 (0) 41 7686 111	France	0800 917 901	India	800 440 1468
Argentina	+54 11 4837 7000	Germany	0800 182 5347	Pakistan	888 550 2682
Brazil	+55 15 3413 8000	Italy	8008 77334	China	+86 21 2892 9000
Venezuela	+58 26 1731 3446	Central & Eastern Europe	+41 (0) 41 7686 111	Japan	+81 3 5769 6803
		Russia/CIS	+7 495 995 9559	South Korea	+82 2 3438 4600
		Egypt	0800 000 0015	Singapore	+65 6 777 8211
		Oman	800 70101	Thailand	001 800 441 6426
		Qatar	431 0044	Malaysia	800 814 008
		Kuwait	663 299 01		
		South Africa	800 991 390		
		Saudi Arabia	800 844 9564		
		UAE	800 0444 0684		

4 Pre-installation

4.1 Planning

For a successful installation, consider each aspect of your application and the meter you are installing.

4.1.1 Sizing

To determine the correct meter size for optimal flow meter performance:

- Determine the limits of measuring flow.
- Determine the process conditions so that they are within the stated requirements for Reynolds number and velocity.

For sizing details, refer to the product reference manual.

Sizing calculations are required to select the proper flow meter size. These calculations provide pressure loss, accuracy, and minimum and maximum flow rate data to guide in proper selection. Vortex sizing software can be found using the Selection and Sizing tool. The Selection and Sizing tool can be accessed online or downloaded for offline use using this link: www.Emerson.com/FlowSizing.

4.1.2 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 Emerson Flow Sales Representative for more information.

Note

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

4.1.3 Orientation

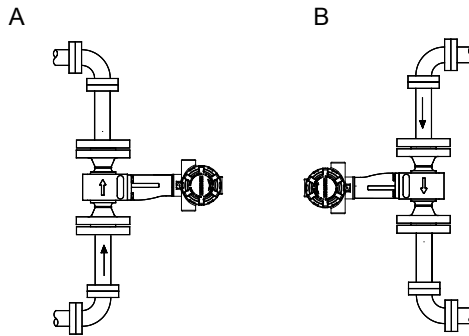
The best orientation for the meter depends on the process fluid, environmental factors, and any other nearby equipment.

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

Figure 4-1: Vertical installation



- A. *Liquid or gas flow*
- B. *Gas flow*

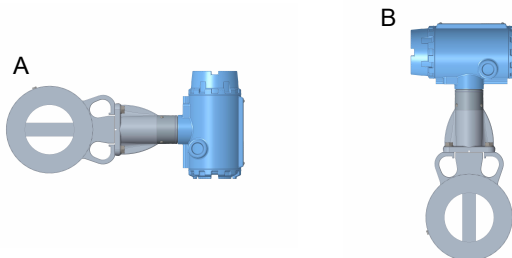
Note

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 helps prevent any entrained air or solids from striking the shedder bar and disrupting the shedding frequency. In gas or steam applications, this helps prevent any entrained liquid (such as condensate) or solids do not strike the shedder bar and disrupt the shedding frequency.

Figure 4-2: Horizontal installation



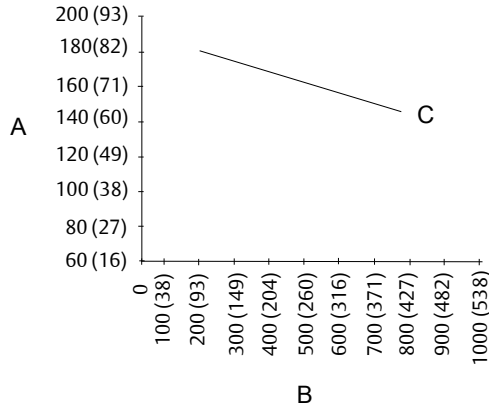
- A. *Preferred installation—meter body installed with electronics to side of pipe*
- B. *Acceptable installation—meter body installed with electronics above pipe*

High-temperature installations

The maximum process temperature for integral electronics is dependent on the ambient temperature where the meter is installed. The electronics must not exceed 185 °F (85 °C).

Figure 4-3 shows combinations of ambient and process temperatures needed to maintain a housing temperature of less than 185 °F (85 °C).

Figure 4-3: Ambient/Process temperature limits

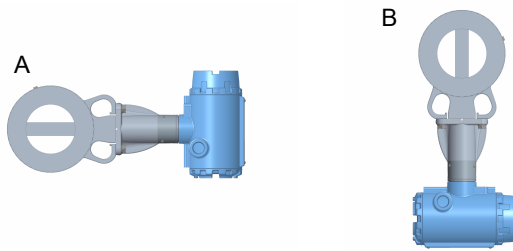


- A. Ambient temperature °F (°C)
- B. Process temperature °F (°C)
- C. 185 °F (85 °C) Housing temperature limit.

Note

The indicated limits are for horizontal pipe and vertical meter position, with meter and pipe insulated with 3 in. (77 mm) of ceramic fiber insulation.

Install the meter body so the electronics are positioned to the side of the pipe or below the pipe as shown in Figure 4-4. Insulation may also be required around the pipe to maintain an electronics temperature below 185 °F (85 °C). See Figure 5-2 for special insulation considerations.

Figure 4-4: 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.
-

4.1.4 Location

Hazardous area

The transmitter 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 [Product certifications](#).

