

The Rosemount® Annubar® Flowmeter Series



Rosemount 3051SFC_A
Compact Annubar
Flowmeter



Rosemount 3051SFA
Annubar Flowmeter



Rosemount 3051CFA
Annubar Flowmeter



Rosemount 2051CFA
Annubar Flowmeter



Rosemount 485
Annubar Primary
Element



Rosemount 585 Severe
Service Annubar Primary
Element

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The Rosemount® Annubar® Flowmeter Series

NOTICE

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.

The United States has two toll-free assistance numbers and one International number.

Customer Central

1-800-999-9307 (7:00 A.M. to 7:00 P.M. CST)

International

1-(952) 906-8888

National Response Center

1-800-654-7768 (24 hours a day)

Equipment service needs

⚠ WARNING

Explosions could result in death or serious injury.

- Do not remove the transmitter cover in explosive atmospheres when the circuit is live.
- Before connecting a Field 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.
- If the line is pressurized, serious injury or death could occur by opening valves.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and the terminals.

⚠ 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.

This device is intended for use in temperature monitoring applications and should not be used in control and safety applications.

If pipe/duct wall is less than 0.125-in. (3.2mm) use extreme caution when installing sensor. Thin walls can deform during welding, installation, or from the weight of a cantilevered flowmeter. These installations may require a fabricated outlet, saddle, or external flowmeter support. Consult factory for assistance.

Section 1 Introduction

1.1 Using this manual

This product manual provides installation, configuration, calibration, troubleshooting, and maintenance instructions for the Rosemount® Annubar® Flowmeter Series.

Section 2: Installation

- Installation flowchart and checklist
- Orienting, mounting, and installing the flowmeter
- Connecting the Wiring

Section 3: Commissioning

- Calibrating the flowmeter

Section 4: Operation and Maintenance

- Troubleshooting information
- Disassembly
- RTD maintenance

Appendix A: Specifications and Reference Data

- Specifications
- Dimensional drawings

Appendix B: Product Certifications

- Approvals certifications
- Installation drawings

Information in this manual applies to circular pipes only. Consult Rosemount Customer Central for instructions regarding use in square or rectangular ducts.

1.2 Product recycling/disposal

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

Section 2 Installation

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Receiving and inspection	page 3
Considerations	page 4
Installation flowchart and checklist	page 6
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2.1 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 operation in this section.

⚠ CAUTION

If pipe/duct wall is less than 0.125-in. (3.2mm) use extreme caution when installing sensor. Thin walls can deform during welding, installation, or from the weight of a cantilevered flowmeter. These installations may require a fabricated outlet, saddle, or external flowmeter support. Consult factory for assistance.

⚠ WARNING

Explosions could result in death or serious injury.

- Do not remove the transmitter cover in explosive atmospheres when the circuit is live.
- Before connecting a Field 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.

2.2 Receiving and inspection

Flowmeters are available in different models and with different options, so it is important to inspect and verify that the appropriate model was delivered before installation.

Upon receipt of the shipment, check the packing list against the material received and the purchase order. All items are tagged with a sales order number, serial number, and customer tag number. Report any damage to the carrier.

2.3 Considerations

2.3.1 Limitations

Structural

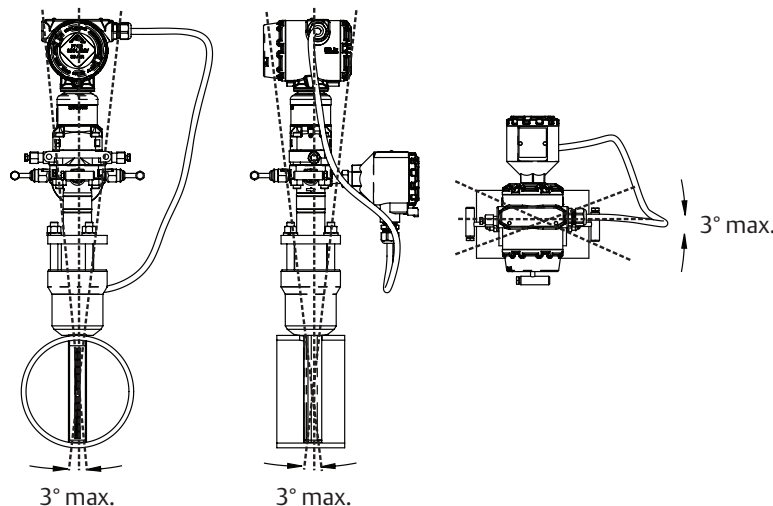
Structural limitations are printed on the sensor tag. Exceeding structural limitations may cause sensor failure.

Functional

The most accurate and repeatable flow measurement occurs in the following conditions:

- The structural limit differential pressure, as printed on the sensor tag, is not exceeded.
- The instrument is not used for two-phase flow or for steam service below saturation temperature.
- Install the flowmeter in the correct location within the piping branch to prevent measurement inaccuracies caused by flow disturbances.
- The flowmeter can be installed with a maximum misalignment of 3 degrees (see [Figure 2-1](#)). Misalignment beyond 3 degrees will cause flow measurement errors.

Figure 2-1. Permissible Misalignment



2.3.2 Environmental

Mount the flowmeter in a location with minimal ambient temperature changes. [Appendix A: Specifications and Reference Data](#) lists the temperature operating limits. Mount to avoid vibration, mechanical shock, and external contact with corrosive materials.

Access requirements

Consider the need to access the flowmeter when choosing an installation location and orientation.

Process flange orientation

Orient the process flanges on a remote mounted flowmeter so that process connections can be made. For safety reasons, orient the drain/vent valves so that process fluid is directed away from technicians when the valves are used. In addition, consider the possible need for a testing or calibration input.

Housing rotation

The electronics housing may be rotated up to 180 degrees (left or right) to improve field access to the two compartments or to better view the optional LCD meter. To rotate the housing, release the housing rotation set screw and turn the housing up to 180 degrees.

Electronics housing

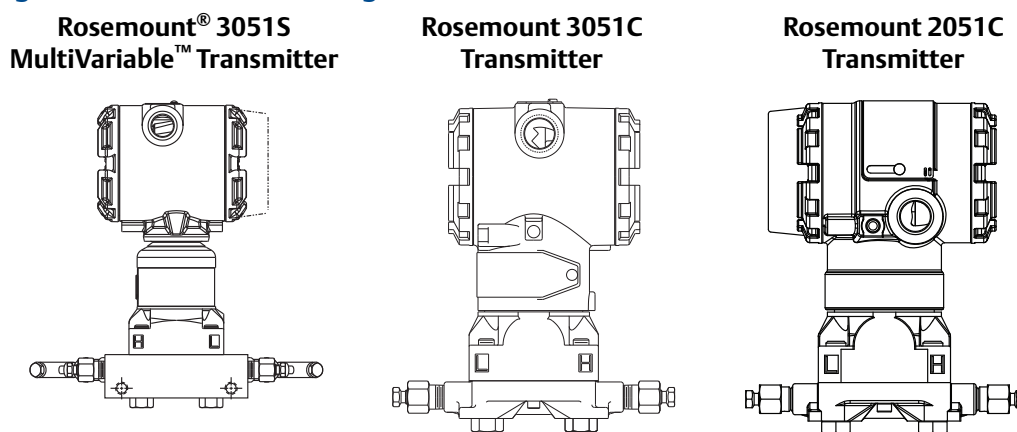
Terminal side

The circuit compartment should not routinely need to be opened when the unit is in service. Wiring connections are made through the conduit openings on the top or side of the housing. The field terminal side is marked on the electronics housing. Mount the flowmeter so that the terminal side is accessible. A 0.75-in. (19 mm) clearance is required for cover removal. Use a conduit plug on the unused side of the conduit opening. A 3-in. (76 mm) clearance is required for cover removal if a meter is installed.

Cover installations

Always install the electronics housing covers metal-to-metal to ensure a proper seal.

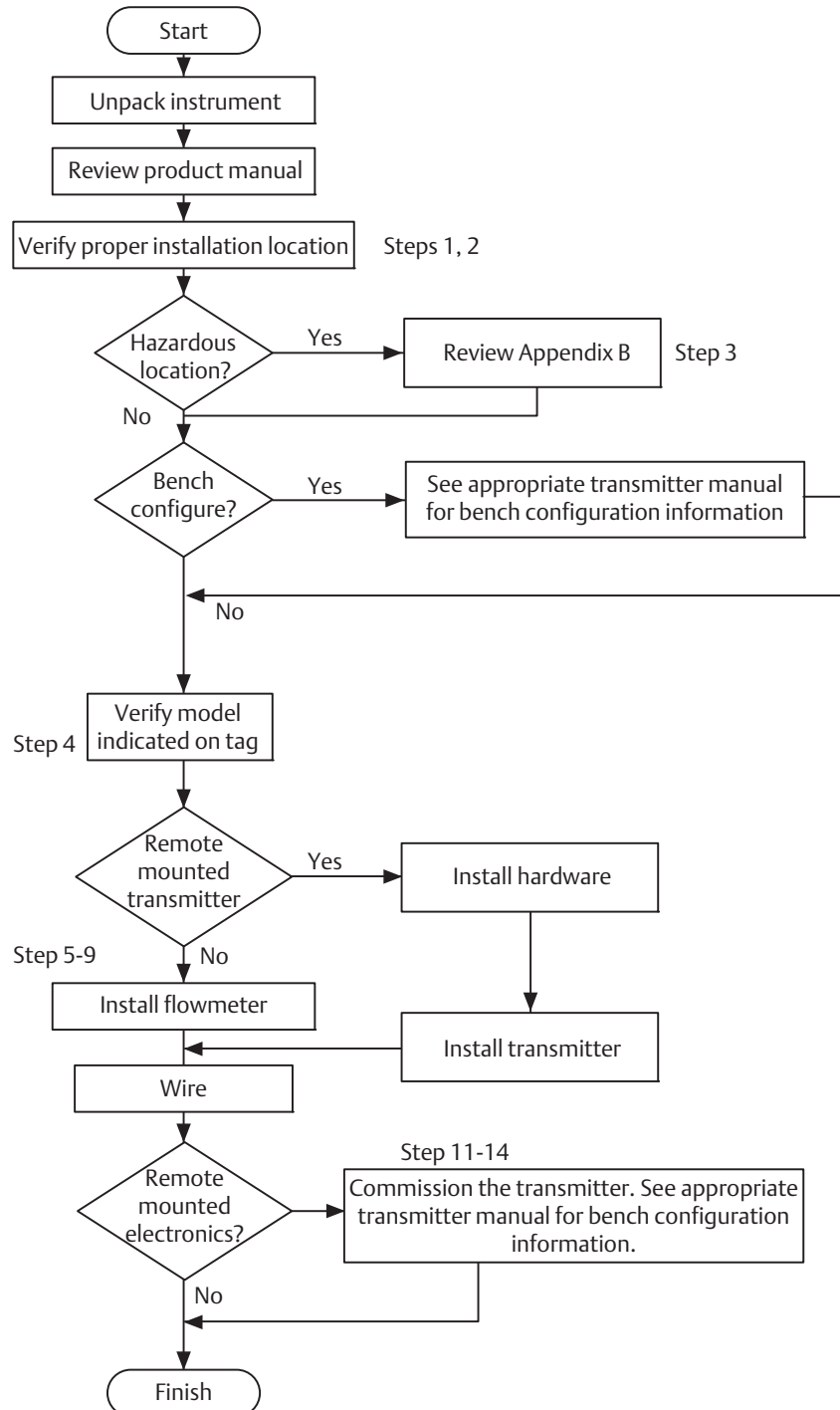
Figure 2-2. Transmitter Housing



2.4 Installation flowchart and checklist

Figure 2-3 is an installation flowchart that provides guidance through the installation process. Following the figure, an installation checklist has been provided to verify that all critical steps have been taken in the installation process. The checklist numbers are indicated in the flowchart.

Figure 2-3. Installation Chart



The following is a summary of the steps required to complete a flowmeter installation. If this is a new installation, begin with [Step 1](#). If the mounting is already in place, verify the hole size and fittings match the recommended specifications (see [Table 2-3 on page 23](#)) and begin with [Step 5](#).

1. Determine where the flowmeter is to be placed within the piping system.
2. Establish the proper orientation as determined by the intended application.
3. Review [Appendix B: Product Certifications](#) and determine if the flowmeter is located in a hazardous location.
4. Confirm the configuration.
5. Drill the correct sized hole into the pipe and deburr. Do not torch-cut holes. If installing a wafer-style Annubar flowmeter, place the flowmeter between raised-face flanges, utilizing the centering ring to install the flowmeter, and skip to [Step 11](#).
6. For instruments equipped with opposite-side support, drill a second hole 180° from the first hole.
7. Weld the mounting per plant welding procedures.
8. Measure the pipe's internal diameter (ID), preferably at $1 \times \text{ID}$ from the hole (upstream or downstream).

Note

To maintain published flowmeter accuracy, provide the pipe ID when purchasing the flowmeter.

9. Check the set-up of the instrument assembly to the pipe.
10. Install the flowmeter.
11. Wire the instrument.
12. Supply power to the flowmeter.
13. Perform a trim for mounting effects.
14. Check for leaks.
15. Commission the instrument.

2.5 Mounting

2.5.1 Tools and supplies

Tools required include the following:

- Open end or combination wrenches (spanners) to fit the pipe fittings and bolts: $\frac{9}{16}$ -in., $\frac{5}{8}$ -in., and $\frac{7}{8}$ -in
- Adjustable wrench: 15-in. ($1\frac{1}{2}$ -in. jaw)
- Nut driver: $\frac{3}{8}$ -in. for vent/drain valves (or $\frac{3}{8}$ -in. wrench)
- #1 Phillip's screwdriver
- Standard screwdrivers: $\frac{1}{4}$ -in. and $\frac{1}{8}$ -in. wide
- 14-in. Pipe wrench
- Wire cutters/strippers
- $\frac{7}{16}$ -in. box wrench (required for the ferry head bolt design)

Supplies required include the following:

- $\frac{1}{2}$ -in. tubing or $\frac{1}{2}$ -in. pipe (recommended) to hook up the electronics to the sensor probe. The length required depends upon the distance between the electronics and the sensor
- Fittings including (but not limited to)
 - Two tube or pipe tees (for steam or high temperature liquid) and
 - Six tube/pipe fittings (for tube)
- Pipe compound or PTFE tape (where local piping codes allow)

2.5.2 Mounting brackets

Mounting brackets are provided with any flowmeter order with a remote mounted transmitter to facilitate mounting to a panel, wall, or 2-in. (50.8 mm) pipe. The bracket option for use with the Coplanar flange is 316 SST with 316 SST bolts.

When installing the transmitter to one of the mounting brackets, torque the bolts to 125 in-lb. (169 N-m).

2.5.3 Bolt installation guidelines

The following guidelines have been established to ensure a tight flange, adapter, or manifold seal. Only use bolts supplied with the instrument or sold by the factory.

The instrument is shipped with the coplanar flange installed with four 1.75-in. (44.5 mm) flange bolts. The following bolts also are supplied to facilitate other mounting configurations:

- Four 2.25-in. (57.2 mm) manifold/flange bolts for mounting the coplanar flange on a three-valve manifold. In this configuration, the 1.75-in. (44.5 mm) bolts may be used to mount the flange adapters to the process connection side of the manifold.
- (Optional) If flange adapters are ordered, four 2.88-in. (73.2 mm) flange/adapter bolts for mounting the flange adapters to the coplanar flange.

Stainless steel bolts supplied by Rosemount Inc. are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. Do not apply additional lubricant when installing either type of bolt. Bolts supplied by Rosemount Inc. are identified by the following head markings:

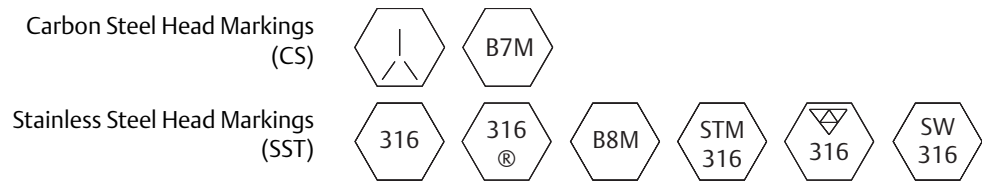
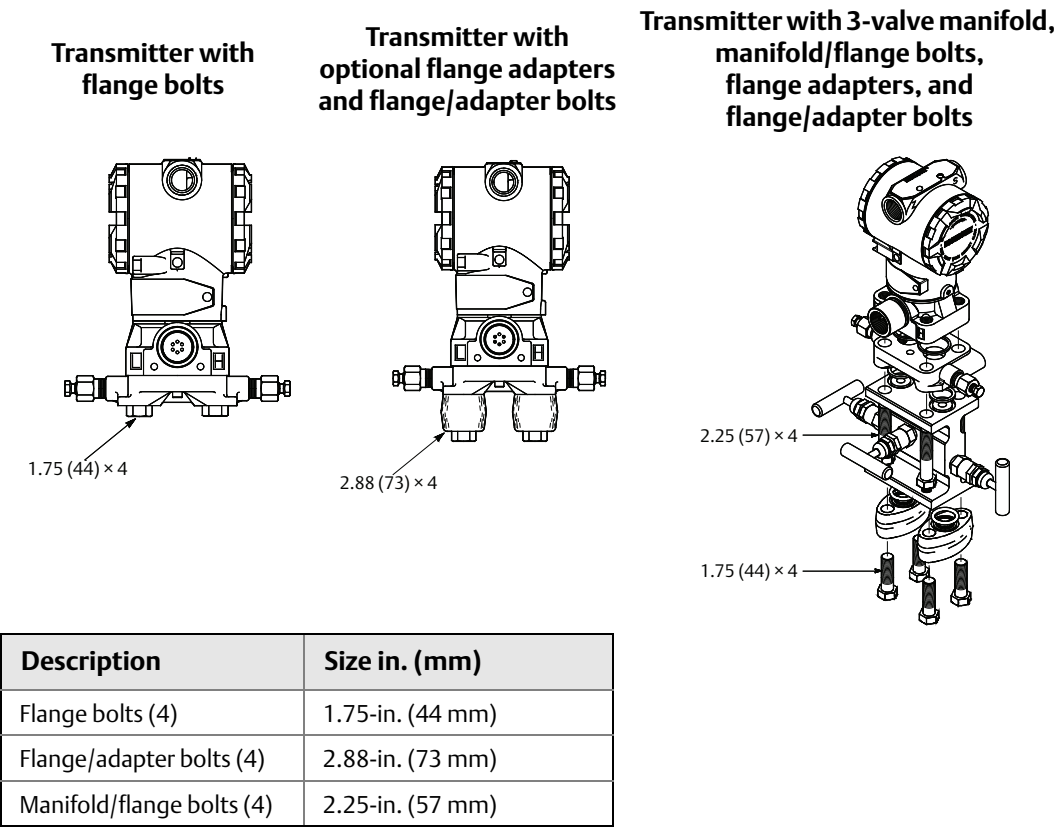


Figure 2-4. Coplanar Mounting Bolts and Bolting Configurations for Coplanar Flange



2.5.4 Instrument manifolds

Figure 2-5 on page 10 identifies the valves on a 5-valve and a 3-valve manifold. Table 2-1 on page 10 explains the purpose of these valves.

An instrument manifold is recommended for all installations. A manifold allows an operator to equalize the pressures prior to the zero calibration of the transmitter as well as to isolate the electronics from the rest of the system without disconnecting the impulse piping. Although a 3-valve manifold can be used, a 5-valve manifold is recommended.

5-valve manifolds provide a positive method of indicating a partially closed or faulty equalizer valve. A closed faulty equalizer valve will block the DP signal and create errors that may not be detectable otherwise. The labels for each valve will be used to identify the proper valve in the procedures to follow.

Note

Some recently-designed instrument manifolds have a single valve actuator, but cannot perform all of the functions available on standard 5-valve units. Check with the manufacturer to verify the functions that a particular manifold can perform. In place of a manifold, individual valves may be arranged to provide the necessary isolation and equalization functions.