Environmental considerations

Avoid excessive heat and vibration to ensure maximum flow meter 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 flow meter 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.

Upstream and downstream piping

The 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.

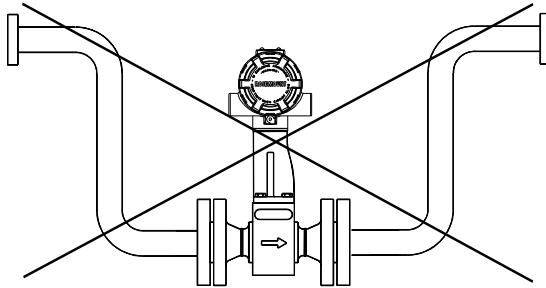
To achieve reference accuracy, straight pipe lengths of 35D upstream and 5D downstream are required. The value of the K-factor may shift up to 0.5% when the upstream straight pipe length is between 10D and 35D. For

optional K-factor corrections, see *Rosemount™ 8800 Vortex Installation Effects Technical Data Sheet*.

Steam piping

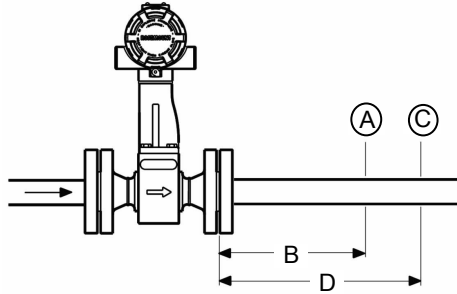
For steam applications, avoid installations such as the one shown in the following figure. Such installations may cause a water-hammer condition at start-up due to trapped condensation. The high force from the water hammer can stress the sensing mechanism and cause permanent damage to the sensor.

Figure 4-5: Wrong steam pipe installation



Pressure and temperature transmitter location

When using pressure and temperature transmitters in conjunction with the vortex flow meter for compensated mass flows, install the transmitter(s) downstream of the vortex flow meter.

Figure 4-6: Pressure and temperature transmitter location


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

4.1.5 Power supply (HART)

Analog 4–20 mA Power supply

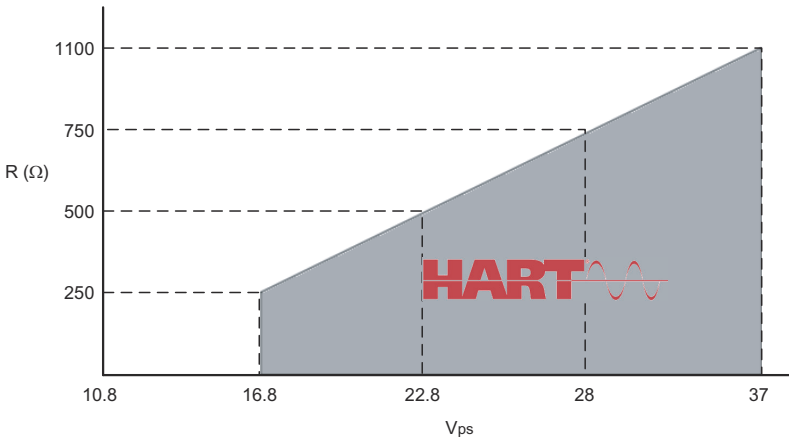
External power supply required. Each transmitter operates on 10.8 VDC to 42 VDC terminal voltage. See [Figure 4-7](#).

Power consumption

One watt maximum per transmitter.

HART communication

Figure 4-7: HART communication voltage/resistance requirement



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

Note that HART Communication requires a minimum loop resistance of 250 ohms up to a maximum of 1100 ohms.

R(Ω) Load resistor value.

V_{ps} Minimum power supply voltage required

$$R(\Omega)_{\max} = 41.7 (V_{ps} - 10.8 \text{ V}).$$

Additional wiring information

- 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.
- If a Smart Wireless THUM™ Adapter is being used with the flow meter to exchange information via IEC 62591 (WirelessHART® 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.
- If a single power supply is used to power more than one transmitter, the power supply used and circuitry common to the transmitters should not have more than 20 ohms of impedance at 1200 Hz. See [Table 4-1](#).

Table 4-1: Resistance based on wire gauge

Gauge number	Ohms per 1,000 ft (305 m) at 68 °F (20 °C) equivalent
14 AWG (2 mm ²)	2.5
16 AWG (1 mm ²)	4.0
18 AWG (0.8mm ²)	6.4
20 AWG (0.5 mm ²)	10
22 AWG (0.3 mm ²)	16
24 AWG (0.2 mm ²)	26

4.1.6 Power supply (FOUNDATION fieldbus)

The flowmeter requires 9-32 Vdc at the power terminals. Each fieldbus power supply requires a power conditioner to decouple the power supply output from the fieldbus wiring segment.

4.2 Commissioning

For proper configuration and operation, commission the meter before putting it into operation. Bench commissioning 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 a configuration device to the signal loop in accordance the device instructions.

4.2.1 HART jumper configuration

Two jumpers on the transmitter specify the alarm and security modes. Set these jumpers during the commissioning stage to avoid exposing the electronics to the plant environment. The two jumpers can be found on the electronics board stack or on the LCD meter.

Alarm As part of normal operations, the transmitter continuously runs a self-diagnostic routine. If the routine detects an internal failure in the electronics, flow meter output is driven to a low or high alarm level, depending on the position of the failure mode jumper. The factory sets the jumper according to the Configuration Data Sheet, if applicable, or HI by default.

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 changes can be made. The factory sets the jumper according to the Configuration Data Sheet, if applicable, or OFF by default.

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 flow meter electronics to the plant environment.

To access the jumpers, remove the transmitter electronics housing or the LCD cover (if equipped) opposite of the terminal blocks, See [Figure 4-8](#) and [Figure 4-9](#).

Figure 4-8: Alarm and security jumpers (no LCD option)

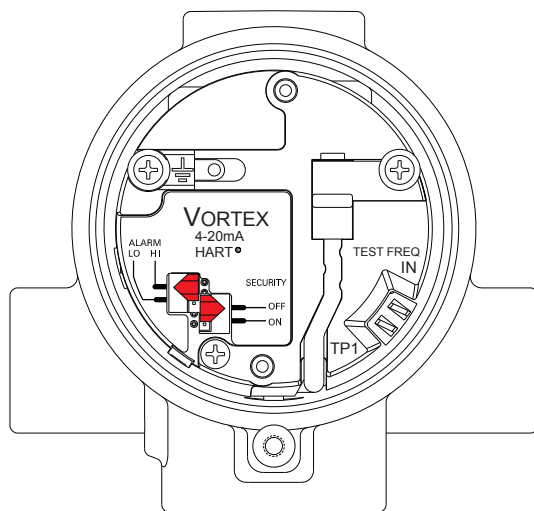
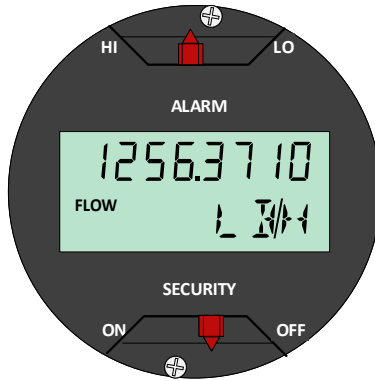


Figure 4-9: LCD indicator alarm and security jumpers (with LCD option)



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 4-2: 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 4-3: 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

4.2.2 FOUNDATION fieldbus jumper configuration

Two jumpers on the transmitter specify the simulation and security modes. Set these jumpers during the commissioning stage to avoid exposing the electronics to the plant environment. The two jumpers can be found on the electronics board stack or on the LCD meter.

Simulate The simulate enable jumper is used in conjunction with the Analog Input (AI) function block simulation. The jumper is also used as a lock-out feature for the AI function block. To enable the simulate enable feature, the jumper must transition from OFF to ON after power is applied to the transmitter, preventing the transmitter from being accidentally left in simulator mode. The factory sets the jumper to OFF by default.

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 changes can be made. The factory sets the jumper to OFF by default.

To access the jumpers, remove the transmitter LCD cover (if equipped) or the electronics housing cover opposite of the terminal blocks, See [Figure 4-10](#) and [Figure 4-11](#).

Figure 4-10: Alarm and security jumpers (no LCD option)

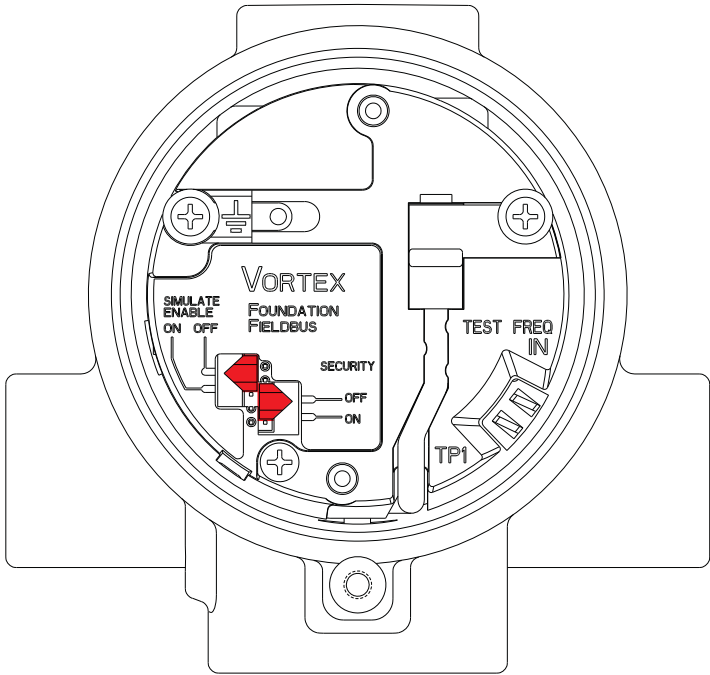
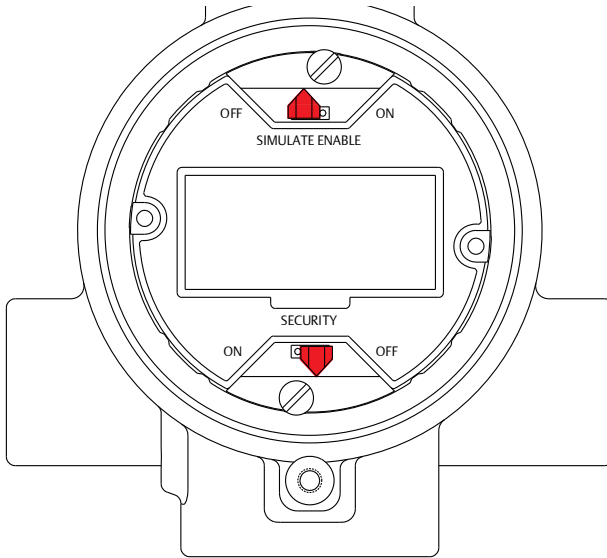


Figure 4-11: LCD indicator alarm and security jumpers (with LCD option)



4.2.3 Calibration

The flow meter is wet-calibrated at the factory and needs 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 configuration device.