Figure 2-5. Valve Identification for 5-Valve and 3-Valve Manifolds

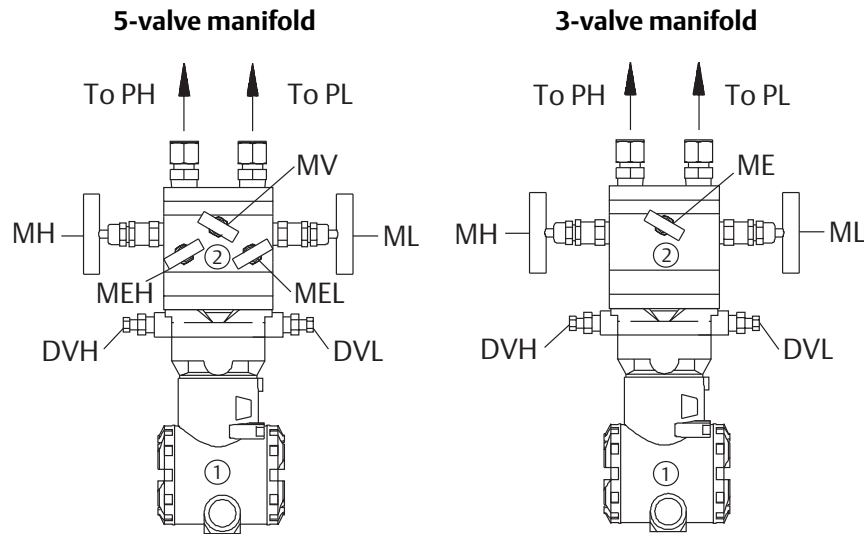


Table 2-1. Description of Impulse Valves and Components

Name	Description	Purpose
Manifold and impulse pipe valves		
PH	Primary Sensor – High Pressure	Isolates the flowmeter sensor from the impulse piping system
PL	Primary Sensor – Low Pressure	
DVH	Drain/Vent Valve – High Pressure	Drains (for gas service) or vents (for liquid or steam service) the DP electronics chambers
DVL	Drain/Vent Valve – Low Pressure	
MH	Manifold – High Pressure	Isolates high side or low side pressure from the process.
ML	Manifold – Low Pressure	
MEH	Manifold Equalizer – High Pressure	Allows high and low pressure side access to the vent valve, or for isolating the process fluid
MEL	Manifold Equalizer – Low Pressure	
ME	Manifold Equalizer	Allows high and low side pressure to equalize
MV	Manifold Vent Valve	Vents process fluid
Components		
1	Transmitter	Reads Differential Pressure Isolates and equalizes transmitter
2	Manifold	
3	Vent Chambers	Collects gases in liquid applications.
4	Condensate Chamber	Collects condensate in gas applications.

2.5.5 Straight run requirements

Use the following to aid in determining the straight run requirements.

Table 2-2. Straight Run Requirements

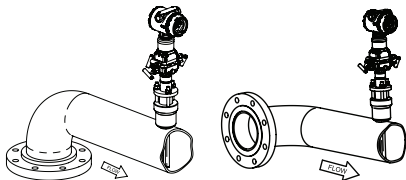
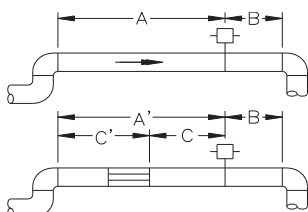
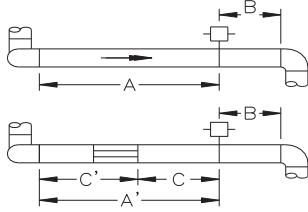
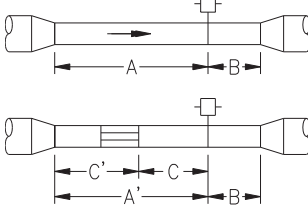
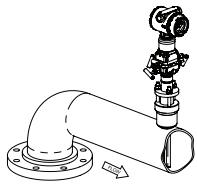
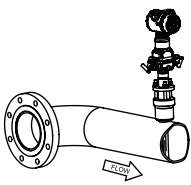
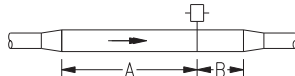
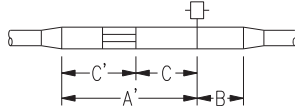
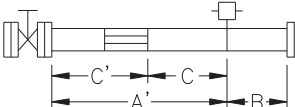
	In plane	Out of plane	Upstream dimensions					Downstream dimensions
			Without straightening vanes		With straightening vanes			
			In plane A	Out of plane A	A'	C	C'	
1		Single elbow	8	10	N/A	N/A	N/A	4
		Single elbow with straightening vanes	N/A	N/A	8	4	4	4
2		Double elbows in plane	11	16	N/A	N/A	N/A	4
		Double elbow in plane with straightening vanes	N/A	N/A	8	4	4	4
3		Double elbows out of plane	23	28	N/A	N/A	N/A	4
		Double elbows out of plane with straightening vanes	N/A	N/A	8	4	4	4
4		Reducer	12	12	N/A	N/A	N/A	4
		Reducer with straightening vanes	N/A	N/A	8	4	4	4

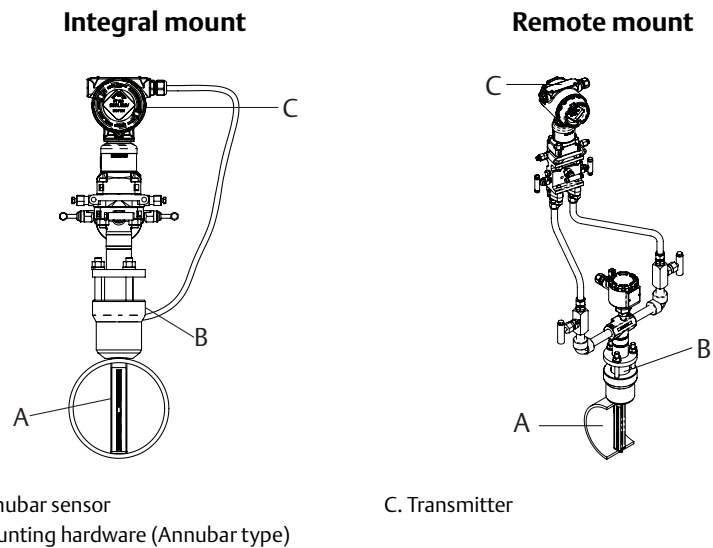
Table 2-2. Straight Run Requirements

	In plane 	Out of plane 	Upstream dimensions					Downstream dimensions
			Without straightening vanes		With straightening vanes			
			In plane A	Out of plane A	A'	C	C'	
5	Expander		18	18	N/A	N/A	N/A	4
								
								
Expander with straightening Vanes		N/A	N/A	8	4	4	4	
6	Valve		30	30	N/A	N/A	N/A	4
								
								
Valve with straightening Vanes		N/A	N/A	8	4	4	4	

Note

- If proper lengths of straight run are not available, position the mounting such that 80% of the run is upstream and 20% is downstream.
- “In Plane A” means the sensor is in the same plane as the elbow. “Out of Plane A” means the sensor is perpendicular to the plane of the elbow.
- The information contained in this manual is applicable to circular pipes only. Consult the factory for instructions regarding use in square or rectangular ducts.
- Straightening vanes may be used to reduce the required straight run length.
- The last row in [Table 2-2](#) applies to gate, globe, plug, and other throttling valves that are partially opened, as well as control valves.

Figure 2-6. Mounting Configuration



Note

The direct-mounted flowmeter is usually shipped with the transmitter assembled to the sensor, unless it is ordered with a Remote-mount Transmitter Connection Platform.

2.5.6 Flowmeter orientation

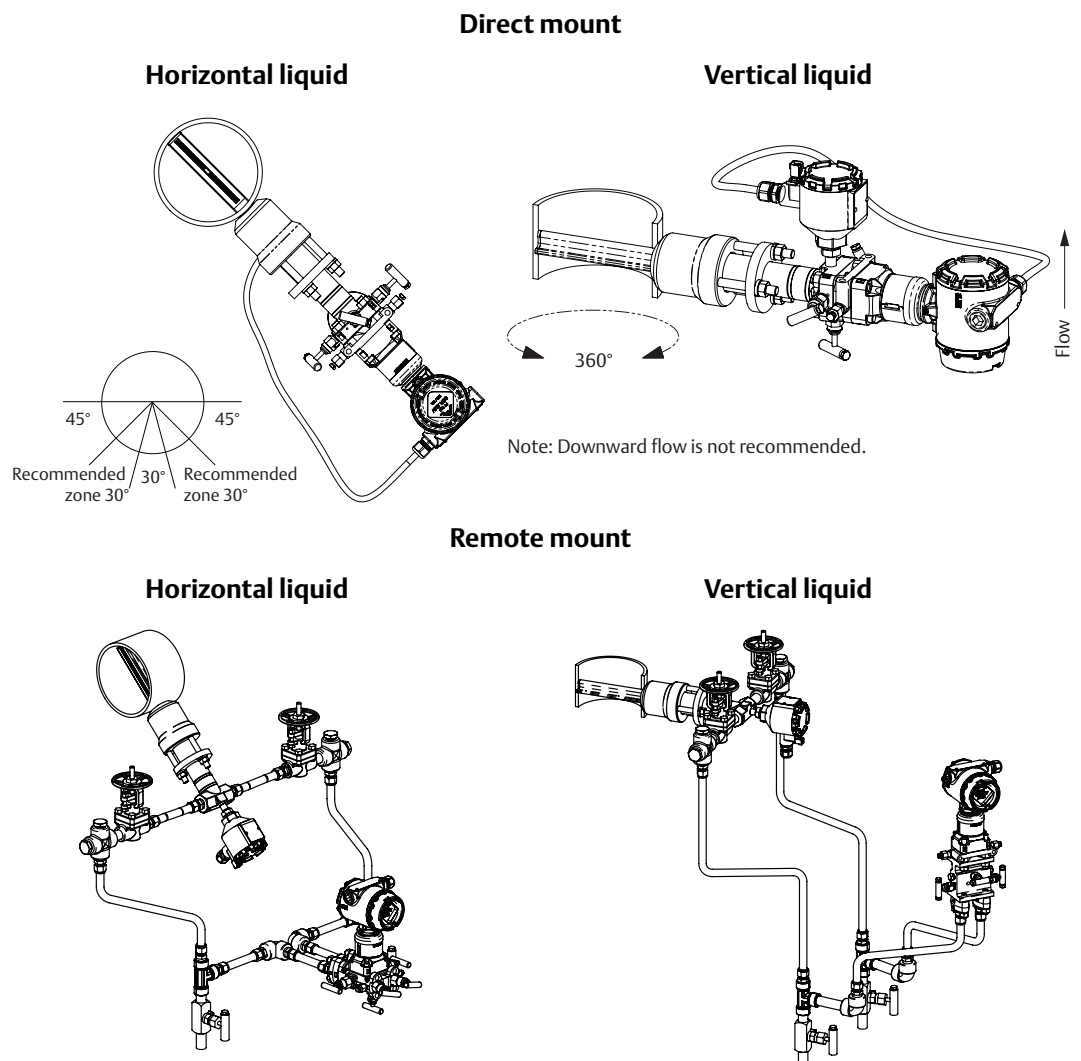
Liquid

Due to the possibility of air getting trapped in the Annubar sensor, it should be located according to [Figure 2-7](#) for liquid applications. It should be mounted between 15° to 45° from vertical down to ensure that air is vented from the Annubar sensor, and that sediment or solid particles are not collected within the Annubar sensor.

For liquid applications, mount the side drain/vent valve upward to allow the gases to vent. In vertical lines, the Annubar sensor can be installed in any position around the circumference of the pipe, provided the vents are positioned properly for bleeding or venting. Vertical pipe installations require more frequent bleeding or venting, depending on the location.

For a remote mounted transmitter, mount the transmitter below the process piping, adjust 10° to 15° above direct vertical down. Route the impulse piping down to the transmitter and fill the system with cool water through the two cross fittings.

Figure 2-7. Liquid Applications



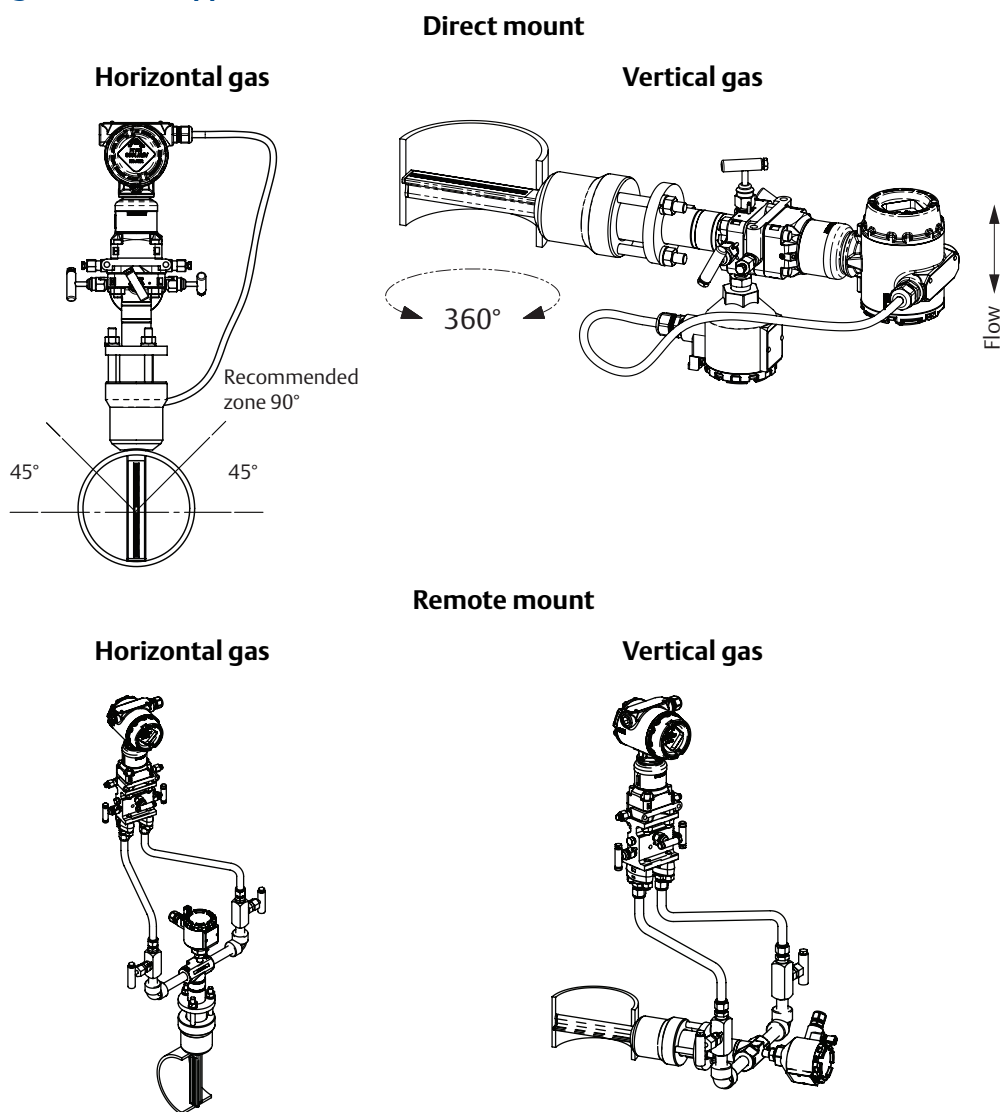
Gas

Figure 2-8 illustrates the recommended location of the flowmeter in gas applications. The sensor should be located on the upper half of the pipe, at least 45° above the horizontal line.

For gas applications, mount the drain/vent valve downward to allow liquid to drain. In vertical lines, the Annubar sensor can be installed in any position around the circumference of the pipe, provided the vents are positioned properly for bleeding or venting. Vertical pipe installations require more frequent bleeding or venting, depending on the location.

For a remote mounted transmitter, secure the transmitter above the Annubar sensor to prevent condensable liquids from collecting in the impulse piping and the DP cell.

Figure 2-8. Gas Applications



Steam

In steam applications, fill the lines with water to prevent the steam from contacting the transmitter. Condensate chambers are not required because the volumetric displacement of the transmitter is negligible.

For a remote mounted transmitter, mount the transmitter below the process piping, adjust to 10° to 15° above direct vertical down. Route the impulse piping down to the transmitter and fill the system with cool water through the two cross fittings.

Top mounting for steam applications is an appropriate mounting option in many cases. Consult Rosemount Customer Central for instructions regarding steam on top mounting.

Figure 2-9 illustrates the recommended location of the flowmeter in steam applications.

Figure 2-9. Steam Applications

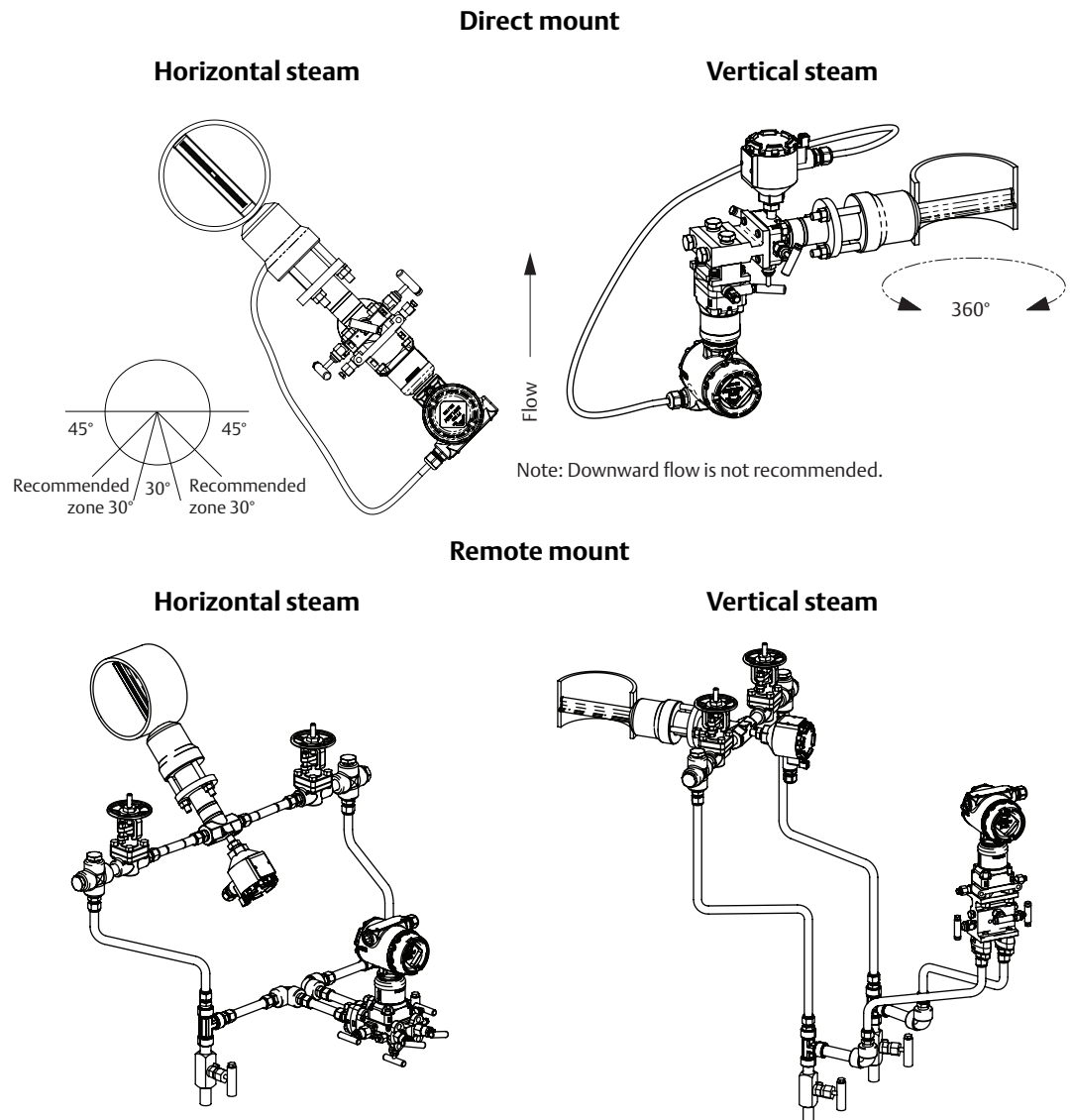
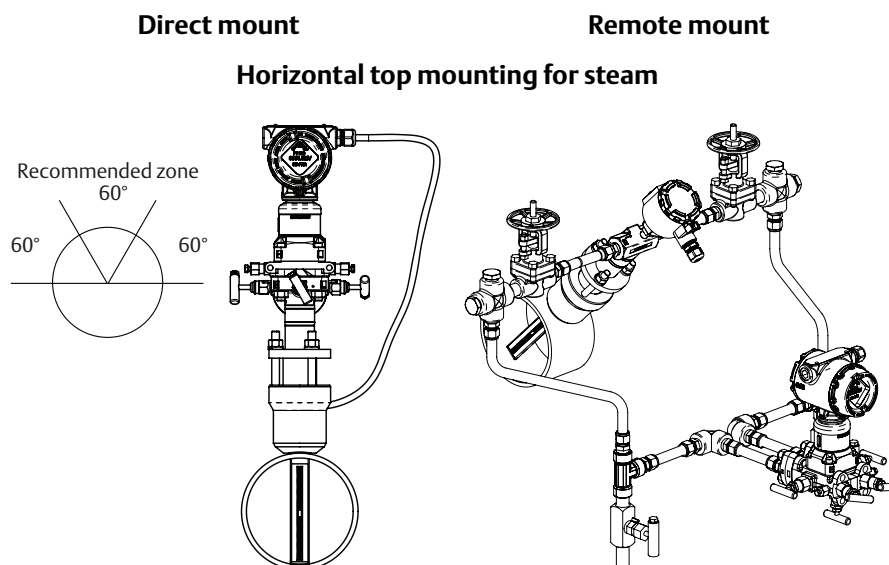


Figure 2-10. Top Mounting for Steam⁽¹⁾



Note

For wet steam, do not mount the flowmeter at the direct vertical position. Mounting at an angle will avoid measurement inaccuracy due to water running along the bottom of the pipe.