5 Basic installation

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.

NOTICE

To avoid damage to the meter, do not lift the flow meter by the transmitter. Lift the meter by the meter body. Lifting supports can be tied around the meter body as shown.

Figure 5-1: Lifting supports



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.

5.3 Gaskets

The flow meter 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.

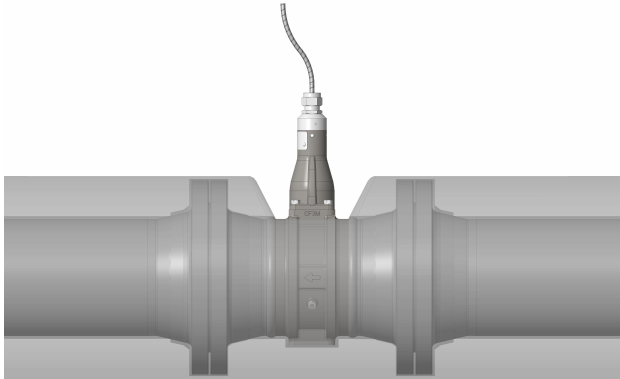
Note

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

5.4 Insulation

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 [#unique_12/unique_12_Connect_42_Insulation](#).

Figure 5-2: Insulation best practice to prevent electronics overheating



⚠ CAUTION

To avoid damage to electronics in high temperature installations, and for both integral and remote electronics, only insulate the meter body as shown, do not insulate the area around the electronics.

5.5 Flanged-style flow meter mounting

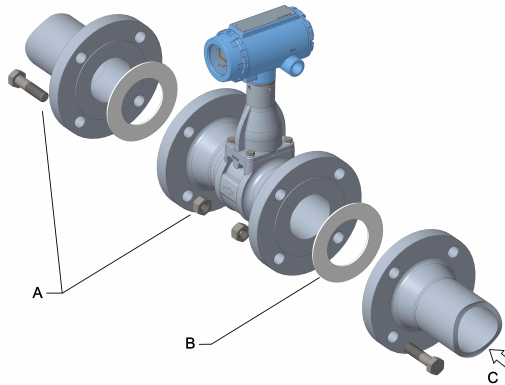
Most vortex flow meters use a flanged-style process connection. Physical mounting of a flanged-style flow meter is similar to installing a typical section of pipe. Conventional tools, equipment, and accessories (such as bolts and gaskets) are required. Tighten the nuts following the sequence shown in [Figure 5-4](#).

Note

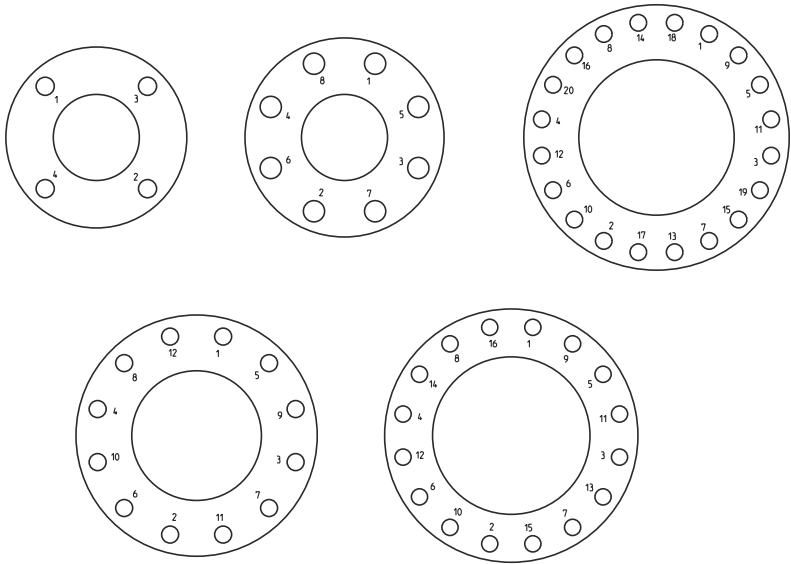
The required bolt load for sealing the gasket joint is affected by several factors, including operating pressure and gasket material, width, and condition. A number of factors also affect the actual bolt load resulting from a measured torque, including condition of bolt threads, friction between the 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 flow meter is centered between flanges of the same nominal size as the flow meter.

Figure 5-3: Flanged-style flow meter installation



- A. *Installation studs and nuts (supplied by customer)*
 - B. *Gaskets (supplied by customer)*
 - C. *Flow*
-

Figure 5-4: Flange bolt torquing sequence**Note**

See the product reference manual for instructions on retrofitting 8800D to 8800A installations.

5.6 Wafer-style flow meter 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 flow meter 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 5-5](#).

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 the product reference manual.

Note

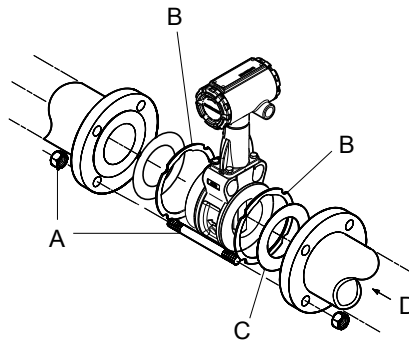
Be sure to align the flow meter so the electronics are accessible, the conduits drain, and the flow meter is not subject to direct heat.

4. Place the remaining studs between the pipe flanges.
5. Tighten the nuts in the sequence shown in [Figure 5-4](#).
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 flow meter is centered between flanges of the same nominal size as the flow meter.

Figure 5-5: Wafer-style flow meter 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. Flow

5.6.1 Stud bolts for wafer-style flow meters

The following tables list the recommended minimum stud bolt lengths for wafer-style meter body size and different flange ratings.

Table 5-1: Stud bolt length for wafer-style flow meters with ASME B16.5 flanges

Line size	Minimum recommended stud bolt lengths (in inches) for each flange rating		
	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 5-2: Stud bolt length for wafer-style flow meters with EN 1092 flanges

Line size	Minimum recommended stud bolt lengths (in mm) for each flange rating			
	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

Line size	Minimum recommended stud bolt lengths (in mm) for each flange rating		
	JIS 10k	JIS 16k and 20k	JIS 40k
15mm	150	155	185
25mm	175	175	190
40mm	195	195	225

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

5.7 Cable glands

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.

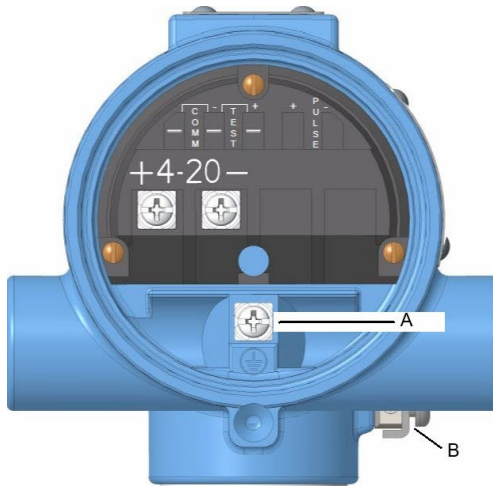
5.8 Flow meter grounding

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. See [Figure 5-6](#).

Figure 5-6: Grounding connections

- A. Internal ground connection
 B. External ground assembly

5.9 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 (\oplus), 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. See [Figure 5-6](#) for the location of the external ground assembly.

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

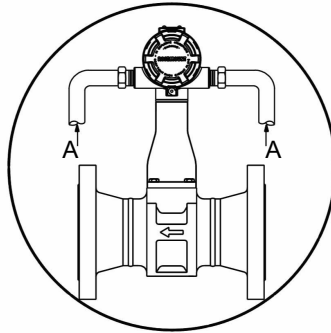
transmitter case is properly grounded. For transient terminal block grounding, see the Reference Manual. Use the above guidelines to ground the transmitter case. Do not run the transient protection ground wire with signal wiring as the ground wire may carry excessive electric current if a lightning strike occurs.

5.10 Conduit 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 5-7: Proper conduit installation



A. Conduit line

5.11 Wiring

The signal terminals are located in a compartment of the electronics housing separate from the flow meter electronics. Connections for a configuration tool and an electric current test connection are above the signal terminals.

Note

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

Common wiring practices

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 (0.205 mm²) or larger, and not exceed 5,000 ft (1500 m).

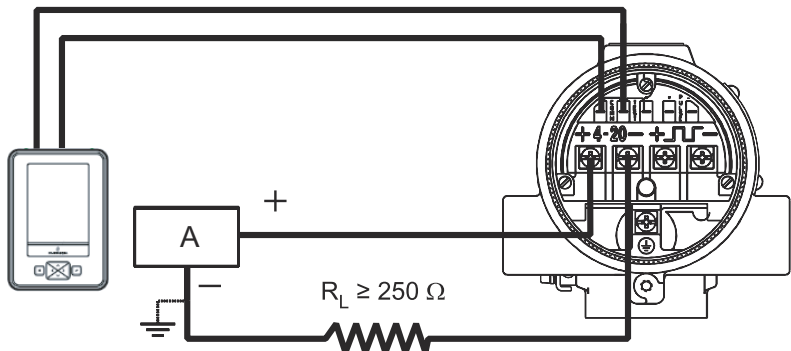
5.11.1 Analog output

The flow meter 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.

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).

Figure 5-8: 4–20 mA wiring



A. Power supply. See [Power supply \(HART\)](#).

5.11.2 FOUNDATION fieldbus wiring

Each fieldbus power supply requires a power conditioner to decouple the power supply output from the fieldbus wiring segment.

All power to the transmitter is supplied over the segment wiring. Use shielded, twisted pair for best results. For new installations or to get maximum performance, twisted pair cable designed especially for fieldbus should be used. [Table 5-3](#) lists the cable characteristics and ideal specifications.