2.5.7 Remote mounted transmitter

Instrument head connections differ between horizontal and vertical pipes. For horizontal lines, the instrument connections are parallel to the pipe and for vertical lines, the instrument connection are perpendicular.

Valves and fittings

Throughout the remote mounting process:

- Use only valves, fittings, and pipe thread sealant compounds that are rated for the service pipeline design pressure and temperature as specified in [Appendix A: Specifications and Reference Data](#).
- Verify that all connections are tight and that all instrument valves are fully closed.
- Verify that the Annubar sensor is properly oriented for the intended type of service: liquid, gas, or steam (see “[Flowmeter orientation](#)” on page 14).

Impulse piping

Impulse piping connects a remote mounted transmitter to the Annubar sensor. Temperatures in excess of 250 °F (121 °C) at the transmitter will damage electronic components; impulse piping allows service flow temperatures to decrease to a point where the transmitter is no longer vulnerable.

1. Consult with RCC to determine if this installation is right for your application.

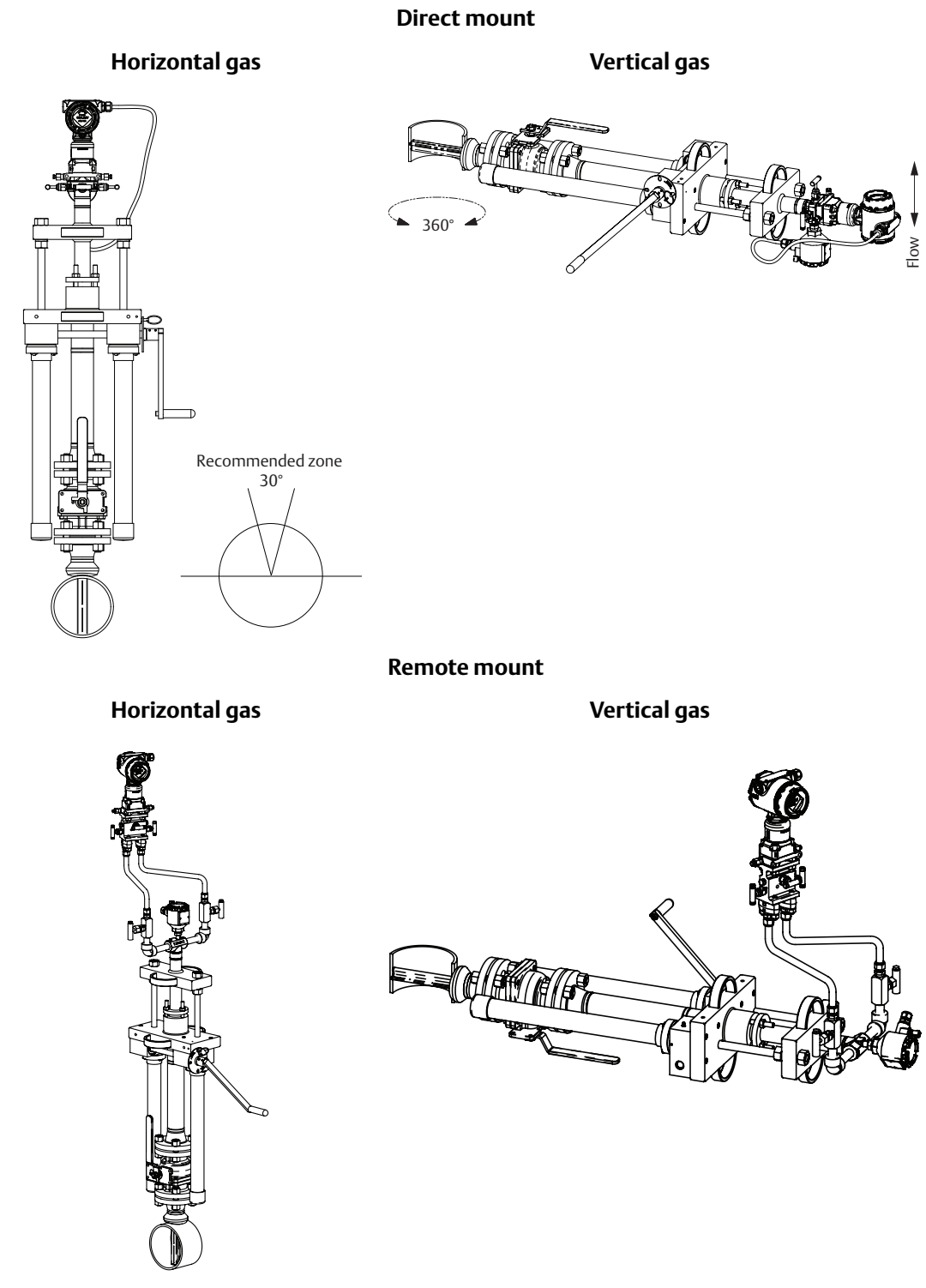
The following restrictions and recommendations apply to impulse piping location.

- Piping used to connect the Annubar sensor and transmitter must be rated for continuous operation at the pipeline-designed pressure and temperature.
- Impulse piping that runs horizontally must slope at least 1-in. per foot (83 mm/m).
- With the Annubar mounted below the pipe, impulse piping must slope downwards (toward the transmitter) for liquid and steam applications.
- With the Annubar sensor mounted above the pipe, impulse piping must slope up (toward from the transmitter) for gas applications.
- For applications where the pipeline temperature is below 250 °F (121 °C), the impulse piping should be as short as possible to minimize flow temperature changes. Insulation may be required.
- For applications where pipeline temperature is above 250 °F (121 °C), the impulse piping should have a minimum length of 1-ft. (0.30 m) for every 100 °F (38 °C) over 250 °F (121 °C), which is the maximum operating transmitter temperature. Impulse piping must be uninsulated to reduce fluid temperature. All threaded connections should be checked after the system comes up to temperature, because connections may be loosened by the expansion and contraction caused by temperature changes.
- A minimum of 1/2-in. (12mm) outer diameter (OD) stainless steel tubing with a wall thickness of at least 0.035-in. is recommended.
- Outdoor installations for liquid, saturated gas, or steam service may require insulation and heat tracing to prevent freezing.
- For installations where the transmitter is more than 6-ft. (1.8m) from the Annubar sensor, the high and low impulse piping must be run together to maintain equal temperature. They must be supported to prevent sagging and vibration.
- Threaded pipe fittings are not recommended because they create voids where air can become entrapped and have more possibilities for leakage.
- Run impulse piping in protected areas or against walls or ceilings. If the impulse piping is run across the floor, ensure that it is protected with coverings or kick plates. Do not locate the impulse piping near high temperature piping or equipment.
- Use an appropriate pipe sealing compound rated for the service temperature on all threaded connections. When making threaded connections between stainless steel fittings, Loctite® PST® Sealant is recommended.

2.5.8 Flo-Tap models

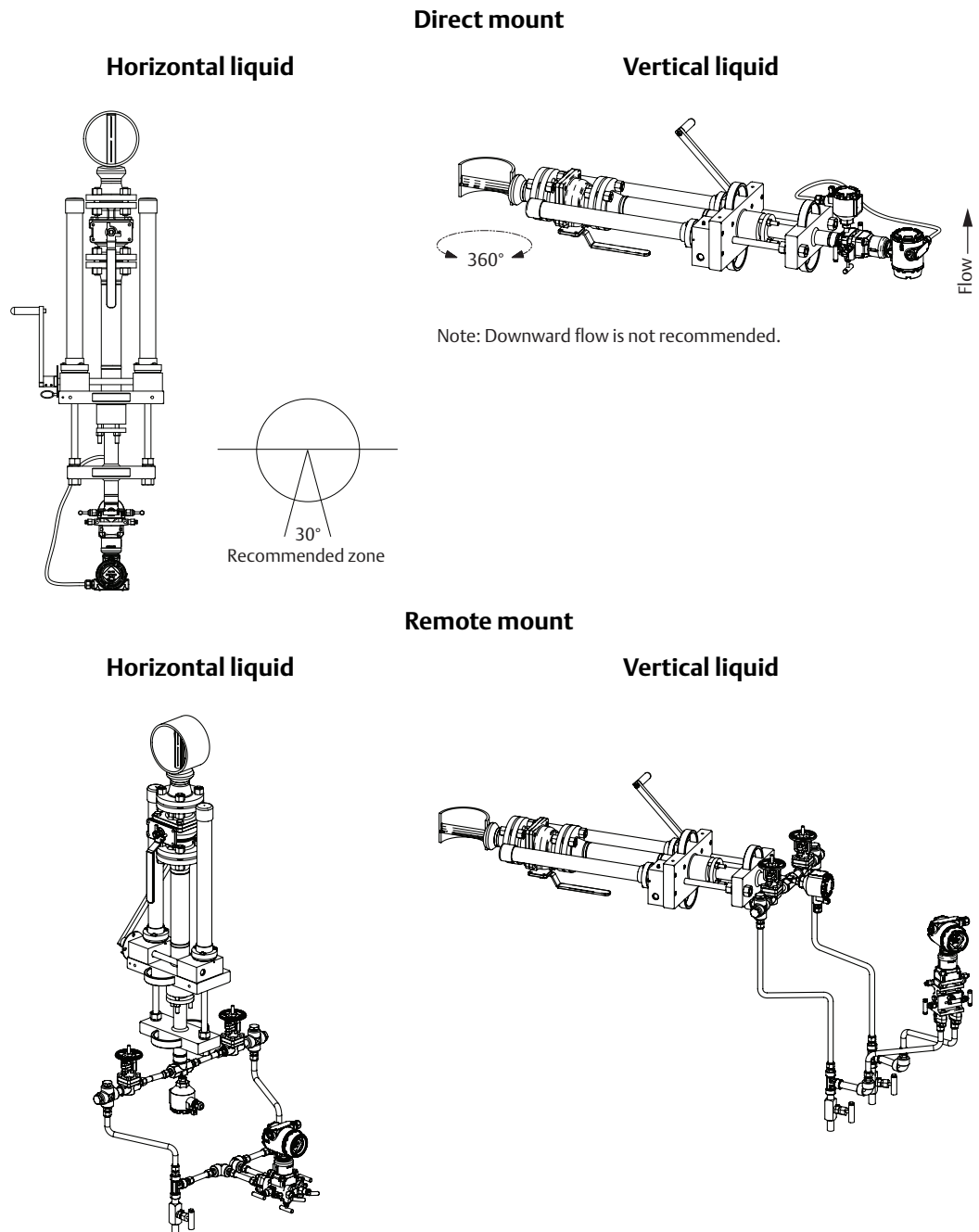
Gas

Figure 2-11. Gas Service



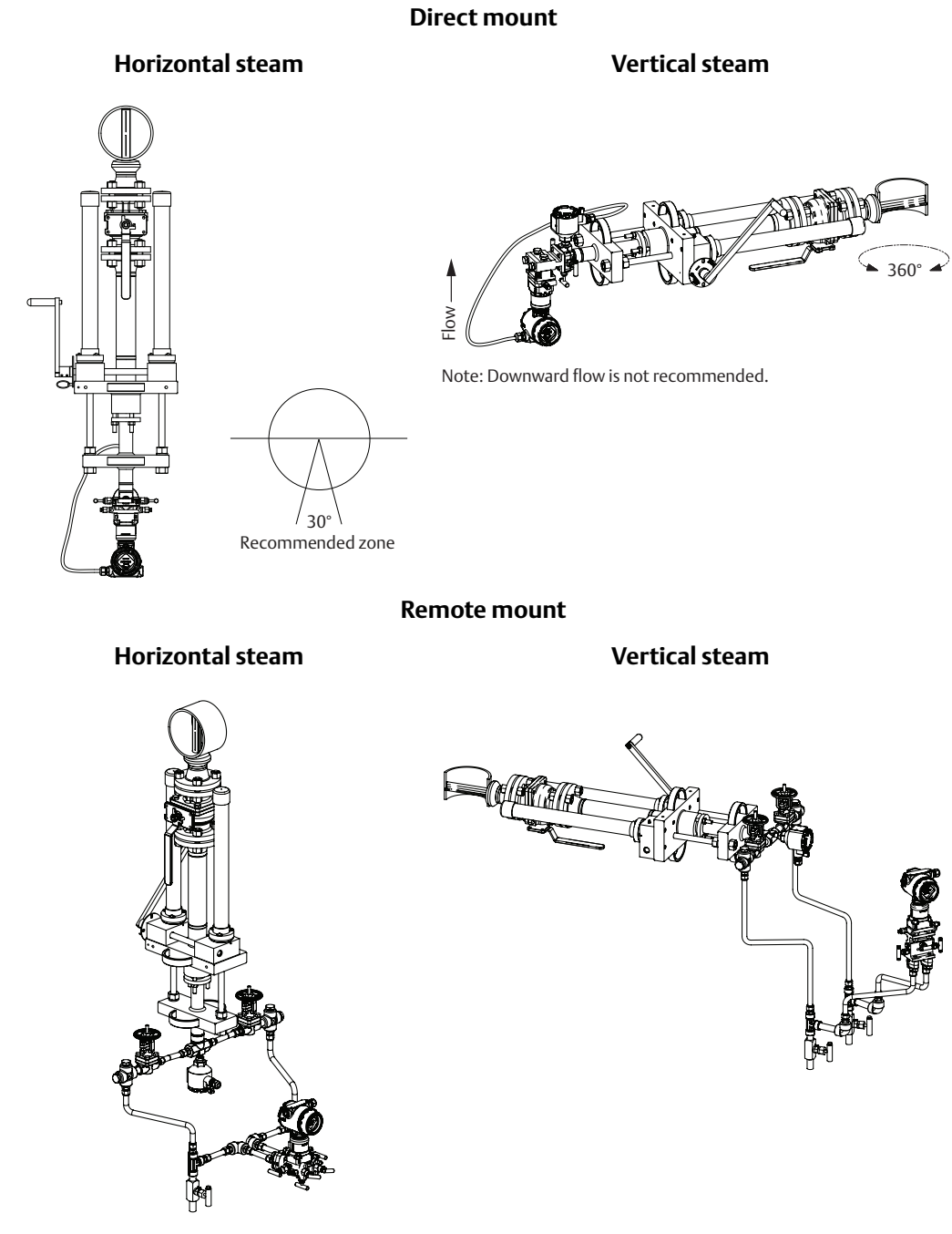
Liquid

Figure 2-12. Liquid Service



Steam

Figure 2-13. Steam



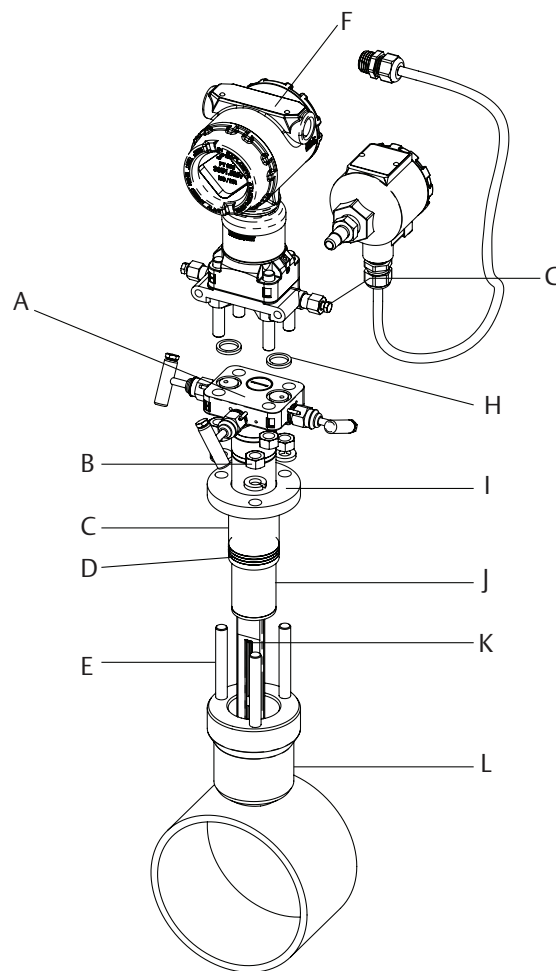
2.6 Installation

This manual contains the horizontal and vertical installation procedures for the Pak-Lok, Flanged, Flange-Lok, Threaded Flo-Tap, Flanged Flo-tap, and Main Steam Annubar sensor models. For installation of the Compact Annubar Flowmeters, see Reference Manual (document number 00809-0100-4810).

2.6.1 Pak-Lok Annubar sensor type (for 485 Annubar Flowmeters)

Figure 2-14 identifies the components of the Pak-Lok assembly.

Figure 2-14. Components



Transmitter and housing are shown for clarity purposes – only supplied if ordered.

A. Direct mount transmitter connection with valves
B. Nuts
C. Follower
D. Packing rings (3)
E. Studs
F. Transmitter

G. Coplanar flange with drain vents
H. O-rings (2)
I. Compression plate
J. Retaining ring
K. 485 Annubar sensor
L. Pak-Lok body

Step 1: Determine the proper orientation

Refer to “Mounting” on page 8 for straight run requirements and orientation information.

Step 2: Drill a hole into the pipe

1. Determine the drill hole size based on the sensor size of sensor width.
2. Determine the sensor size based on the width of the Annubar sensor. See Table 2-3.
3. From the previous steps, select the location to drill the hole.
4. Determine the diameter of the hole to be drilled according to the specifications in Table 2-3 and drill the hole with a hole saw or drill. Do not torch cut the hole.

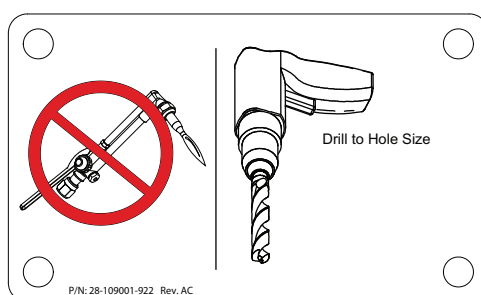
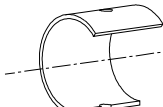


Table 2-3. 485 Sensor Size/Hole Diameter Chart

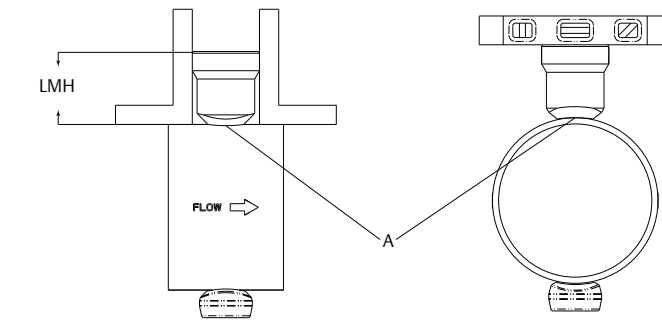
Sensor size	Sensor width	Hole diameter		Note: Drill the hole 180° from the first hole for opposite-side support models.  Drill the appropriate diameter hole through the pipe wall.
1	0.590-in. (14.99 mm)	$\frac{3}{4}$ -in. (19 mm)	+ $\frac{1}{32}$ -in. (0.8 mm)	
			– 0.00	
2	1.060-in. (26.92 mm)	$1\frac{5}{16}$ -in. (34 mm)	+ $\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	
3	1.935-in. (49.15 mm)	$2\frac{1}{2}$ -in. (64 mm)	+ $\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	

5. If opposite-side support coupling is supplied, a second identically sized hole must be drilled opposite the first hole so that the sensor can pass completely through the pipe. (To determine an opposite-side support model, measure the distance from the tip of the first slot or hole. If the distance is greater than 1-in. (25.4 mm), it is the opposite-side model.) To drill the second hole, follow these steps:
 - a. Measure the pipe circumference with a pipe tape, soft wire, or string (for the most accurate measurement the pipe tape needs to be perpendicular to the axis of flow).
 - b. Divide the measured circumference by two to determine the location of the second hole.
 - c. Re-wrap the pipe tape, soft wire, or string from the center of the first hole. Then, using the number calculated in the preceding step, mark the center of what will become the second hole.
 - d. Using the diameter determined from Table 2-3, drill the hole into the pipe with a hole saw or drill. Do not torch cut the hole.
6. Deburr the drilled hole(s) on the inside of the pipe.

Step 3: Weld the mounting hardware

1. Center the Pak-Lok body over the mounting hole, gap $\frac{1}{16}$ -in. (1.5 mm) and place four $\frac{1}{4}$ -in. (6 mm) tack welds at 90° increments.
2. Check alignment of the Pak-Lok body both parallel and perpendicular to the axis of flow. If alignment of mounting is within tolerances (see Figure 2-15), finish weld per local codes. If alignment is outside of specified tolerance, make adjustments prior to finish weld.

Figure 2-15. Alignment



A. Tack welds

3. If opposite side support is being used, center the fitting for the opposite side support over the opposite side hole, gap $\frac{1}{16}$ -in. (1.5 mm) and place four $\frac{1}{4}$ -in. (6 mm) tack welds at 90° increments. Insert the sensor into the mounting hardware. Verify that the tip of the bar is centered in the opposite side fitting and verify that the plug will fit around bar. If the bar is centered in the fitting and plug fits around the bar, finish weld per local codes. If the alignment of the bar does not allow enough clearance to insert the opposite side plug, make the necessary adjustments prior to making the finish weld.
4. To avoid serious burns, allow the mounting hardware to cool before continuing.

Step 4: Insert Annubar sensor

After the mounting hardware has cooled, use the following steps for installation.

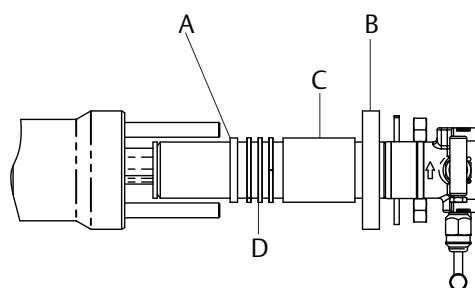
1. Thread studs into the Pak-Lok body.
2. To ensure the flowmeter contacts the opposite side wall, mark the tip of the sensor with a marker. (Do not mark if the sensor was ordered with special-cleaned option code P2 or PA.)
3. Insert the flowmeter into the Pak-lok body until the sensor tip contacts the pipe wall (or support plug). Rotate the flowmeter back and forth.
4. Remove the flowmeter.

Serial No.	Date
Model	
Customer Tag	
Pipe I.D.	Wall
Max. Allow FlowRate	
Max. Insert/Retract Flow	
Max. Press.	@ Temp
Span (20mA)	

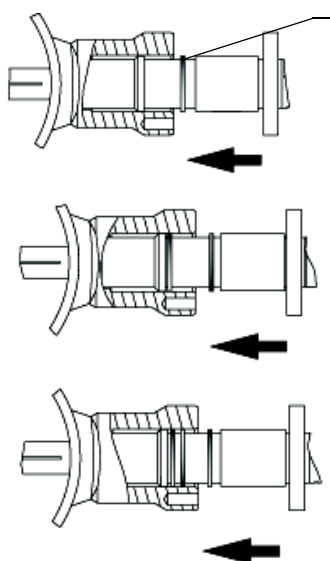
00-370000-2X1 Rev AC

5. Verify the sensor tip made contact with the pipe wall by removing the pipe and ensuring that some of the marker has been rubbed off. For special-cleaned Annubar sensors, look for wear marks on the tip. If the tip did not touch the wall, verify pipe dimensions and the height of mounting body from the outer diameter of the pipe and re-insert.
6. Align the flow arrow with the direction of flow. Re-insert the flowmeter into the Pak-Lok body and install the first packing ring on the sensor between the lock ring and the packing follower. Take care not to damage the split packing rings.
7. Push the packing ring into the Pak-Lok body and against the weld lock ring. Repeat this process for the two remaining rings, alternating the location of the packing ring split by 180°.

Figure 2-16. Packing Ring Detail



- A. Retaining ring
B. Compression plate
C. Follower
D. Packing rings (3)



1. Install the first Packing Ring underneath the Follower.
2. Use the Follower and the Compression Plate to compress the first Packing Ring against the Retaining Ring.
3. Install the second Packing Ring underneath the Follower. Alternate packing ring splits by 120 degrees to each other.
4. Use the Follower and the Compression Plate to compress the second Packing Ring against the first Packing Ring.
5. Install the third Packing Ring underneath the Follower.
6. Use the Follower and the Compression Plate to compress the third Packing Ring against the second Packing Ring.

8. Tighten the nuts onto the studs:
 - Place the included split-ring lock washer between each of the nuts and the compression plate. Give each nut one half ($\frac{1}{2}$) turn in succession until the split-ring lock washer is flat between the nut and the compression plate.

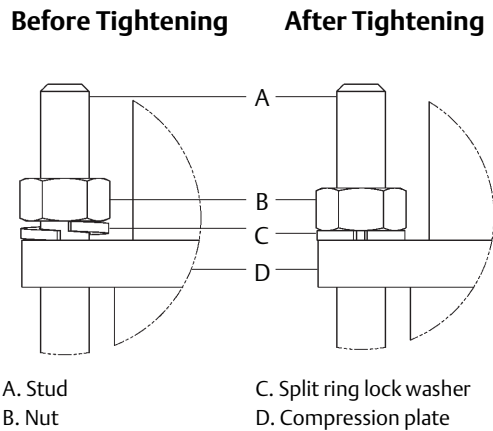
Sensor size	Torque
1	40-in./lb (4.52 Nm)
2	100-in./lb (11.30 Nm)
3	250-in./lb (28.25 Nm)

- Inspect the unit for leakage; if any exists, tighten the nuts in one-quarter ($\frac{1}{4}$) turn increments until there is no leakage.

Note

On sensor size (1), failure to use the split-ring lock washers, improper washer orientation, or over-tightening the nuts may result in damage to the flowmeter.

Figure 2-17. Split-Ring Lock Washer Orientation



Note

Pak-Lok sealing mechanisms generate significant force at the point where the sensor contacts the opposite pipe wall. Caution needs to be exercised on thin-walled piping (ANSI Schedule 10 and below) to avoid damage to the pipe.

Figure 2-18. Complete Installation of Pak-Lok

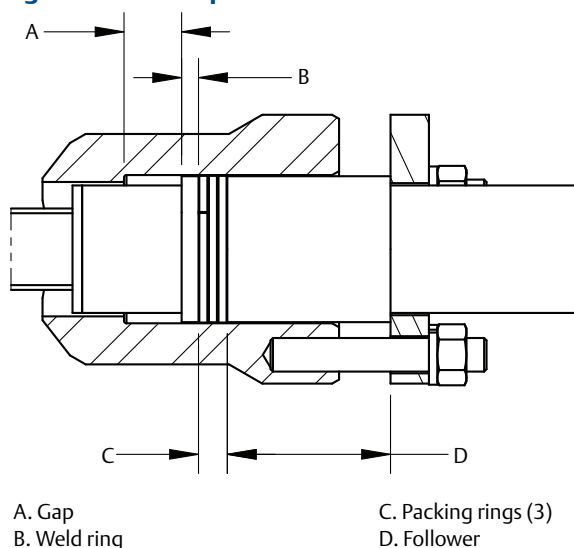


Figure 2-18 shows a view of the Pak-Lok Annubar sensor when installation is completed. Please note that there should be a gap between the Pak-Lok Body and the Weld Ring.

Step 5: Mount the transmitter

Direct mount head

With valves

- Place PTFE O-rings into grooves on the face of head.
- Align the high side of the transmitter to the high side of the probe (“Hi” is stamped on the side of the head) and install.
- Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

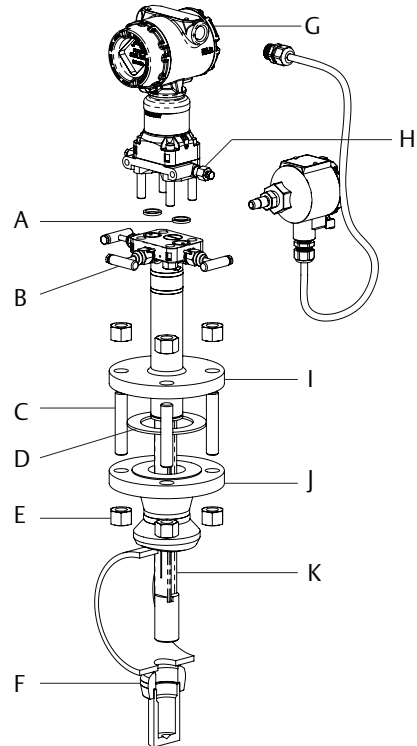
Without valves

- Place PTFE O-rings into grooves on the face of head.
- To install a manifold, orient the equalizer valve or valves so they are easily accessible. Install manifold with the smooth face mating to the face of the head. Tighten in cross pattern to a torque of 400 in-lb. (45 N-m).
- Place PTFE O-rings into grooves on the face of the manifold.
- Align the high side of the transmitter to the high side of the probe (“Hi” is stamped on the side of the head) and install.
- Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

2.6.2 Flanged with opposite side support Annubar sensor type (for 485 and 585 Annubar Flowmeters)

Figure 2-19 identifies the components of the Flanged assembly.

Figure 2-19. Components



Transmitter and housing are shown for clarity purposes – only supplied if ordered.

- | | |
|--|-------------------------------------|
| A. O-rings (2) | G. Transmitter |
| B. Direct mount transmitter connection with valves | H. Coplanar flange with drain vents |
| C. Studs | I. Sensor flange |
| D. Gasket | J. Mounting flange assembly |
| E. Nuts | K. 485 Annubar sensor |
| F. Opposites side support | |

Step 1: Determine the proper orientation

Refer to “Mounting” on page 8 for straight run requirements and orientation information.

Step 2: Drill a hole into the pipe

1. Determine the drill hole size based on the Sensor Size of Sensor Width.
2. Depressurize and drain the pipe.
3. From the previous steps, select the location to drill the hole.
4. Determine the diameter of the hole to be drilled according to the specifications in Table 2-4 and drill the hole with a hole saw or a drill. Do not torch cut the hole.

Table 2-4. 485 Sensor Size/Hole Diameter Chart

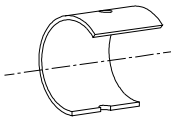
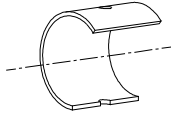
Sensor size	Sensor width	Hole diameter		Note: Drill the hole 180° from the first hole for opposite-side support models.  Drill the appropriate diameter hole through the pipe wall.
1	0.590-in. (14.99 mm)	$\frac{3}{4}$ -in. (19 mm)	+ $\frac{1}{32}$ -in. (0.8 mm)	
			– 0.00	
2	1.060-in. (26.92 mm)	$1\frac{5}{16}$ -in. (34 mm)	+ $\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	
3	1.935-in. (49.15 mm)	$2\frac{1}{2}$ -in. (64 mm)	+ $\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	

Table 2-5. 585 Sensor Size/Hole Diameter Chart

Sensor size	Sensor width	Hole diameter		Note: Drill the hole 180° from the first hole for opposite-side support models.  Drill the appropriate diameter hole through the pipe wall.
11	0.80-in. (20.32 mm)	$\frac{7}{8}$ -in. (23 mm)	+ $\frac{1}{32}$ -in. (0.8 mm)	
			– 0.00	
22	1.20-in. (30.48 mm)	$1\frac{5}{16}$ -in. (34 mm)	+ $\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	
44	2.30-in.	$2\frac{1}{2}$ -in. (64 mm)	+ $\frac{1}{16}$ -in. (1.6 mm)	
	(58.42 mm)		– 0.00	

5. If opposite-side support coupling is supplied, a second identically sized hole must be drilled opposite the first hole so that the sensor can pass completely through the pipe. To drill the second hole, follow these steps:
 - a. Measure the pipe circumference with a pipe tape, soft wire, or string (for the most accurate measurement the pipe tape needs to be perpendicular to the axis of flow).
 - b. Divide the measured circumference by two to determine the location of the second hole.
 - c. Re-wrap the pipe tape, soft wire, or string from the center of the first hole. Then, using the number calculated in the preceding step, mark the center of what will become the second hole.
 - d. Using the diameter determined from Table 2-4, drill the hole into the pipe with a hole saw or drill. Do not torch cut the hole.
6. Deburr the drilled holes on the inside of the pipe.

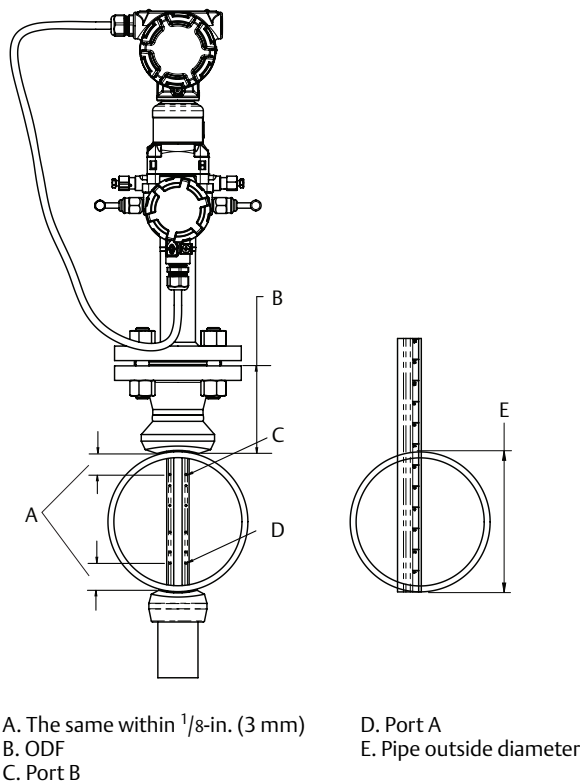
Step 3: Assemble and check fit-up

For accurate measurement, use the following steps to ensure that Ports A and B are equal distances from the inside walls of the pipe.

1. Assemble the Annubar sensor to the mounting hardware with the gaskets and bolts.
2. Hand tighten the bolts just enough to hold the position of the sensor centered in the mounting hardware.
3. Measure the distance from the high point of the weldolet to the first sensing hole, port B, then subtract $\frac{1}{16}$ -in. (1.6 mm).
4. Measure the distance from the end of the transferred length in [Step 3](#) to the last sensing hole, port A.
5. Compare the numbers obtained in [Step 3](#) and 4.

Small discrepancies can be compensated for with the fit-up of the mounting hardware. Large discrepancies may cause installation problems or error.

Figure 2-20. Fit-Up Check for Annubar Sensor with Opposite Side Support



Step 4: Weld the mounting hardware

- Center the Flanged body over the mounting hole, gap $\frac{1}{16}$ -in. (1.5 mm) and measure the distance from the outside diameter of the pipe to the face of the flange. Compare this to the table below and adjust the gap as necessary.

Table 2-6. 485 and 585 Flange Sizes and ODF per Sensor Size

485 Sensor size	585 Sensor size	Flange type	Pressure class	Flange size/ rating/type	ODF in. (mm) ⁽¹⁾
1	11	A	1	1½-in. 150# RF	3.88 (98.6)
			3	1½-in. 300# RF	4.13 (104.9)
			6	1½-in. 600# RF	4.44 (112.8)
			N/9	1½-in. 900# RF	4.94 (125.5)
			F	1½-in. 1500# RF	4.94 (125.5)
			T	1½-in. 2500# RF	6.76 (171.7)
		R	1	1½-in. 150# RTJ	4.06 (103.1)
			3	1½-in. 300# RTJ	4.31 (109.5)
			6	1½-in. 600# RTJ	4.44 (112.8)
			N/9	1½-in. 900# RTJ	4.94 (125.5)
			F	1½-in. 1500# RTJ	4.94 (125.5)
			T	1½-in. 2500# RTJ	6.81 (173.0)
		D	1	DN40 PN16 RF	3.21 (81.5)
			3	DN40 PN40 RF	3.21 (81.5)
			6	DN40 PN100 RF	3.88 (98.6)
2	22	A	1	2.0-in. 150# RF	4.13 (104.9)
			3	2.0-in. 300# RF	4.38 (111.3)
			6	2.0-in. 600# RF	4.75 (120.7)
			N/9	2.0-in. 900# RF	5.88 (149.4)
			F	2.0-in. 1500# RF	5.88 (149.4)
			T	3.0-in. 2500# RF	9.88 (251.0)
		R	1	2.0-in. 150# RTJ	4.31 (119.5)
			3	2.0-in. 300# RTJ	4.63 (117.6)
			6	2.0-in. 600# RTJ	4.81 (122.2)
			N	2.0-in. 900# RTJ	5.94 (150.9)
			F	2.0-in. 1500# RTJ	5.94 (150.9)
			T	3.0-in. 2500# RTJ	10.00 (254.0)
		D	1	DN50 PN16 RF	3.40 (86.4)
			3	DN50 PN40 RF	3.52 (89.4)
			6	DN50 PN100 RF	4.30 (109.5)

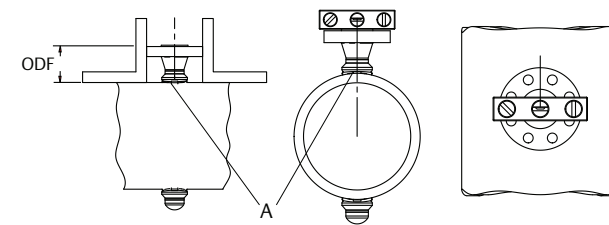
Table 2-6. 485 and 585 Flange Sizes and ODF per Sensor Size

485 Sensor size	585 Sensor size	Flange type	Pressure class	Flange size/rating/type	ODF in. (mm) ⁽¹⁾
3	44	A	1	3.0-in. 150# RF	4.63 (117.6)
			3	3.0-in. 300# RF	5.00 (127.0)
			6	3.0-in. 600# RF	5.38 (136.7)
			N/9	4.0-in. 900# RF	8.19 (208.0)
			F	4.0-in. 1500# RF	8.56 (217.4)
			T	4.0-in. 2500# RF	11.19 (284.2)
		R	1	3.0-in. 150# RTJ	4.81 (122.2)
			3	3.0-in. 300# RTJ	5.25 (133.4)
			6	3.0-in. 600# RTJ	5.44 (138.2)
			N/9	4.0-in. 900# RTJ	8.25 (209.6)
			F	4.0-in. 1500# RTJ	8.63 (219.2)
			T	4.0-in. 2500# RTJ	11.38 (289.1)
		D	1	DN80 PN16 RF	3.85 (97.8)
			3	DN80 PN40 RF	4.16 (105.7)
			6	DN80 PN100 RF	4.95 (125.7)

1. Tolerances for the ODF dimension above a 10-in. (254 mm) line size is ± 0.060 -in. (1,6 mm). Below 10-in. (254 mm) line size is ± 0.030 -in. (0,8 mm).

- Place four 1/4-in. (6-mm) tack welds at 90° increments. Check alignment of the mounting both parallel and perpendicular to the axis of flow (see [Figure 2-21](#)). If alignment of the mounting is within tolerances, finish weld per local codes. If alignment is outside of specified tolerance, make adjustments prior to making the finish weld.

Figure 2-21. Alignment



A. Tack welds

- Center the fitting for the opposite side support over the opposite side hole, gap 1/16-in. (1.5 mm) and place four 1/4-in. (0.5 mm) tack welds at 90° increments. Insert the sensor into the mounting hardware. Verify that the tip of the bar is centered in the opposite side fitting and that the plug will fit around bar. If the sensor is centered in the fitting and plug fits around the sensor, finish weld per local codes. If alignment of the sensor does not allow enough clearance to insert the opposite side plug, make the necessary adjustments prior to making the finish weld.
- To avoid serious burns, allow the mounting hardware to cool before continuing.

Step 5: Insert the Annubar sensor

1. If opposite side support is threaded, apply an appropriate thread sealing compound to the support plug threads and tighten until no leakage occurs.
2. Align the flow arrow on the head with the direction of flow. Assemble the Annubar sensor to the mounting flange using a gasket, bolts, and nuts.
3. If opposite side support is a socket weld fitting, insert the plug into the socket fitting until the parts contact. Retract the plug $\frac{1}{16}$ -in. (1.5 mm), remove the Annubar sensor and apply fillet weld per local codes.
4. Tighten the nuts in a cross pattern to allow even compression of the gasket.

Step 6: Mount the transmitter

Direct mount head

With valves

1. Place PTFE O-rings into grooves on the face of head.
2. Align the high side of the transmitter to the high side of the probe ("Hi" is stamped on the side of the head) and install.
3. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

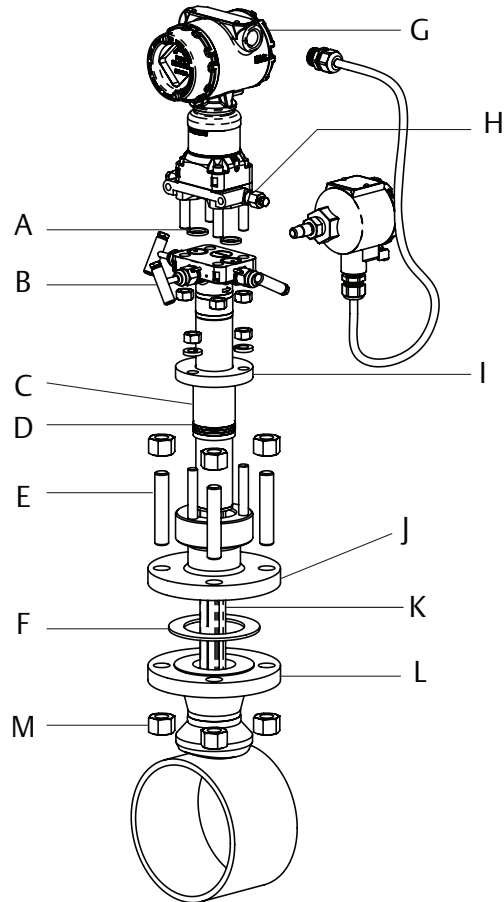
Without valves

1. Place PTFE O-rings into grooves on the face of head.
2. To install a manifold, orient the equalizer valve or valves so they are easily accessible. Install manifold with the smooth face mating to the face of the head. Tighten in cross pattern to a torque of 400 in-lb. (45 N-m).
3. Place PTFE O-rings into grooves on the face of the manifold.
4. Align the high side of the transmitter to the high side of the probe ("Hi" is stamped on the side of the head) and install.
5. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

2.6.3 Flange-Lok model (for 485 Annubar Flowmeters)

Figure 2-22 identifies the components of the Flange-Lok assembly.