Table 5-3: Ideal cable specifications for fieldbus wiring

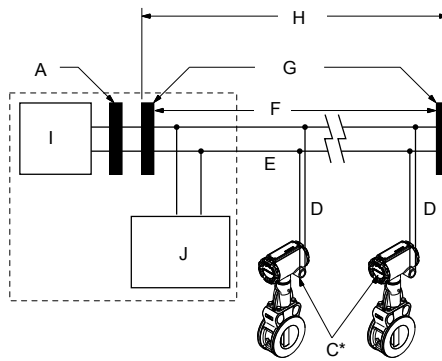
Characteristic	Ideal specification
Impedance	100 Ohms \pm 20% at 31.25 kHz
Wire size	18 AWG (0.8 mm ²)
Shield coverage	90%
Attenuation	3 db/km
Capacitive unbalance	2 nF/km

Note

The number of devices on a fieldbus segment is limited by the power supply voltage, the resistance of the cable, and the amount of current drawn by each device.

Transmitter wiring connection

To make the transmitter wiring connection, remove the FIELD TERMINALS end cover on the electronics housing. Connect the power leads to the positive (+) and negative (–) terminals. The power terminals are polarity insensitive: the polarity of the DC power leads does not matter when connecting to the power terminals. When wiring to screw terminals, crimped lugs are recommended. Tighten the terminals to ensure adequate contact. No additional power wiring is required.

Figure 5-9:

- A. Integrated power conditioner and filter
- B. The power supply, filter, first terminator, and configuration tool are typically located in the control room.
- C. Devices 1 through 16 (Intrinsically safe installations may allow fewer devices per I.S. barrier).
- D. Spur
- E. Trunk.
- F. Fieldbus segment
- G. Terminators
- H. 6234 ft (1900 m) max (depending upon cable characteristics)
- I. Power supply
- J. Fieldbus configuration tool

5.12 Remote installation

If a remote electronics option (Rxx or Axx) was ordered, the flow meter assembly will be shipped in two parts:

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

If an armored remote electronics option (Axx) was ordered, 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. Information on remote installation can be found in [Cable connections](#).

5.12.1 Mounting

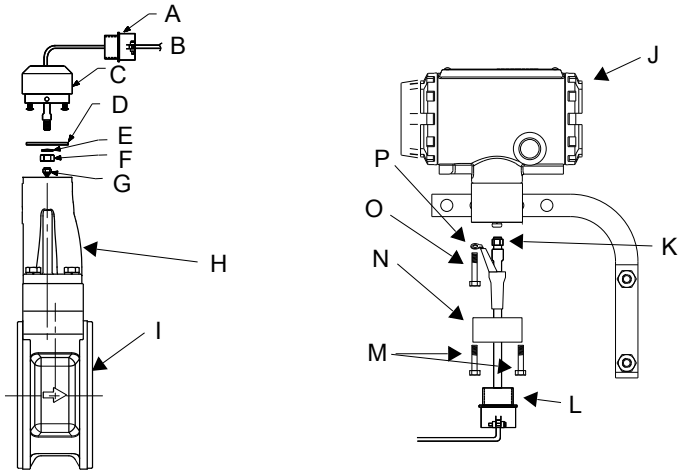
Mount the meter body in the process flow line as described earlier in this section. Mount the bracket and electronics housing in the desired location.

The housing can be repositioned on the bracket to facilitate field wiring and conduit routing.

5.12.2 Cable connections

Complete these steps for connecting the loose end of the coaxial cable to the electronics housing. If connecting/disconnecting the meter adapter to the meter body, refer to the product reference manual.

Figure 5-10: Remote installation



- 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
- J. Electronics housing
- K. Coaxial cable SMA nut
- L. ½ NPT conduit adapter or cable gland (supplied by customer)
- M. Housing adapter screws
- N. Housing adapter
- O. Housing base screw
- P. Ground connection

⚠ CAUTION

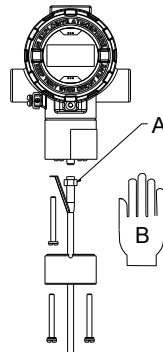
To prevent moisture from entering the coaxial cable connections, install the interconnecting coaxial cable in a single dedicated conduit run or use sealed cable glands at both ends of the cable.

In remote mount configurations when ordered with a hazardous area option code, the remote sensor cable and the interconnecting thermocouple cable (MTA or MCA 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.

⚠ CAUTION

The coaxial remote cable cannot be field terminated or cut to length. Coil any extra coaxial cable with no less than a 2-in. (51 mm) radius.

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 hand tighten the coaxial cable SMA nut to the electronics housing to 7 in-lbs (0.8 N-m).

Figure 5-11: Attaching and tightening SMA nut

- A. SMA nut
- B. Hand tighten

Note

Do not over-tighten the coaxial cable nut to 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.

5.12.3 Housing rotation

The entire electronics housing may be rotated in 90° increments for easy viewing. Use the following steps to change the housing orientation,

1. Loosen the three housing rotation set screws at the base of the electronics housing with a 5/32" hex wrench by turning the screws clockwise (inward) until they clear the support tube.
2. Slowly pull the electronics housing out of the support tube.

⚠ CAUTION

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.

3. Unscrew the sensor cable from the housing with a 5/16" open end wrench.
4. Rotate the housing to the desired orientation.
5. Hold it in this orientation while you screw the sensor cable onto the base of the housing.

⚠ CAUTION

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.