Figure 2-22. Components



Transmitter and housing are shown for clarity purposes – only supplied if ordered.

- | | |
|--|-------------------------------------|
| A. O-Rings (2) | H. Coplanar flange with drain vents |
| B. Direct mount transmitter connection with valves | I. Compression plate |
| C. Follower | J. Flange-Lok assembly |
| D. Packing rings (3) | K. 485 Annubar sensor |
| E. Studs | L. Mounting flange assembly |
| F. Gasket | M. Nuts |
| G. Transmitter | |

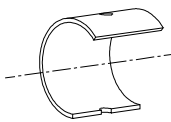
Step 1: Determine the proper orientation

Refer to “Mounting” on page 8 for straight run requirements and orientation information.

Step 2: Drill a hole into the pipe

1. Determine the drill hole size based on the Sensor Size of Sensor Width.
2. De-pressurize and drain the pipe.
3. Select the location to drill the hole.
4. Determine the diameter of the hole to be drilled according to the specifications in Table 2-7 and drill the hole with a hole saw or a drill. Do not torch cut the hole.

Table 2-7. Drill Hole into Pipe

Sensor size	Sensor width	Hole diameter		Note: Drill the hole 180° from the first hole for opposite-side support models. 
1	0.590-in. (14.99 mm)	$\frac{3}{4}$ -in. (19 mm)	$+\frac{1}{32}$ -in. (0.8 mm)	
			– 0.00	
2	1.060-in. (26.92 mm)	$1\frac{5}{16}$ -in. (34 mm)	$+\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	
3	1.935-in. (49.15 mm)	$2\frac{1}{2}$ -in. (64 mm)	$+\frac{1}{16}$ -in. (1.6 mm)	
			– 0.00	

5. If opposite-side support coupling is supplied, a second identically sized hole must be drilled opposite the first hole so that the sensor can pass completely through the pipe. (To determine an opposite-side support model, measure the distance from the tip of the first slot or hole. If the distance is greater than 1-in. (25.4 mm), it is the opposite-side model.) To drill the second hole, follow these steps:
 - a. Measure the pipe circumference with a pipe tape, soft wire, or string (for the most accurate measurement the pipe tape needs to be perpendicular to the axis of flow).
 - b. Divide the measured circumference by two to determine the location of the second hole.
 - c. Re-wrap the pipe tape, soft wire, or string from the center of the first hole. Then, using the number calculated in the preceding step, mark the center of what will become the second hole.
 - d. Using the diameter determined from Table 2-7, drill the hole into the pipe with a hole saw or drill. Do not torch cut the hole.
6. Deburr the drilled hole or holes on the inside of the pipe.

Step 3: Weld the mounting hardware

- Center the Flange-Lok body over the mounting hole, gap $\frac{1}{16}$ -in. (2 mm) and measure the distance from the OD of the pipe to the face of the flange. Compare this to the table below and adjust the gap as necessary.

Table 2-8. 485 and 585 Flange Sizes and ODF Per Sensor Size

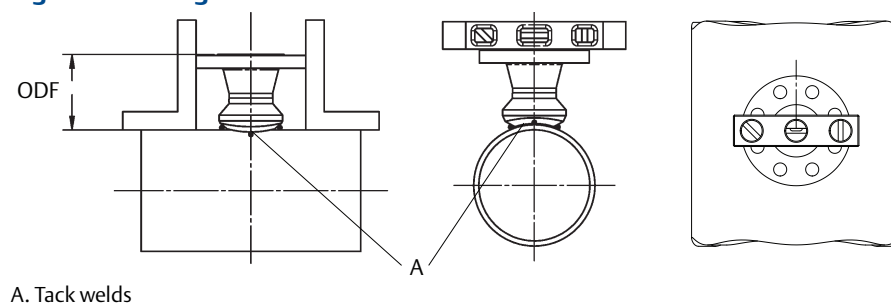
485 Sensor size	Flange type	Pressure class	Flange size/ rating/type	ODF in. (mm) ⁽¹⁾
1	A	1	1½-in. 150# RF	3.88 (98.6)
		3	1½-in. 300# RF	4.13 (104.9)
		6	1½-in. 600# RF	4.44 (112.8)
		N	1½-in. 900# RF	4.94 (125.5)
		F	1½-in. 1500# RF	4.94 (125.5)
		T	1½-in. 2500# RF	6.76 (171.7)
	R	1	1½-in. 150# RTJ	4.06 (103.1)
		3	1½-in. 300# RTJ	4.31 (109.5)
		6	1½-in. 600# RTJ	4.44 (112.8)
		N	1½-in. 900# RTJ	4.94 (125.5)
		F	1½-in. 1500# RTJ	4.94 (125.5)
		T	1½-in. 2500# RTJ	6.81 (173.0)
	D	1	DN40 PN16 RF	3.21 (81.5)
		3	DN40 PN40 RF	3.21 (81.5)
		6	DN40 PN100 RF	3.88 (98.6)
2	A	1	2.0-in. 150# RF	4.13 (104.9)
		3	2.0-in. 300# RF	4.38 (111.3)
		6	2.0-in. 600# RF	4.75 (120.7)
		N	2.0-in. 900# RF	5.88 (149.4)
		F	2.0-in. 1500# RF	5.88 (149.4)
		T	3.0-in. 2500# RF	9.88 (251.0)
	R	1	2.0-in. 150# RTJ	4.31 (119.5)
		3	2.0-in. 300# RTJ	4.63 (117.6)
		6	2.0-in. 600# RTJ	4.81 (122.2)
		N	2.0-in. 900# RTJ	5.94 (150.9)
		F	2.0-in. 1500# RTJ	5.94 (150.9)
		T	3.0-in. 2500# RTJ	10.00 (254.0)
	D	1	DN50 PN16 RF	4.63 (117.6)
		3	DN50 PN40 RF	5.00 (127.0)
		6	DN50 PN100 RF	5.38 (136.7)

Table 2-8. 485 and 585 Flange Sizes and ODF Per Sensor Size

485 Sensor size	Flange type	Pressure class	Flange size/ rating/type	ODF in. (mm) ⁽¹⁾
3	A	1	3.0-in. 150# RF	4.63 (117.5)
		3	3.0-in. 300# RF	5.00 (126.9)
		6	3.0-in. 600# RF	5.38 (136.6)
	R	1	3.0-in. 150# RTJ	4.81 (122.2)
		3	3.0-in. 300# RTJ	5.25 (133.4)
		6	3.0-in. 600# RTJ	5.44 (138.2)
	D	1	DN80 PN16 RF	3.85 (97.8)
		3	DN80 PN40 RF	4.16 (105.7)
		6	DN80 PN100 RF	4.95 (125.7)

1. Tolerances for the ODF dimension above a 10-in. (254 mm) line size is ± 0.060 -in. (1,6 mm). Below 10-in. (254 mm) line size is ± 0.030 -in. (0,8 mm).
2. Place four 1/4-in. (6-mm) tack welds at 90° increments. Check alignment of the mounting both parallel and perpendicular to the axis of flow (see [Figure 2-23](#)). If alignment of the mounting is within tolerances, finish weld per local codes. If outside of specified tolerance, make adjustments prior to making the finish weld.

Figure 2-23. Alignment

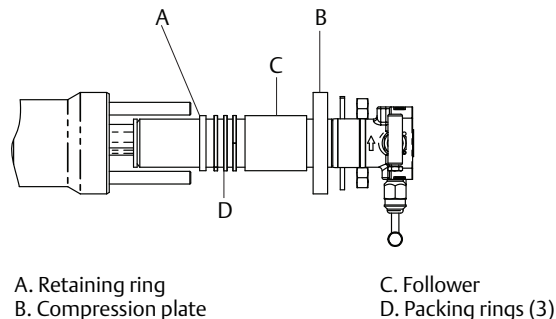


3. If opposite side support is being used, center the fitting for the opposite side support over the opposite side hole, gap 1/16-in. (1.5 mm) and place four 1/4-in. (6-mm) tack welds at 90° increments. Insert the sensor into the mounting hardware. Verify that the tip of the bar is centered in the opposite side fitting and that the plug will fit around the bar. If the sensor is centered in the fitting and plug fits around the sensor, finish weld per local codes. If alignment of the sensor does not allow enough clearance to insert the opposite side plug, make the necessary adjustments prior to making the finish weld. The Annubar sensor must be removed before welding or installing the opposite side support plug.
4. To avoid serious burns, allow the mounting hardware to cool before continuing.

Step 4: Insert into pipe

1. After the mounting hardware has cooled, use the following steps for installation.
2. Assemble the sensor flange to the mounting flange using gasket, studs, and nuts.
3. Tighten the nuts in a cross pattern to allow even compression of the gasket.
4. Thread studs into Flange-Lok body.
5. To ensure the flowmeter contacts the opposite side wall, mark the tip of the sensor with a marker. (Do not mark if the sensor was ordered with special-cleaned option code P2 or PA.)
6. Insert the flowmeter into the Flange-lok body until the sensor tip contacts the pipe wall (or support plug), rotating back and forth.
7. Remove the flowmeter.
8. Verify the sensor tip made contact with the pipe wall by ensuring that some of the marker has been rubbed off. For special-cleaned bars, look for wear marks on the tip. If the tip did not touch the wall, verify pipe dimensions and the height of the mounting body from the OD of the pipe and re-insert.
9. Re-insert the flowmeter into the Flange-Lok body and install the first packing ring on the sensor between the lock ring and the packing follower. Take care not to damage the split packing rings.
10. Push the packing ring into the Flange-Lok body and against the weld retaining ring. Repeat this process for the two remaining rings, alternating the location of the packing ring split by 180°.

Figure 2-24. Packing Ring Detail



11. Tighten the nuts onto the studs:
 - a. Place the included split-ring lock washer between each of the nuts and the compression plate. Give each nut one half ($1/2$) turn in succession until the split-ring lock washer is flat between the nut and the compression plate. Torque is as follows:

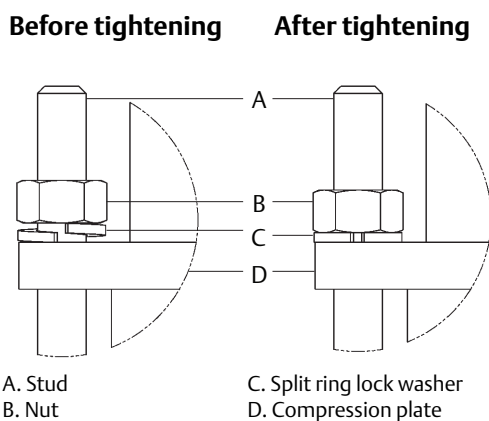
Sensor size	Torque
1	40 in/lb (4.52 Nm)
2	100 in/lb (11.30 Nm)
3	250 in/lb (28.25 Nm)

- b. Inspect the unit for leakage; if any exists, tighten the nuts in one-quarter ($1/4$) turn increments until there is no leakage.

Note

On sensor size (1), failure to use the split-ring Lock washers, improper washer orientation, or over-tightening the nuts may result in damage to the flowmeter.

Figure 2-25. Split-Ring Lock Washer Orientation



Note

Flange-Lok sealing mechanisms generate significant force at the point where the sensor contacts the opposite pipe wall. Caution needs to be exercised on thin-walled piping (ANSI Schedule 10 and below) to avoid damage to the pipe.

Figure 2-26. Complete Installation of Flange-Lok

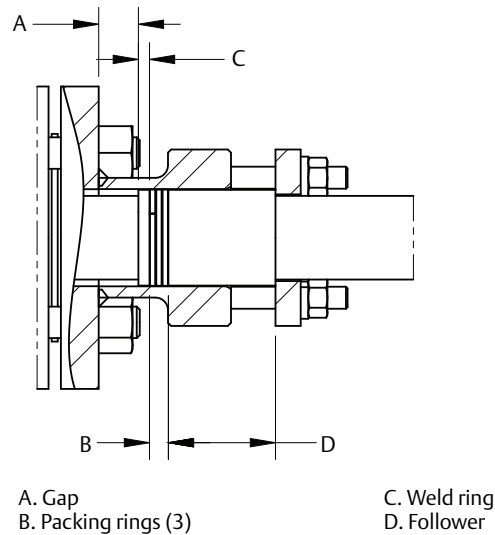


Figure 2-26 shows a view of the Flange-Lok Annubar sensor when installation is completed. Please note that there should be a gap between the Flange-Lok Body and the Weld Ring.

Step 5: Mount the transmitter

Direct mount head

With valves

1. Place PTFE O-rings into grooves on the face of head.
2. Align the high side of the transmitter to the high side of the Annubar sensor ("Hi" is stamped on the side of the head) and install.
3. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

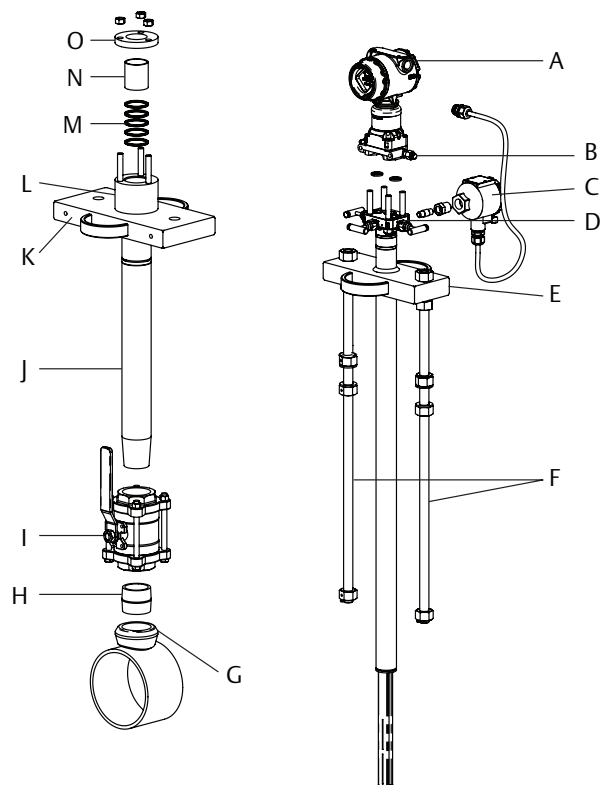
Without valves

1. Place PTFE O-rings into grooves on the face of head.
2. To install a manifold, orient the equalizer valve or valves so they are easily accessible. Install manifold with the smooth face mating to the face of the head. Tighten in cross pattern to a torque of 400 in-lb. (45 N-m).
3. Place PTFE O-rings into grooves on the face of the manifold.
4. Align the high side of the transmitter to the high side of the Annubar sensor ("Hi" is stamped on the side of the head) and install.
5. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

2.6.4 Threaded Flo-tap (for 485 Annubar Flowmeter)

Figure 2-27 identifies the components of the Threaded Flo-Tap assembly.

Figure 2-27. Components



Transmitter and housing are shown for clarity purposes – only supplied if ordered.

- | | |
|--|----------------------|
| A. Transmitter | I. Isolation valve |
| B. Coplanar flange with drain vents | J. Cage nipple |
| C. Temperature sensor connection housing | K. Support plate |
| D. Direct mount transmitter connection with valves | L. Packing gland |
| E. Head plate | M. Packing |
| F. Drive rods | N. Follower |
| G. Threaded pipe fitting | O. Compression plate |
| H. Guide nipple | P. O-rings (2) |

Step 1: Determine the proper orientation

Refer to “[Mounting](#)” on [page 8](#) for straight run requirements and orientation information.

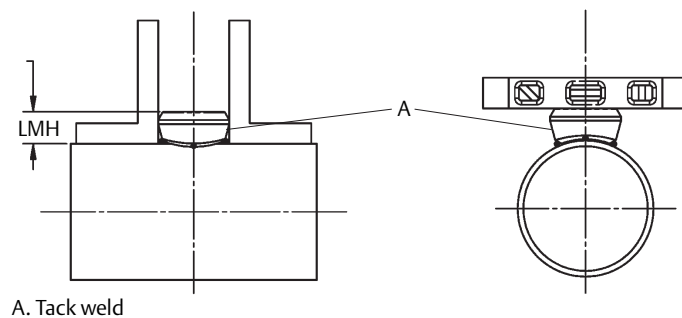
Step 2: Weld the mounting hardware

Note

Rosemount-supplied mounting includes critical alignment hardware that assists in the correct drilling of the mounting hole. This significantly reduces problems encountered during insertion.

1. At the pre-determined position, place the threadolet on the pipe, gap $\frac{1}{16}$ in. (16 mm) and place four $\frac{1}{4}$ -in. (6-mm) tack welds at 90° increments.
2. Check alignment of the mounting both parallel and perpendicular to the axis of flow. If the mounting alignment is within tolerances, finish weld per local codes. If outside of tolerances, make adjustments prior to making the finish weld.
3. To avoid serious burns, allow mounting hardware to cool before continuing.

Figure 2-28. Alignment



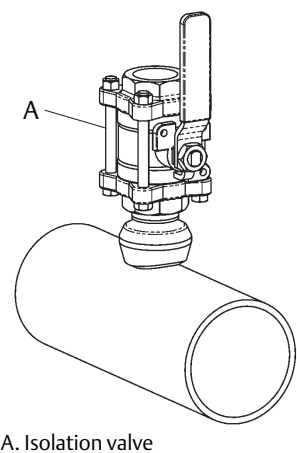
Step 3: Install the isolation valve

1. Thread the guide nipple into the mounting.
2. Thread the isolation valve into the guide nipple, ensuring that the valve stem is positioned so that when the Flo-Tap is installed, the insertion rods will straddle the pipe and the valve handle will be centered between the rods (see Figure 2-29).

Note

Interference will occur if the valve is located inline with the insertion rods.

Figure 2-29. Install the Isolation Valve



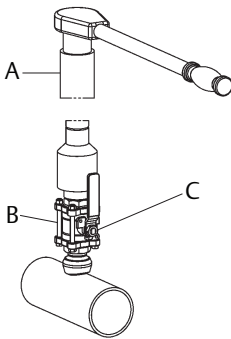
A. Isolation valve

Step 4: Mount the drilling machine and drill hole

Drilling machine is not provided with the assembly.

- 1. Determine the drill hole size based on the sensor size or sensor width.
- 2. Mount the drilling machine to the isolation valve.
- 3. Open the valve fully.
- 4. Drill the hole into the pipe wall in accordance with the instructions provided by the drilling machine manufacturer.
- 5. Fully retract the drill beyond the valve.

Table 2-9. Sensor Size/Hole Diameter Chart

Sensor size	Sensor width	Hole diameter		
1	0.590-in. (14.99 mm)	$\frac{3}{4}$ -in. (19 mm)	$+\frac{1}{32}$ -in. (0.8 mm)	
			- 0.00	
2	1.060-in. (26.92 mm)	$1\frac{5}{16}$ -in. (34 mm)	$+\frac{1}{16}$ -in. (1.6 mm)	
			- 0.00	
3	1.935-in. (49.15 mm)	$2\frac{1}{2}$ -in. (64 mm)	$+\frac{1}{16}$ -in. (1.6 mm)	
			- 0.00	

A. Pressure drilling machine
B. Isolation valve is fully open when inserting drill
C. Isolation Valve is fully closed after withdrawing drill

Step 5: Remove the drilling machine

Follow these steps to remove the drilling machine:

1. Verify the drill has been fully retracted past the valve.
2. Close the isolation valve to isolate the process.
3. Bleed drilling machine pressure and remove.
4. Check isolation valve and mounting for leakage.

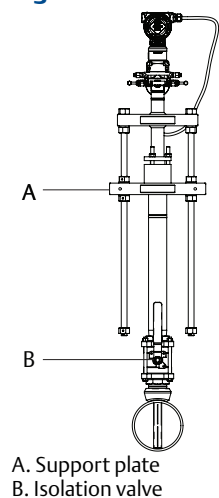
Step 6: Mount the Annubar sensor

1. Install the complete Flo-Tap assembly (fully retracted) onto the isolation valve by threading the close nipple into the valve using the proper thread sealant compound.
2. Rotate the Flo-Tap assembly until the flow arrow on the head aligns with the direction of flow in the pipe.
3. Ensure the vent valves are closed before proceeding to the next step.
4.  Quickly open and close the isolation valve to pressurize the Annubar sensor. Use extreme caution if the flowing medium is steam or caustic.
5. Check the entire installation for leakage. Tighten as required to stop any connection from leaking. Repeat steps 4 and 5 until there is no leakage.
 - a. If the Flo-tap comes equipped with the gear drive option, place the PVC protector rod assembly over the drive rods and attach to the gear drive with the supplied hardware.

Note

Flo-Tap Annubar sensors have the potential to carry a large amount of weight at a great distance from the piping, necessitating external support. The support plate has threaded holes to assist in supporting the Annubar sensor. Threaded holes ($\frac{3}{8}$ in.-16 UNC) are provided on the support plate for external support.

Figure 2-30. Flo-Tap Installation



Step 7: Insert the Annubar sensor

Insert the sensor with one of the two drive options available – manual drive (M) or gear drive (G).

Manual (not recommended for line sizes above 12-in. [300 mm])

1. Open the isolation valve fully.
2. Rotate drive nuts clockwise (as viewed from the top) as shown in [Figure 2-30](#). The nuts must be tightened alternately, about two turns at a time to prevent binding caused by unequal loading.
3. Continue this procedure until the tip of the probe firmly contacts the opposite side of the pipe.
 - a. The orange stripes are a visual indication of when the sensor is approaching the opposite side wall.
 - b. As the orange stripe approaches the support plate, place a finger above the packing gland while cranking.
 - c. Turn the drive nuts an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn to secure the sensor.

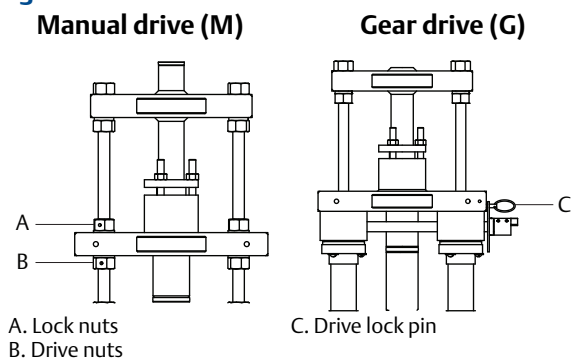
Gear drive (G)

1. Fully open the isolation valve.
2. Rotate the crank clockwise. If a power drill with an adapter is used, do not exceed 200 rpm.
 - a. Continue rotating the crank until the sensor firmly contacts the opposite side of the pipe. The orange stripes are a visual indication of when the sensor is approaching the opposite side wall.
 - b. As the orange stripes approach the support plate, remove the power drill and continue cranking manually. Place a finger above the packing gland while cranking. When the movement stops, the sensor is in contact with the opposite side wall.
 - c. Turn the handle an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn to secure the sensor.
3. Secure the drive by inserting the drive lock pin as shown in [Figure 2-31](#).

Note

Do not place a finger above the packing gland for high temperature applications.

Figure 2-31. Insert Annubar Sensor



Step 8: Mount the transmitter

Direct mount head

With valves

1. Place PTFE O-rings into grooves on the Annubar sensor head.
2. Align the high side of the transmitter to the high side of the sensor ("Hi" is stamped on the side of the head) and install.
3. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

Without valves

1. Place PTFE O-rings into grooves on the Annubar sensor head.
2. To install a manifold, orient the equalizer valve or valves so they are easily accessible. Install manifold with the smooth face mating to the face of the head. Tighten in cross pattern to a torque of 400 in-lb. (45 N-m).
3. Place PTFE O-rings into grooves on the face of the manifold.
4. Align the high side of the transmitter to the high side of the probe ("Hi" is stamped on the side of the head) and install.

Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

Step 9: Retract the Annubar sensor

Manual drive (M)

1. Retract by rotating the drive nuts counter-clockwise. The nuts must be turned alternately, about two turns at a time, to prevent binding caused by unequal loading.
2. Continue this procedure until the rod end nuts are against the packing body mechanism.

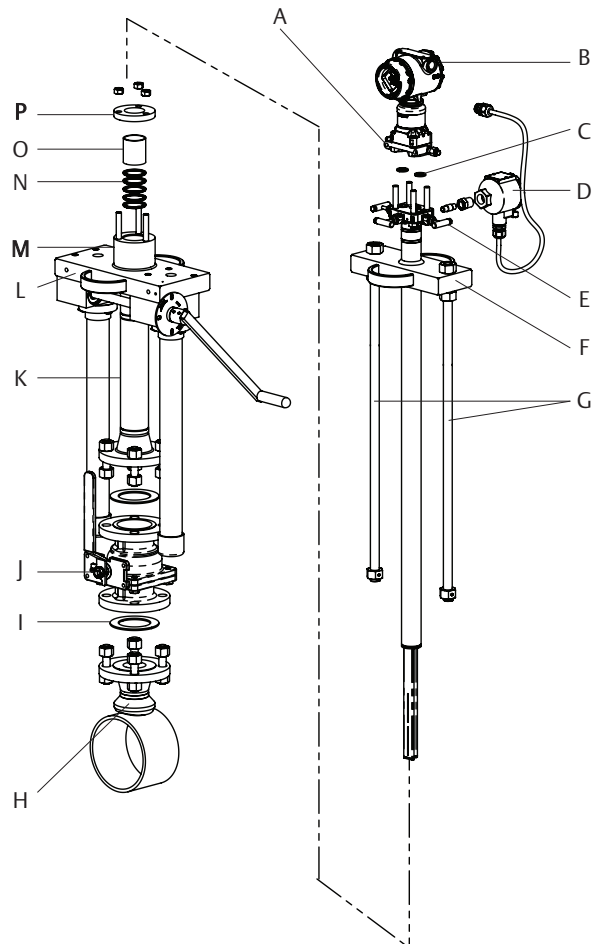
Gear drive (G)

1. Remove the drive lock pin.
2. Retract the sensor by rotating the crank counter-clockwise. If a power drill with an adapter is used, do not exceed 200 rpm.
3. Retract until the rod end nuts are against the packing body mechanism.

2.6.5 Flanged Flo-tap (for 485 and 585 Annubar Flowmeters)

Figure 2-32 identifies the components of the Flanged Flo-Tap assembly.

Figure 2-32. Components



Transmitter and housing are shown for clarity purposes – only supplied if ordered.

- | | |
|--|----------------------|
| A. Coplanar flange with drain vents | I. Gasket |
| B. Transmitter | J. Isolation valve |
| C. O-rings (2) | K. Cage nipple |
| D. Temperature sensor connection housing | L. Support plate |
| E. Direct mount transmitter connection with valves | M. Packing gland |
| F. Head plate | N. Packing |
| G. Drive rods | O. Follower |
| H. Mounting flange assembly | P. Compression plate |

Step 1: Determine the proper orientation

Refer to “[Mounting](#)” on page 8 for straight run requirements and orientation information.

Step 2: Weld the mounting hardware

Note

Rosemount-supplied mounting includes critical alignment hardware that assists in the correct drilling of the mounting hole. This significantly reduces problems encountered during insertion.

- At the pre-determined position, place the flanged assembly on the pipe, gap $\frac{1}{16}$ in. (1,6 mm) and measure the distance from the outside diameter of the pipe to the face of the flange. Compare this to the chart below and adjust the gap as necessary.

Table 2-10. 485 and 585 Flange Sizes and ODF per Sensor Size

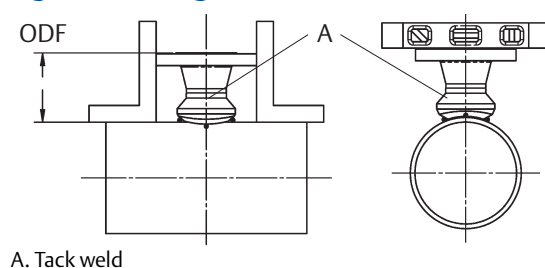
485 Sensor size	585 Sensor size	Flange type	Pressure class	Flange size/rating/type	ODF in. (mm) ⁽¹⁾
1	11	A	1	1½-in. 150# RF	3.88 (98.6)
			3	1½-in. 300# RF	4.13 (104.9)
			6	1½-in. 600# RF	4.44 (112.8)
			N	1½-in. 900# RF	4.94 (125.5)
			F	1½-in. 1500# RF	4.94 (125.5)
			T	1½-in. 2500# RF	6.76 (171.7)
		R	1	1½-in. 150# RTJ	4.06 (103.1)
			3	1½-in. 300# RTJ	4.31 (109.5)
			6	1½-in. 600# RTJ	4.44 (112.8)
			N	1½-in. 900# RTJ	4.94 (125.5)
			F	1½-in. 1500# RTJ	4.94 (125.5)
			T	1½-in. 2500# RTJ	6.81 (173.0)
		D	1	DN40 PN16 RF	3.21 (81.5)
			3	DN40 PN40 RF	3.21 (81.5)
			6	DN40 PN100 RF	3.88 (98.6)
2	22	A	1	2.0-in. 150# RF	4.13 (104.9)
			3	2.0-in. 300# RF	4.38 (111.3)
			6	2.0-in. 600# RF	4.75 (120.7)
			N	2.0-in. 900# RF	5.88 (149.4)
			F	2.0-in. 1500# RF	5.88 (149.4)
			T	3.0-in. 2500# RF	9.88 (251.0)
		R	1	2.0-in. 150# RTJ	4.31 (119.5)
			3	2.0-in. 300# RTJ	4.63 (117.6)
			6	2.0-in. 600# RTJ	4.81 (122.2)
			N	2.0-in. 900# RTJ	5.94 (150.9)
			F	2.0-in. 1500# RTJ	5.94 (150.9)
			T	3.0-in. 2500# RTJ	10.00 (254.0)
		D	1	DN50 PN16 RF	3.40 (86.4)
			3	DN50 PN40 RF	3.52 (89.4)
			6	DN50 PN100 RF	4.30 (109.5)

Table 2-10. 485 and 585 Flange Sizes and ODF per Sensor Size

485 Sensor size	585 Sensor size	Flange type	Pressure class	Flange size/rating/type	ODF in. (mm) ⁽¹⁾
3	44	A	1	3.0-in. 150# RF	4.63 (117.6)
			3	3.0-in. 300# RF	5.00 (127.0)
			6	3.0-in. 600# RF	5.38 (136.7)
			N	4.0-in. 900# RF	8.19 (208.0)
			F	4.0-in. 1500# RF	8.56 (217.4)
			T	4.0-in. 2500# RF	11.19 (284.2)
		R	1	3.0-in. 150# RTJ	4.81 (122.2)
			3	3.0-in. 300# RTJ	5.25 (133.4)
			6	3.0-in. 600# RTJ	5.44 (138.2)
			N	4.0-in. 900# RTJ	8.25 (209.6)
			F	4.0-in. 1500# RTJ	8.63 (219.2)
			T	4.0-in. 2500# RTJ	11.38 (289.1)
		D	1	DN80 PN16 RF	3.85 (97.8)
			3	DN80 PN40 RF	4.16 (105.7)
			6	DN80 PN100 RF	4.95 (125.7)

1. Tolerances for the ODF dimension above a 10-in. (254 mm) line size is ± 0.060 -in. (1,6 mm). Below 10-in. (254 mm) line size is ± 0.030 -in. (0,8 mm).
2. Place four 1/4-in. (6-mm) tack welds at 90° increments. Check alignment of the mounting both parallel and perpendicular to the axis of flow.
3. If the mounting alignment is within tolerances, finish weld per local codes. If outside of tolerances, make adjustments prior to making the finish weld.
4. To avoid serious burns, allow the mounting hardware to cool before continuing.

Figure 2-33. Alignment



Step 3: Install the isolation valve

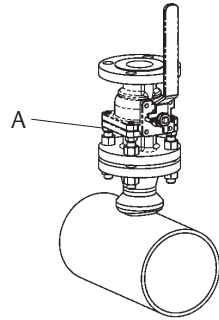
1. Position the isolation valve onto the mounting flange. Ensure the valve stem is positioned so that when the Flo-Tap is installed, the insertion rods will straddle the pipe and the valve handle will be centered between the rods (see Figure 2-34).

Note

Interference will occur if the valve is located inline with the insertion rods.

2. Fasten the isolation valve to the mounting using gasket, bolts, and nuts.

Figure 2-34. Install Isolation Valve



A. Isolation valve

Step 4: Mount the drilling machine and drill hole

Drilling machine is not provided with the assembly.

1. Determine the drill hole size based on the sensor size or sensor width.
2. Mount the drilling machine to the isolation valve.
3. Open the valve fully.
4. Drill the hole into the pipe wall in accordance with the instructions provided by the drilling machine manufacturer.
5. Retract the drill fully beyond the valve.

Table 2-11. 485 Drill Hole Sizes

Sensor size	Sensor width	Hole diameter		A. Pressure drilling machine B. Isolation valve is fully open when inserting drill C. Isolation valve is fully closed after withdrawing drill
1	0.590-in. (14.99 mm)	$\frac{3}{4}$ -in. (19 mm)	$+\frac{1}{32}$ -in. (0.8 mm)	
			- 0.00	
2	1.060-in. (26.92 mm)	$1\frac{5}{16}$ -in. (34 mm)	$+\frac{1}{16}$ -in. (1.6 mm)	
			- 0.00	
3	1.935-in. (49.15 mm)	$2\frac{1}{2}$ -in. (64 mm)	$+\frac{1}{16}$ -in. (1.6 mm)	
			- 0.00	

Table 2-12. 585 Drill Hole Sizes

Sensor size	Sensor width	Hole diameter	
11	0.8-in. (20.32 mm)	$\frac{7}{8}$ -in. (23 mm)	$+\frac{1}{32}$ -in. (0,8 mm)
			- 0.00
22	1.20-in. (30.48 mm)	$1\frac{5}{16}$ -in. (34 mm)	$+\frac{1}{16}$ -in. (1,6 mm)
			- 0.00
44	2.30-in. (58.42 mm)	$2\frac{1}{2}$ -in. (64 mm)	$+\frac{1}{16}$ -in. (1,6 mm)
			- 0.00

Step 5: Remove the drilling machine

1. Verify that the drill has been fully retracted past the valve.
2. Close the isolation valve to isolate the process.
3. Bleed drilling machine pressure and remove.
4. Check isolation valve and mounting for leakage.

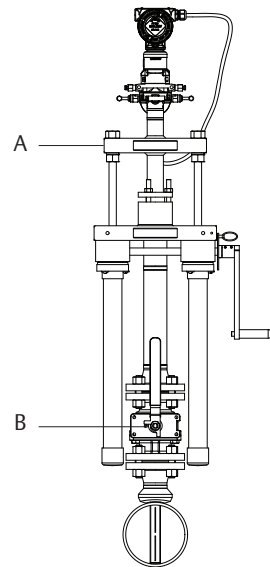
Step 6: Mount the Annubar sensor

1. Align the flow arrow on the head with the direction of flow.
2. Use the supplied gaskets and flange bolts to fasten the Flo-Tap assembly to the isolation valve.
3. Tighten the nuts in a cross pattern to compress the gasket evenly.
4. Ensure the vent valves are closed before proceeding.
5.  Quickly open and close the isolation valve to pressurize the Annubar sensor. Use extreme caution if the flowing medium is steam or caustic.
6. Check the entire installation for leakage. Tighten as required to stop any connection from leaking. Repeat [Steps 4](#) and [5](#) until there is no leakage.
 - a. If the Flo-tap comes equipped with the gear drive option, place the PVC protector rod assembly over the drive rods and attach to the gear drive with the supplied hardware.

Note

Flo-Tap Annubar sensors have the potential to carry a large amount of weight at a great distance from the piping, necessitating external support. The support plate has threaded holes to assist in supporting the Annubar sensor. Threaded holes ($\frac{3}{8}$ in.-16 UNC) are provided on the support plate for external support.

Figure 2-35. Flo-Tap Installation



Step 7: Insert the Annubar sensor

Insert the sensor with one of the two drive options available – manual (M) or gear drive (G).

Manual (M) (not recommended for line size above 12-in. (300 mm))

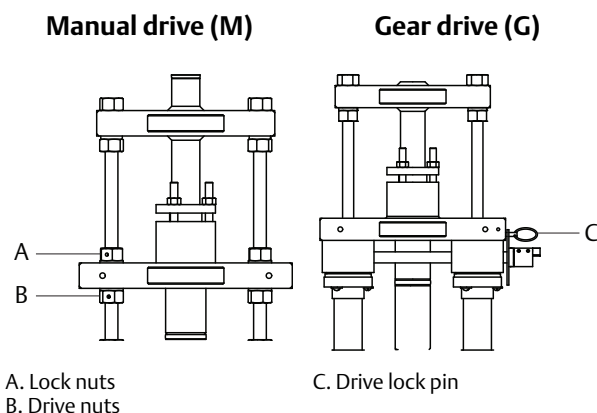
1. Open the isolation valve fully.
2. Rotate drive nuts clockwise (as viewed from the top) as shown in [Figure 2-35](#). The nuts must be tightened alternately, about two turns at a time to prevent binding caused by unequal loading.
3. Continue this procedure until the tip of the probe firmly contacts the opposite side of the pipe.
 - a. The orange stripes are a visual indication of when the sensor is approaching the opposite side wall.
 - b. As the orange stripe approaches the support plate, place a finger above the packing gland while cranking.
 - c. Turn the drive nuts an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn to secure the sensor.

Gear drive (G)

1. Open the isolation valve fully.
2. Rotate the crank clockwise. If a power drill with an adapter is used, do not exceed 200 rpm.
 - a. Continue rotating the crank until the sensor firmly contacts the opposite side of the pipe. The orange stripes are a visual indication of when the sensor is approaching the opposite side wall.

- b. As the orange stripes approach the support plate, remove the power drill and continue cranking manually. Place a finger above the packing gland while cranking. When movement stops, the sensor is in contact with the opposite side wall.
 - c. Turn the handle an additional $\frac{1}{4}$ to $\frac{1}{2}$ turn to secure the sensor.
 3. Secure the drive by inserting the drive lock pin as shown in Figure 2-36.

Figure 2-36. Insert Annubar Sensor



Step 8: Retract the Annubar sensor

Manual Drive (M)

1. Retract by rotating the drive nuts counter-clockwise. The nuts must be turned alternately, about two turns at a time, to prevent binding caused by unequal loading.
2. Continue this procedure until the rod end nuts are against the packing body mechanism.

Gear Drive (G)

1. Remove the drive lock pin.
2. Retract the sensor by rotating the crank counter-clockwise. If a power drill with an adapter is used, do not exceed 200 rpm.
3. Retract until the rod end nuts are against the packing body mechanism.

Step 9: Mount the transmitter

Direct mount head

With valves

1. Place PTFE O-rings into grooves on the face of head.
2. Align the high side of the transmitter to the high side of the sensor ("Hi" is stamped on the side of the head) and install.
3. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

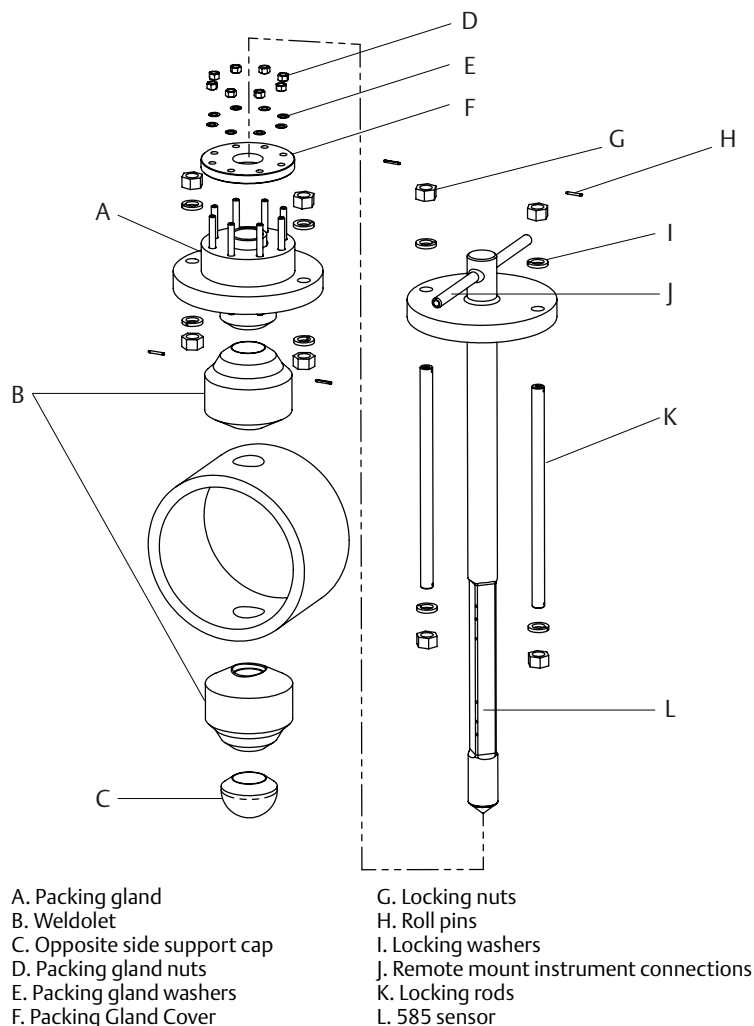
Without valves

1. Place PTFE O-rings into grooves on the face of head.
2. To install a manifold, orient the equalizer valve or valves so they are easily accessible. Install manifold with the smooth face mating to the face of the head. Tighten in cross pattern to a torque of 400 in-lb. (45 N-m).
3. Place PTFE O-rings into grooves on the face of the manifold.
4. Align the high side of the transmitter to the high side of the probe ("Hi" is stamped on the side of the head) and install.
5. Tighten the nuts in a cross pattern to 400 in-lb. (45 N-m).