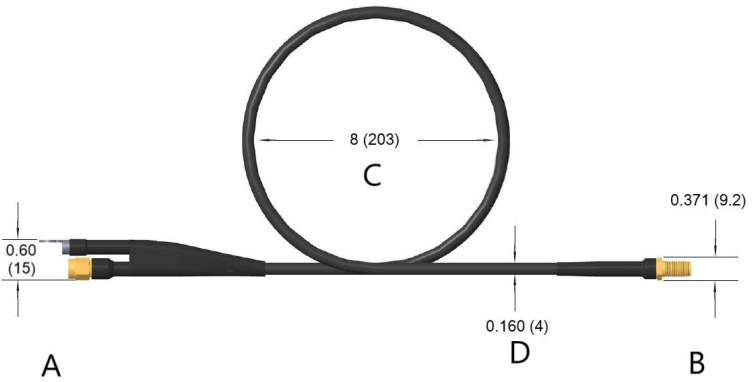
6. Place the electronics housing into the top of the support tube.
7. Use a hex wrench to turn the three housing rotation screws counter-clockwise (outward) to engage the support tube.

5.12.4 Specifications and requirements for remote sensor cable

If using a Rosemount remote sensor cable, observe these specifications and requirements.

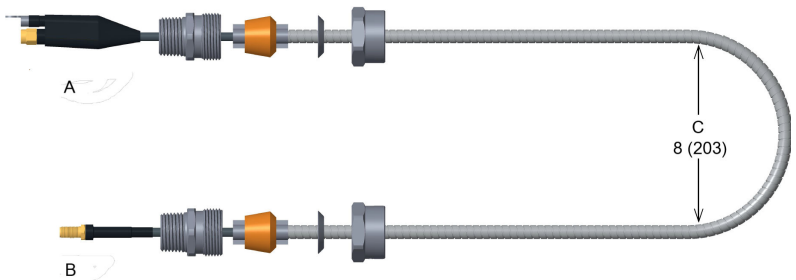
- The remote sensor cable is a proprietary design tri-axial cable
- It is considered a low voltage signal cable
- It is rated for and/or part of intrinsically safe installations
- Non armored version is designed to be run through metal conduit
- Cable is water resistant, but not submersible. As a best practice, exposure to moisture should be avoided if possible
- Rated operating temperature is -58°F to $+392^{\circ}\text{F}$ (-50°C to $+200^{\circ}\text{C}$)
- Flame Resistant in accordance with IEC 60332-3
- Non-armored and armored version minimum bend diameter is 8 inches (203 mm)
- Nominal O.D. of the non-armored version is 0.160 inches (4 mm)
- Nominal O.D. of the armored version is 0.282 inches (7.1 mm)

Figure 5-12: Non-armored cable



- A. Transmitter end
- B. Sensor end
- C. Minimum bend diameter
- D. Nominal O.D.

Figure 5-13: Armored cable



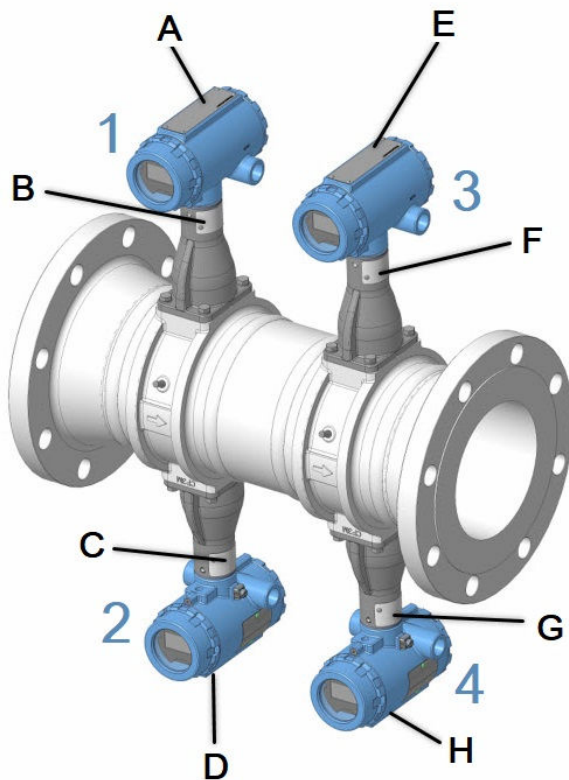
- A. Transmitter end
- B. Sensor end
- C. Minimum bend diameter

5.12.5 Quad transmitter numbering and orientation

When quad vortex flow meters are ordered, for configuration purposes, the transmitters are identified as Transmitter 1, Transmitter 2, Transmitter 3, and Transmitter 4. The transmitter and meter body nameplate of a Quad Vortex flow meter can be used to identify and verify the transmitter number. See [Figure 5-14](#) for Quad transmitter orientation and nameplate locations.

See Figure 4-14 and 4-15 for Quad transmitter and meter body nameplate number location.

Figure 5-14: Quad transmitter numbering

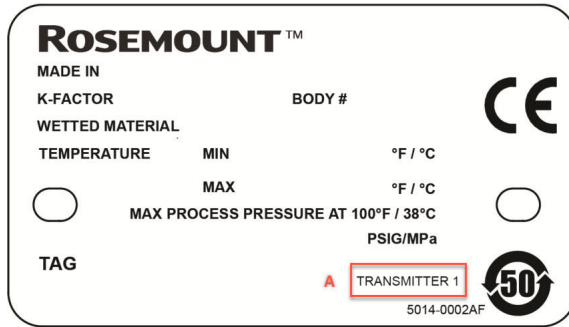


- A. Transmitter 1 transmitter nameplate
- B. Transmitter 1 meter body nameplate
- C. Transmitter 2 transmitter nameplate
- D. Transmitter 2 meter body nameplate
- E. Transmitter 3 transmitter nameplate
- F. Transmitter 3 meter body nameplate
- G. Transmitter 4 transmitter nameplate
- H. Transmitter 4 meter body nameplate

Figure 5-15: Quad transmitter nameplate



Figure 5-16: Quad meter body nameplate



6 Basic configuration

The transmitter 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 transmitter is not configured or if the configuration variables need revision. The basic setup section includes parameters typically required for basic operation.