2.6.6 Main steam line (for 585 Annubar Flowmeters)

Figure 2-37 identifies the components of the Main Steam Annubar sensor assembly.

Figure 2-37. Components



Step 1: Determine the proper orientation

Refer to “Mounting” on page 8 for straight run requirements and orientation information.

Step 2: Drill mounting hole into pipe

1. De-pressurize and drain the pipe.
2. At the predetermined position, drill the hole into the pipe wall in accordance with the instructions provided by the drilling machine manufacturer. Drill 2.5-in. (64 mm) hole. Drill hole has a tolerance of $+1/16$ -in. or -0 in. (1,6 mm or -0 mm).

3. After the hole is drilled, deburr the hole on the inside of the pipe.
4. A second identically sized hole must be drilled opposite the first hole so that the sensor can pass completely through the pipe. To drill the second hole, follow these steps:
 - a. Measure the pipe circumference with a pipe tape, soft wire, or string. (For the most accurate measurement the pipe tape needs to be perpendicular to the axis of flow.)
 - b. Divide the measured circumference by two to determine the location of the second hole.
 - c. Re-wrap the pipe tape, soft wire, or string from the center of the first hole. Then, using the number calculated in the preceding step, mark the center of what will become the second hole.
 - d. Using the diameter determined in [Step 3](#), drill the hole into the pipe with a hole saw or drill. Do not torch cut the hole.
5. Deburr the drilled holes on the inside of the pipe.

Step 3: Weld the mounting hardware

An alignment bar is needed during the welding of the heavy wall weldolets to the steam pipeline. The alignment bar can be ordered from Emerson™ Process Management.

1. Weld the heavy wall weldolet to the packing gland assembly with a full penetration-groove weld.
 - a. Place the alignment bar through the packing gland and the weldolet. The weldolet will also have a bearing sleeve in it and it should be near the radius end of the weldolet which will be the end welded to the pipe. Ensure the support plate is attached to the packing gland before making the weld.
 - b. Tack weld the weldolet to the packing gland. Remove the alignment bar.
 - c. Weld the first pass. Recheck alignment with the alignment bar. Adjust alignment as necessary. Do not allow the alignment bar to get too hot, as it will be difficult to remove. Use it only briefly to check alignment between weld passes.
 - d. Complete remaining weld passes, using alignment bar to verify alignment several times during the process. Emerson Process Management recommends the weld thickness is equal to the base metal thickness.
2. Weld the weldolet and packing gland assembly to the pipe.
 - a. Place alignment bar back into the pipe, slide the weldolet and packing gland assembly down the alignment bar, and let it rest on the pipe.
 - b. Ensure the 1 1/8-in. (29 mm) holes in the support plate are perpendicular to the pipe centerline within $\pm 3^\circ$ for horizontal lines and parallel to the pipe centerline within $\pm 3^\circ$ for vertical lines. This will ensure the impact and static holes will be in line with the flow stream. See [Figure 2-5 on page 10](#).
 - c. Tack weld the weldolet to the pipe. Check alignment. Remove the alignment bar and weld the first pass. Emerson Process Management recommends using TIG welding for the first two passes as a minimum. Experience has shown that welding about 1/2 to 2/3 of the weld using GTAW (TIG) and then using other weld processes (GMAW, SMAW, FCAW) leads to lower chances of movement of the weldment during welding.

Note

It is very helpful to have two welders welding the assemblies to pipe, with one welder starting 180° from the other. This helps prevent movement of the fittings during the temperature changes associated with welding.

- d. Check the alignment after the first pass. Remove the alignment bar and weld the next pass. Recheck alignment.
 - e. Continue applying weld passes and rechecking alignment until welding is complete. The fillet welds will be approximately 1¹/₈-in. (29 mm).
3. Weld the opposite side weldolet to the pipe.
 - a. Slide the alignment bar through mounting and hole in top side of pipe and place the opposite-side support weldolet over the end of the alignment bar.
 - b. Visually center the opposite-side weldolet over the hole. Tack weld the weldolet, using tack bars or an equivalent method.
 - c. Weld the first pass and check alignment using the alignment bar and continue welding. Check alignment frequently during welding. Adjust weldolet as you are making tacks to keep aligned. Do not leave alignment bar in too long as it will heat up and make it very difficult to remove.
 - d. When welding is complete, the alignment bar should slide freely through the packing into the opposite-side weldolet.
 - e. Weld opposite end cap to weldolet using a full penetration groove weld.
4. Perform required heat treatment.
5. Reinstall 585 Main Steam Annubar sensor after heat treating and ensure the flow arrow is pointing in the direction of flow.

Step 4: Insert the Annubar sensor

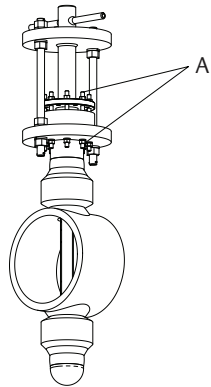
1. Place the packing into the packing gland with the two split rings (Garlock style 1303FEP) on the outside and the three Garlock Carbon/Graphite solid die-formed rings on the inside. Make sure the splits in the outer packing are 180° apart.

Note

The packing gland and support plate will be shipped fully assembled.

2. Slide the 585 Annubar sensor through the packing and install the locking rods, nuts, and lock washers. The dimension between the plates should be 11.0-in. (279 mm). See [Figure 2-38 on page 58](#). If there is visual access to the inside of the pipe, ensure that the sensing holes are equally spaced from the inner diameter of the pipe.
3. Make the small adjustment (if necessary), then lock the 585 in place with the locking rods, nuts, and lock washers. When installed, the 585 will have a dimension of 29.6-in. (752 mm) from pipe OD to top of head.
4. The last thing to be done is to tighten the packing gland nuts to 25 to 30 ft-lbs. (34 to 41 N-m). See [Figure 2-36](#).

Figure 2-38. Tighten The Packing Gland Nuts



A. Packing gland nuts

Step 5: Mount the transmitter

- Impulse piping that runs horizontally must slope downward at least one inch per foot (83 mm/m).
- Impulse piping should have a minimum length of 1-ft. (0.3048 m) for every 100 °F (38 °C) temperature increase over 250 °F (121 °C).
 - a. Impulse piping must be non-insulated to reduce fluid temperature.
 - b. Any threaded connections should be checked after the system reaches the intended temperature because connections may come loose with contraction and expansion caused by temperature change.
- Outdoor installations may require insulation and heat tracing to prevent freezing.
- When impulse piping is longer than 6-ft. (1.8 m) the high and low impulse lines must be positioned together to maintain equal temperature. They must be supported to prevent sagging and vibration.
- Impulse lines should be positioned in protected areas or against walls or ceilings. Use appropriate pipe sealing compound rated for the service temperature on all threaded connections. Do not place the impulse piping near high temperature piping or equipment.
 - a. An instrument manifold is recommended for all installations. Manifolds allow an operator to equalize the pressures prior to zeroing and isolates the process fluid from the transmitter.
 - b. Use only valves and fittings rated for the design pressure and temperature (in some cases the primary instrument valve may be supplied by Emerson Process Management with the Annubar sensor).
 - c. Use a pipe thread sealant compound that is rated for use at the service temperature and pressure for all valves and fittings.
 - d. Verify that all connections are tight and that all instrument valves are fully closed.
 - e. Verify that the sensor probe is properly oriented as per the submitted outline drawings.
 - f. The piping used to connect the sensor probe and transmitter must be rated for continuous operation at the pipeline-designed pressure and temperature. A minimum of one-half inch ($\frac{1}{2}$ -in., 12 mm) O.D. stainless steel tubing with a wall thickness of at least $\frac{1}{16}$ -in. (1,6 mm) is recommended.

2.7 Wire the transmitter

See appropriate transmitter manual for bench configuration information.

Transmitter	HART® document number	FOUNDATIONFieldbus™ document number	PROFIBUS® document number
Rosemount 3051S MultiVariable Mass and Energy Flow Transmitter	00809-0100-4803	N/A	N/A
Rosemount 3051S Pressure Transmitter	00809-0100-4801	00809-0200-4801	N/A
Rosemount 3095MV MultiVariable Mass Flow Transmitter	00809-0100-4716	00809-0100-4716	N/A
Rosemount 3051 Pressure Transmitter	00809-0100-4001	00809-0100-4774	00809-0100-4797
Rosemount 2051 Pressure Transmitter	00809-0100-4101	00809-0200-4101	N/A

Do not connect the powered signal wiring to the test terminals. Power may damage the test diode in the test connection.

Plug and seal unused conduit connections on the electronics housing to avoid moisture accumulation in the terminal side of the housing. Excess moisture accumulation may damage the electronics. If the connections are not sealed, the electronics should be remote mounted with the electrical housing positioned downward for drainage. Wiring should be installed with a drip loop and the bottom of the drip loop should be lower than the conduit connections and the housing.

 Inductive-based transient protectors, including the Rosemount 470 transient protector, can adversely affect the output of the Annubar sensor. If transient protection is desired, install the Transient Protection Terminal Block. Consult the factory for instructions.

2.7.1 Wiring diagrams

-  1. Remove the housing cover on the side marked FIELD TERMINALS. Do not remove the instrument covers in explosive atmospheres when the circuit is live.
2. Connect the lead that originates at the positive side of the power supply to the terminal marked “+” and the lead that originates at the negative side of the power supply to the terminal marked “–.” Avoid contact with the leads and terminals.

Section 3 Commissioning

Safety messages	page 61
Transmitter commissioning	page 62
Commissioning the Annubar sensor	page 62

3.1 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 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 live.
- Before connecting a Field 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.
- If the line is pressurized, serious injury or death could occur by opening valves.

⚠ CAUTION

Section 3 contains information that are suggested procedures only. The user must follow all plant safety procedures for their process and location.

3.2 Transmitter commissioning

See the appropriate transmitter manual for wiring and configuration instructions.

Table 3-1. Transmitter Manual Document Numbers

Transmitter	HART® document number	FOUNDATION fieldbus™ document number	PROFIBUS® document number
Rosemount® 3051S MultiVariable™ Mass and Energy Flow Transmitter	00809-0100-4803	N/A	N/A
Rosemount 3051S Pressure Transmitter	00809-0100-4801	00809-0200-4801	N/A
Rosemount 3095 MultiVariable Mass Flow Transmitter	00809-0100-4716	00809-0100-4716	N/A
Rosemount 3051 Pressure Transmitter	00809-0100-4001	00809-0100-4774	00809-0100-4797
Rosemount 2051 Pressure Transmitter	00809-0100-4101	00809-0200-4101	N/A

3.3 Commissioning the Annubar sensor

3.3.1 Direct mount transmitter

Prepare transmitter for service

Prior to commissioning the flowmeter, a zero trim procedure (or “dry zero”) should be performed to eliminate any positional effects to the transmitter. Refer to [Figure 3-1](#) and [Figure 3-2](#) for valve designations.

1. Open first the equalizer valve(s) MEL and MEH or ME.
2. Close valves MH and ML.
3. Read the transmitter output. It should read within the range 3.98 mA to 4.02 mA. If the output is outside of this range, perform a zero trim procedure as described in transmitter manual (see [Table 3-1](#) for transmitter manual document numbers).

“Calibrate out” line pressure effects

For applications with static pressures of 100 psi (6.9 bar) and higher, the DP sensor should be zeroed for line pressure effects. The “zero” calibration procedure is affected by static pressure and ambient temperature, but these effects can be minimized by zeroing the DP sensor at normal operating conditions.

The effect of static pressure is calibrated out by exposing the transmitter to the line pressure and performing a “zero” or wet calibration, as described below.

Although the line pressure effects are relatively small, they significantly affect the accuracy of the Annubar sensor when used with low flows.

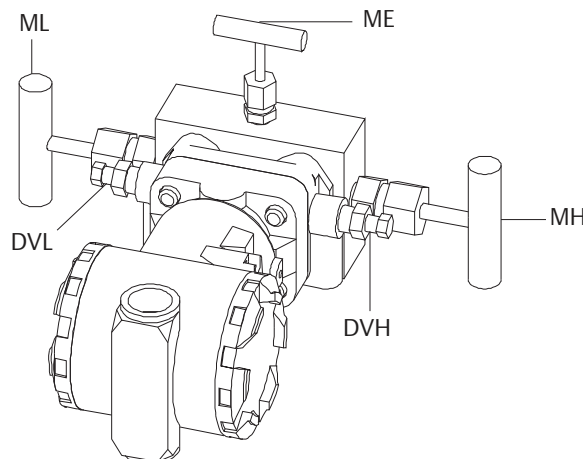
Periodic “zero” calibration and/or commissioning is recommended to maintain the accuracy of Annubar sensor. The frequency of this type of maintenance should be established for each individual application.

Liquid service 3-valve manifold

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Open the high and low manifold valves MH and ML. Refer to [Figure 3-1](#) for valve designations.
2. Open the Equalizer valve ME.
3. Open the drain/vent valves on the transmitter DVH and DVL; bleed until no air is apparent in the liquid.
4. Close both drain/vent valve DVH and DVL.
5. Close the low side manifold valve ML.
6. Check the transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA then perform a zero trim procedure as described in the transmitter manual.
7. After the zero trim, if the signal reads outside of the range 3.98 mA to 4.02 mA, repeat [Steps 1 - 6](#).
8. Close the Equalizer valve ME.
9. Open the low side valve ML and ensure that the high side valve MH is open.
10. The system is now operational.

Figure 3-1. Valve Identification for Direct Mounted Annubar Sensor Models with 3-Valve Manifold

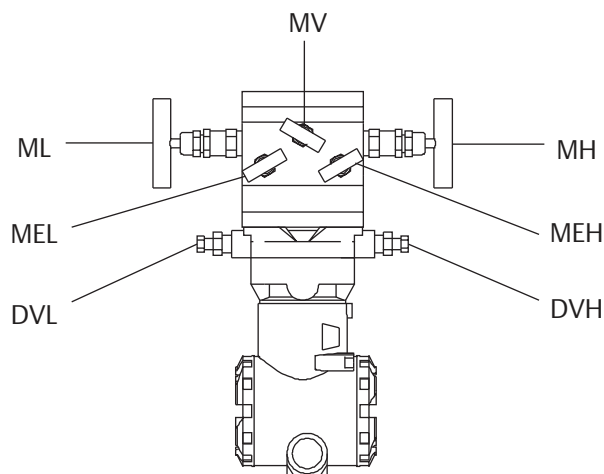


Liquid service 5-valve manifold

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Open high and low manifold valves MH and ML. Refer to [Figure 3-2](#) for valve designations.
2. Open high side equalizer valve MEH.
3. Open low side equalizer valve MEL.
4. Open manifold vent MV; Bleed until no air is present in the liquid.
5. Close manifold vent MV.
6. Close low side manifold valve ML.
7. Check transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA then perform a zero trim procedure as described in the transmitter manual.
8. After the zero trim, if the signal reads outside the range 3.98 mA to 4.02 mA, repeat [Steps 1 - 6](#).
9. Close low side equalizer valve MEL.
10. Close high side equalizer valve MEH.
11. Open low side manifold valve ML and ensure high side manifold valve MEH is open.
12. The system is now operational.

Figure 3-2. Valve Identification for Direct Mounted Models with 5-Valve Manifold



Gas service 3-valve manifold

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Open the high and low manifold valves MH and ML. Refer to [Figure 3-1](#) for valve designations.
2. Open the Equalizer valve ME.
3. Open the drain/vent valves on the transmitter DVH and DVL; bleed to ensure that no liquid is present.
4. Close both drain/vent valve DVH and DVL.
5. Close the low side valve ML.
6. Check the transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA, then perform a zero trim.
7. After zero trim, if the signal reads outside of the range 3.98 mA to 4.02 mA, repeat [Steps 1 - 6](#).
8. Close the Equalizer valve ME.
9. Open the low side valve ML, ensure that the high side valve MH is open. The system is now operational.

Gas service 5-valve manifold

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

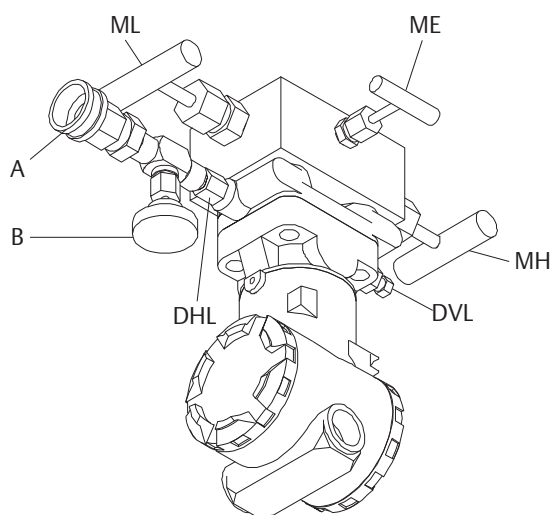
1. Open high and low manifold valves MH and ML. Refer to [Figure 3-2](#) for valve designations.
2. Open high side equalizer valve MEH.
3. Open low side equalizer valve MEL.
4. Open manifold vent MV; Bleed until no liquid is present in the gas.
5. Close manifold vent MV.
6. Close low side manifold valve ML.
7. Check transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA then, perform a zero trim procedure as described in the transmitter manual.
8. After the zero trim, if the signal reads outside the range 3.98 mA to 4.02 mA, repeat [Steps 1 - 6](#).
9. Close low side equalizer valve MEL.

10. Close high side equalizer valve MEH.
11. Open low side manifold valve ML and ensure high side manifold valve MEH is open.
12. The system is now operational.

Steam service (filling the water legs)

1. Ensure the steam line is depressurized with no steam.
2. Check the transmitter for a dry zero of 4 mA with no water loss.
3. Attach hose connection valve to high side vent DVH. See [Figure 3-3](#).
4. Attach a water supply to the hose connection. The water supply should have a maximum psi of 100.
5. Open the high and low manifold valves MH and ML and equalizer valve ME (MEH and MEL for 5-Valve Manifolds).
6. Ensure low side vent DVL is closed.
7. Open the hose connect valve for a minimum of 30 seconds. Water will flow through both the high and low chambers and into the pipe.
8. Close the high side manifold valve MH for 30 seconds to force water to the ML side.
9. Re-open the MH valve.
10. Open low side vent DVL until no air is observed.
11. Close the low-side vent DVL.
12. Close the hose connect valve and remove hose.
13. Close both manifold high side valve MH and manifold low side valve ML.
14. Check the transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA, air is probably still in the system; repeat this procedure from step 2, and trim sensor if necessary.
15. Open the manifold high side valve MH.
16. Close equalizer valve ME (for 5-Valve Manifolds first close valve MEL, then close valve MEH).
17. Open the manifold low side valve ML. The system is now operational.

Figure 3-3. Valve Identification for Direct Mounted Annubar Sensor Models in Steam Service



A. Hose connection
B. Hose connect valve

Steam service 3-valve manifold

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

After flow has been started and allowed to reach operating conditions, a zero trim procedure needs to be performed.

1. Using the drain/vent valves DVH and DVL; burp (carefully crack vents open and closed to ensure that no air is present, this may need to be done more than one time.) Refer to [Figure 3-1](#) for valve designations.

Note

[Step 1](#) would cause a loss of some water column in both the high and low sides, due to draining of the water legs. If [Step 2](#) is performed, the Annubar sensor assembly should be given sufficient time to re-stabilize before continuing to [Step 3](#).

2. Close the low side valve ML.
3. Open the Equalizer valve ME.
4. Check the transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA then, perform a zero trim.
5. Close the Equalizer valve ME.
6. Open the low side valve ML, ensure that the high side valve MH is open. The system is now operational

Steam service 5-valve manifold

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

After flow has been started and allowed to reach operating conditions a zero trim procedure needs to be performed.

1. Using the drain/vent valves DVH and DVL; burp (carefully crack vents open and closed to ensure that no air is present, this may need to be done more than one time.) Refer to [Figure 3-2](#) for valve designations.

Note

[Step 1](#) would cause a loss of some water column in both the high and low sides, due to draining of the water legs. If [Step 2](#) is performed, the Annubar sensor assembly should be given sufficient time to re-stabilize before continuing to [Step 3](#).