Note

ProLink III paths are only applicable to HART devices. For more information on Fieldbus devices, refer to the 8800D product manual for Fieldbus protocol (00809-0100-4772).

6.1 Process variables

Process variables define the flow meter output. When commissioning a flow meter, review each process variable, its function and output, and take corrective action if necessary before using the flow meter in a process application.

6.1.1 Primary variable mapping

Allows the user to select which variables the transmitter will output.

ProLink III	Device Tools → Configuration → Communications (HART)
-------------	--

Note

The Primary Variable is also the Analog Output variable.

This can be either Process Temperature (MTA or MCA option only) or Flow. Flow variables are available as Corrected Volume Flow, Mass Flow, Velocity Flow, or Volume Flow. 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](#). Use the Process Variable Units function to select the units for your application.

6.1.2 Percent of range

ProLink III	Device Tools → Configuration → Outputs → Analog Output
-------------	--

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.

6.1.3 Analog output

ProLink III	Device Tools → Configuration → Outputs → Analog Output
-------------	--

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.

6.1.4 Process variable units

ProLink III	Device Tools → Configuration → Process Measurement → (select type)
-------------	--

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

Allows the user to view the volumetric flow rate value.

Volume flow units

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

Table 6-1: Volume flow units

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

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

Table 6-2: Corrected volume flow units

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

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

Mass flow units

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

Table 6-3: Mass flow units

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

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

Velocity flow units

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

- feet per second
- meters per second

Velocity measurement base

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

6.2 Tag

ProLink III	Device Tools → Configuration → Informational Parameters → Transmitter
-------------	---

The quickest way to identify and distinguish between flow meters. Flow meters can be tagged according to the requirements of your application. The tag may be up to eight characters long.

6.3 Long Tag

ProLink III	Device Tools → Configuration → Informational Parameters → Transmitter
-------------	---

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

6.4 Process configuration

ProLink III	Device Tools → Configuration → Device Setup
-------------	---

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

Set process fluid

Non-MultiVariable and MTA meters

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. For more information on temperature compensation configuration, please consult the advance functionality of the Operation section of the 00809-0100-4004 Manual.

MPA and MCA meters

Select the fluid type - either Liquid, Gas, or Steam. For more information on pressure and temperature compensation configuration, please consult the advanced installation and advanced configuration sections of the 00809-1100-4004 Manual.

Fixed process temperature

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 or MCA option is installed.

Fixed process density

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:

Meters with MTA option

The transmitter is in TComp Sat Steam or TComp Liquids for MTA meters. When the process fluid is set to Tcomp Sat Steam or TComp Liquids, the changes in density are automatically being compensated for and any error in the user-entered density will cause error in the measurement.

Meters with MPA or MCA option Actual Compensation reads Temperature, Pressure or Pressure and Temperature Compensation. If Actual Compensation reads Temperature, Pressure or Pressure and Temperature Compensation, density is automatically compensated, any error in the user-entered density will result in error in the measurement.

Base process density

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:

$$\text{Density ratio} = \text{density at actual (flowing) conditions} / \text{density at standard (base) conditions}$$

6.5 Reference K-factor

ProLink III	Device Tools → Configuration → Device Setup
-------------	---

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

6.6 Flange type

ProLink III	Device Tools → Configuration → Device Setup
-------------	---

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

Table 6-4: Flange types

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

Table 6-4: Flange types (continued)

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		

6.7 Pipe I.D.

ProLink III	Device Tools → Configuration → Device Setup
-------------	---

The pipe I.D. (inside diameter) of the pipe adjacent to the flow meter can cause entrance effects that may alter flow meter readings. Configuring the actual mating pipe inside diameter will correct for these effects. Enter the appropriate value for this variable.

Pipe I.D. values for schedule 10, 40, and 80 piping are given in the following table. If the mating pipe I.D. is not listed in the table, confirm it with the manufacturer or measure it yourself.

Table 6-5: 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)
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)

6.8 Upper and lower range values

ProLink III	Device Tools → Configuration → Outputs → Analog Output
-------------	--

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 flow meter performance.

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

Upper Range Value This is the 20 mA set point for the meter.

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

6.9 Damping

ProLink III	Device Tools → Configuration → Outputs → Analog Output
-------------	--

Damping changes the response time of the flow meter 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.

6.10 Optimize Digital Signal Processing (DSP)

ProLink III	Device Tools → Configuration → Process Measurement → Signal Processing
-------------	--

A function that can be used to optimize the range of the flow meter 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 flow meter 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.

7 Safety instrumented systems installation

For safety certified installations, refer to the Rosemount 8800D Safety Manual (Document # 00809-0200-4004) for installation procedure and system requirements.

8 Product certifications

For information about product certifications, refer to *Rosemount™ 8800D Series Vortex Flowmeter Approval Document (00825-VA00-0001)*. You can find it at emerson.com or contact an Emerson Flow representative (see back page).



Quick Start Guide
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