2. Close the low side valve ML.
3. Open manifold vent MV; Bleed until no liquid is present in the gas.
4. Close manifold vent MV.
5. Close low side manifold valve ML.
6. Check transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA then, perform a zero trim procedure as described in the transmitter manual.

3.3.2 Remote mount transmitter

Prepare transmitter for service

Prior to commissioning the flowmeter, a zero trim procedure (or “dry” zero) should be performed to eliminate any positional effects to the transmitter. Refer to [Figure 3-1](#) and [Figure 3-2](#) for valve designations.

1. Open first the equalizer valve(s) MEL and MEH or ME.
2. Close valves MH and ML.
3. Read the transmitter output. It should read within the range 3.98 mA to 4.02 mA. If the output is outside of this range, perform a zero trim procedure as described in transmitter manual (see [Table 3-1](#) for transmitter manual document numbers).

Check for system leaks

Check the system for leaks after installation is complete. A leak in a differential pressure instrument system can produce a difference in pressure that is larger than the signal itself.

Before the system is filled and/or commissioned, it is a simple matter to use compressed air or another inert, compressed gas to check for leaks. The gas pressure must be below the maximum allowed, but at least equal to the normal operating pressure in order to reveal potential leaks. A typical pressure used is 100 psig (690 kPa).

Before pressurizing the system, check for leaks by doing the following:

1. Open equalizer valve(s) MEH, MEL, or ME to prevent over-pressuring the DP sensor on one side. Refer to [Figure 3-4](#), [Figure 3-5](#), and [Figure 3-6](#) for valve designations.
2. Close valves PH, PL, MV, DVH, and DVL.
3. Open valves MH and ML.
4. Install all appropriate tapped plugs.
5. Apply pressure at a convenient point on either the high or low side of the system. The DVH, DVL, or MV ports could be used.
6. Use a suitable leak detection solution and apply to all of the impulse piping, valves, manifold, and connections. A leak is indicated by a continuous stream of bubbles.
7. Repair any leaks in the system by first removing pressure from the system. Repeat [Steps 1 - 6](#) as necessary until no leaks are detected.
8. Remove test pressure and re-install all appropriate plugs.

“Calibrate out” line pressure effects

Note

Do not begin this procedure until the system leak check has been completed on the impulse piping and all leaks have been fixed.

For applications 100 psi and higher, the DP sensor should be zeroed for line pressure effects. The “zero” calibration procedure is affected by static pressure and ambient temperature, but these effects can be minimized by zeroing the DP sensor at normal operating conditions.

The effect of static pressure is calibrated out by exposing the transmitter to the line pressure and performing a “zero” or wet calibration, as described below.

Although the line pressure effects are relatively small, they significantly affect the accuracy of the Annubar sensor when used with low flows.

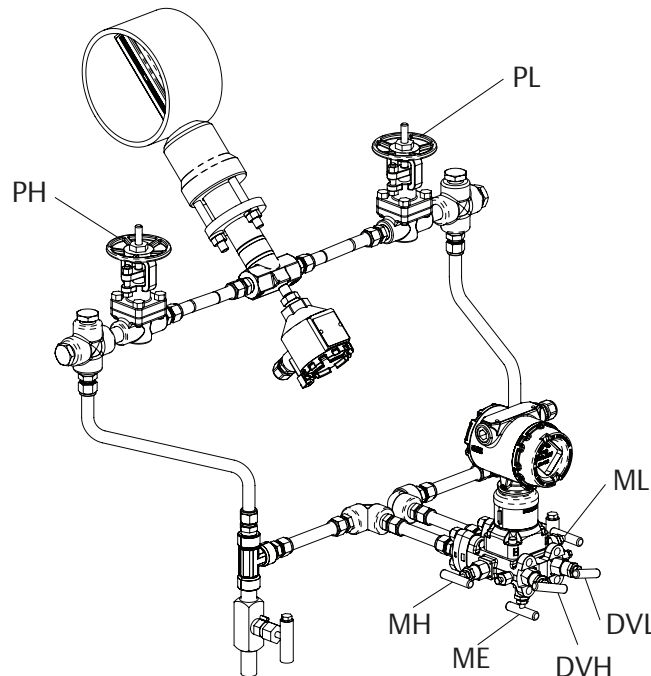
Periodic “zero” calibration and/or commissioning is recommended to maintain the accuracy of Annubar sensor. The frequency of this type of maintenance should be established for each individual application.

Liquid service below 250 °F (121 °C)

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Ensure that primary instrument valves PH and PL are *closed*. Refer to [Figure 3-4](#) for valve designations.
2. Open valves ME, ML, and MH.
 - a. For 5-valve manifolds, first open valve MEH, then open valve MEL.
3. Slowly open the low side primary instrument valve PL and then the high side primary instrument valve PH.
4. For 3-valve manifolds:
 - a. Open drain/vent valves DVL and DVH to bleed air out of system. Bleed until no air is apparent in the liquid.
 - b. Close valves DVL and DVH.

Figure 3-4. Remote Mount Liquid Application



5. For five-valve manifolds:
 - a. Slowly open vent valve MV to bleed out any entrapped air in manifold. Bleed until no air is apparent in the liquid.
 - b. Close vent valve MV.

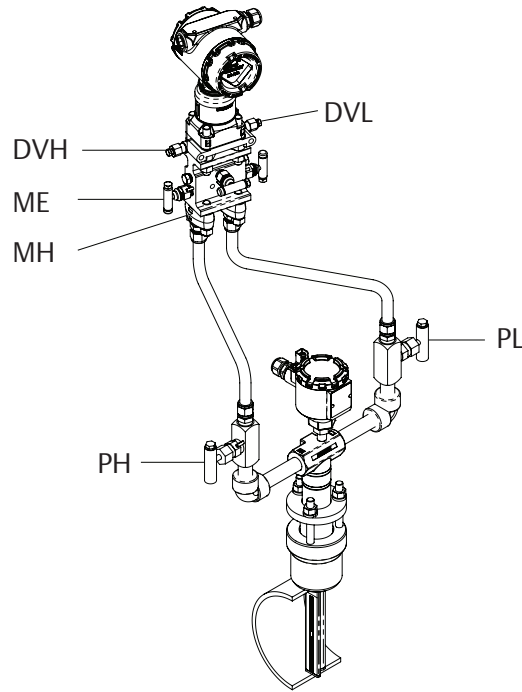
6. Gently tap the transmitter body, valve manifold, and impulse piping to dislodge any remaining entrapped air. If air remains, repeat [Steps 4 or 5](#).
7. Close the low side primary instrument valve PL.
8. Check the transmitter zero by noting the output. If the signal reads outside the range 3.98 mA to 4.02 mA, air is probably still in the system; repeat the procedure from [Step 2](#). Perform a zero trim procedure, if necessary.
9. Close equalizer valve(s).
 - a. For 3-valve manifolds, close valve ME.
 - b. For 5-valve manifolds, first close valve MEL, then close valve MEH.
10. Slowly open low side primary instrument valve PL. The system is now operational.
 - a. For 5-valve manifolds only: Open vent valve MV. If valve MV is leaking, valves MEH and/or MEL are not fully closed or require repair. This must be done before taking any readings. Close vent valve MV once verified.

Gas service

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Ensure primary instrument valves PH and PL are open. Refer to [Figure 3-5](#) for valve designations.
2. Slowly open drain valves DVH and DVL to allow the condensate to drain.
3. Close drain valves DVH and DVL.
4. Close the primary instrument valves PH and PL.
5. Open valves ME, ML, and MH.
 - a. For 5-valve manifolds, first open valve MEH, then open valve MEL.
6. Slowly open the high side primary instrument valve PH.
7. Check transmitter zero by noting the reading. If the signal reads outside of the range 3.98 mA to 4.02 mA, condensate may be in the DP transmitter or system; repeat the procedure from step 1 to remove any condensate. A signal outside the range 3.98 mA to 4.02 mA can also be caused by system leaks; check for leaks in system. Perform zero trim procedure, if necessary.
8. Close equalizer valve(s).
 - a. For 3-valve manifolds, close valve ME.
 - b. For 5-valve manifolds, first close valve MEH, then close valve MEL.
9. Slowly open the low side primary instrument valve PL. The system is now operational.
 - a. For 5-valve manifolds only: Open vent valve MV. If valve MV is leaking, valves MEH and/or MEL are not fully closed or require repair. This must be done before taking any readings. Close vent valve MV once verified.

Figure 3-5. Remote Mount Gas Application



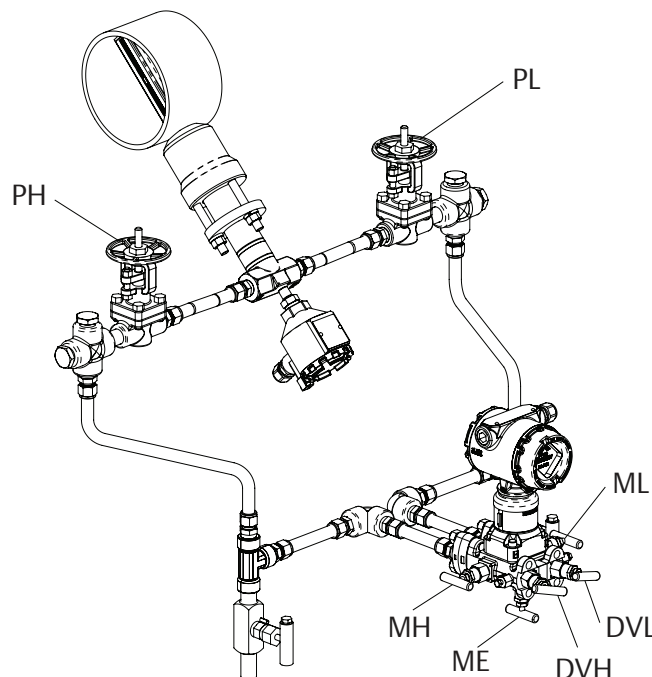
Steam service or liquid service above 250 °F (121 °C)

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Ensure that primary instrument valves PH and PL are *closed*; ME, ML, and MH are *closed*; and DVL and DVH are *closed*. Refer to [Figure 3-6](#) for valve designations.
 - a. For 5-valve manifolds, ensure that valves MEH and MEL are *closed*.
2. Fill tees with water on each side until water overflows.
3. Open valves MH, ML, and equalizer valve ME.
 - a. For 5-valve manifolds, open valves MH and ML and equalizer valves by first opening MEH, then opening MEL.
4. Briefly, open drain valves DVL and DVH.
5. Tap manifold until no air bubbles are visible.
6. Close both drain valves DVL and DVH.
7. Refill tees with water to the middle of each tee fitting.
8. Gently tap transmitter body, valve manifold, and impulse piping to dislodge any remaining entrapped air.
9. Check transmitter zero by noting the output. If the signal reads outside of the range 3.98 mA to 4.02 mA, air is probably still in the system; repeat this procedure from step 2. Perform zero trim procedure, if necessary.

10. Close equalizer valve ME.
 - a. For 5-valve manifolds, first close valve MEH, then close valve MEL.
11. Replace plugs in tees, allowing for air gap at the top of each tee.
12. Slowly open primary instrument valves PH and PL. The system is now operational.
 - a. For 5-valve manifolds only: Open vent valve MV. If valve MV is leaking, valves MEH and/or MEL are not fully closed or require repair. This must be done before taking any readings. Close vent valve MV once verified.

Figure 3-6. Remote Mount Steam Installation



Re-check zero post equilibrium

The following procedures assume the process pipe is pressurized to normal operating pressure and should be followed to obtain a true zero at static or “pipe” pressure.

1. Close primary instrument valves, PH and PL.
2. Remove plugs on tee fittings.
3. Check transmitter zero by noting output. Perform zero trim procedure, if necessary.
4. Re-install plugs on tee fittings.
5. Open primary instrument valves, PH and PL.

Section 4 Operation and Maintenance

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Dirt accumulation	page 80
Main steam line Annubar sensor maintenance	page 81

4.1 Safety messages

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

WARNING

Explosions can result in death or serious injury.

- Do not remove the instrument cover in explosive environments when the circuit is live.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.
- Before connecting a communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or nonincendive field wiring practices.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and the terminals.

4.2 RTD maintenance

This section covers RTD maintenance procedures.

4.2.1 Replacing an RTD

Note

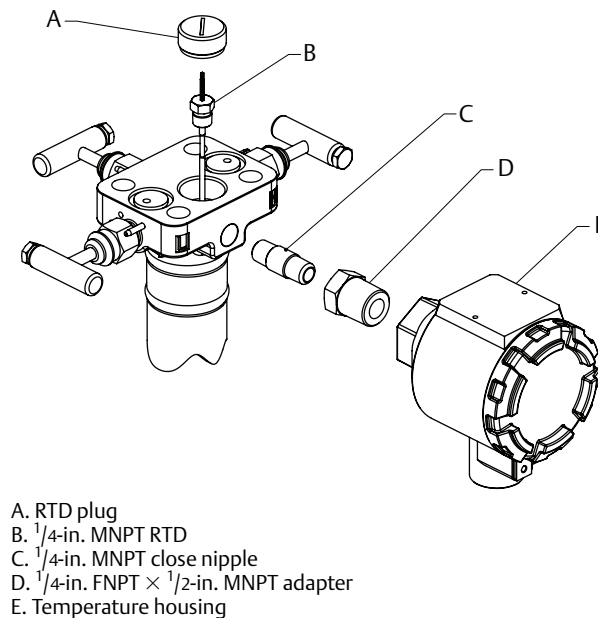
For RTD replacement of the Compact Annubar Flowmeters, see Reference Manual (document number 00809-0100-4810).

Direct mount

If an RTD needs to be replaced on a direct mounted Annubar Flowmeter, proceed as follows:

1. Close instrument valves to ensure that the pressure is isolated from the transmitter.
2. Open the bleed valves on the transmitter to remove all pressure.
3. Remove the cap and the RTD wiring only from the temperature housing and from the transmitter.
4. Remove the transmitter.
5. Remove the RTD plug.
6. Pull the RTD wire out of the nipple and remove the RTD. Remove the RTD by inserting the wires through a $\frac{7}{16}$ -in. deep socket. Then use pliers or vise grips to rotate the socket. The RTD is in a thermowell. No live line pressure will be present.
7. Install the new RTD and thread finger tight plus $\frac{1}{8}$ of a turn. Thread the wires through the nipple. Note it may be easier to remove the terminal block from the temperature housing to reinsert the RTD wires.
8. Using appropriate thread lubricant, reinstall the $\frac{1}{2}$ -in. NPT plug.
9. Use the same PTFE gaskets to reinstall the transmitter to the Annubar Flowmeter sensor head.
10. Use a torque wrench to tighten the stainless steel hex nuts in a cross pattern to 300 in-lbs.
11. Reconnect the RTD wires in the temperature housing and replace the cover.
12. Open the instrument valves.

Figure 4-1. Exploded View of Direct Mounted Annubar Sensor, Integral RTD Installation

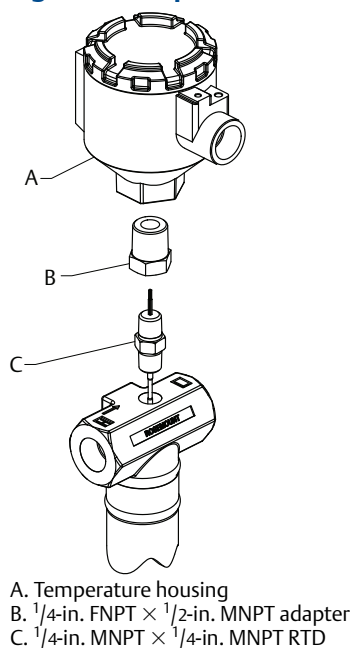


Remote mount

If an RTD needs to be replaced on a remote mounted Annubar Flowmeter, proceed as follows:

1. Close instrument valves to ensure that the pressure is isolated from the transmitter.
2. Open the bleed valves on the transmitter to remove all pressure.
3. Remove the cap from the temperature housing.
4. Remove the RTD wiring from the terminal block.
5. Remove the temperature housing from the head.
6. Pull the RTD wire out of the nipple and remove the RTD. The RTD is in a thermowell. No live line pressure will be present.
7. Install the new RTD and thread the wires through the nipple.
8. Using the appropriate thread lubricant or tape, install the terminal housing onto the remote head.
9. Reconnect the RTD wires to the terminal.
10. Open the instrument valves.

Figure 4-2. Exploded View of Remote Mounted Annubar Sensor, Integral RTD Installation



4.2.2 Electrical RTD check procedure

If the RTD is not functioning properly, perform the following checks to determine if the RTD is failed. Figure 4-3 shows the schematic of a 4-wire RTD.

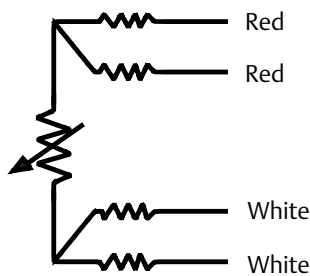
Continuity check

1. Using an Ohm meter or a Multimeter, check the resistance between each of the red and white wires.
2. If the resistance measured represents the proper temperature, proceed to the Grounding Check.
3. If the resistance measured does not represent the proper temperature or no resistance is measured (i.e. Open circuit), the RTD is damaged and must be replaced.

Grounding check

1. Using an Ohm meter or a Multimeter, test for each wire of the RTD to the sheath for a resistance value. If the RTD is installed in the Annubar sensor, test to the instrument connections of Annubar sensor instead of the sheath of the RTD. All tests should measure an infinite resistance (i.e. Open circuit) between the RTD wires and the sheath.
2. If all tests verify an open circuit, the RTD is functioning properly.
3. If any tests confirm a shorted wire to the RTD sheath, the RTD is damaged and must be replaced.

Figure 4-3. Schematic of a Typical 4-Wire RTD



4.3 Pak-Lok, Flange-Lok, and Flo-Tap maintenance

The Pak-Lok, Flange-Lok, and Flo-Tap models utilize a packing gland mechanism to sustain a seal on the process fluid. Periodically the packing rings need to be checked to ensure that they are continuing to seal properly.

- Check the packing gland for leaks. If a leak is present, check that the nuts are tightened down on the packing studs. If the leak persists, then the packing rings should be replaced.
- If the process fluid goes through large degrees of temperature cycling, verify that the packing is tightened down sufficiently and that the tip of the Annubar sensor is still secured against the opposite side pipe wall. A leak would indicate the packing has loosened. Also, excessive vibration of the Pak-Lok, Flange-lok, or Flo-tap model could indicate the tip of the sensor is no longer secured to the pipe wall. For the Pak-lok or Flange-lok models, re-tighten the nuts to ensure that the packing is sufficiently tightened and that the tip of the Annubar sensor is still secured against the opposite side pipe wall. For the Flo-tap models, tighten the drive nuts or rotate the crank clockwise until the sensor is secured against the opposite side pipe wall. Re-tighten the packing gland nuts to ensure that the packing is sufficiently tightened.
- If there is excessive vibration present in the Annubar sensor, immediate attention is required as the sensor may no longer be secured against the opposite side pipe wall. This could result in the sensor bending, cracking, or breaking. For the Pak-lok or Flange-lok models, re-tighten the nuts to ensure that the packing is sufficiently tightened and that the tip of the Annubar sensor is still secured against the opposite side pipe wall. For the Flo-tap models, tighten the drive nuts or rotate the crank clockwise until the sensor is secured against the opposite side pipe wall. Re-tighten the packing gland nuts to ensure that the packing is sufficiently tightened. If excessive vibration is still present, contact an Emerson™ Process Management representative.
- If the packing rings appear brittle, old, or compressed beyond further use, a new set of rings should be ordered for replacement. Installation instructions can be found in [Section 2: Installation](#) of this manual.

Table 4-1. Replacement Part Numbers for Pak-Lok, Flange-Lok, and Flo-Tap Packing

Model	Packing kits	Part number
Pak-Lok or Flange-Lok	Sensor Size 1 Grafoil (Standard)	28-503002-920
	Sensor Size 2 Grafoil (Standard)	28-503002-921
	Sensor Size 3 Grafoil (Standard)	28-503002-922
	Sensor Size 1 PTFE (Option P2)	28-503002-910
	Sensor Size 2 PTFE (Option P2)	28-503002-911
	Sensor Size 3 PTFE (Option P2)	28-503002-912
Flo-tap	485 Sensor Size 1 Grafoil (Standard)	28-505010-900
	485 Sensor Size 2/585 Sensor Size 22 Grafoil (Standard)	28-505010-901
	485 Sensor Size 3/585 Sensor Size 44 Grafoil (Standard)	28-505010-902
	485 Sensor Size 1 PTFE (Option P2)	28-505010-910
	485 Sensor Size 2/585 Sensor Size 22 PTFE (Option P2)	28-505010-911
	485 Sensor Size 3/585 Sensor Size 44 PTFE (Option P2)	28-505010-912

4.4 Gas entrapment

In certain liquid applications (i.e. – buried water lines) it may be necessary to mount the transmitter and Annubar sensor above the pipe. This can lead to gas entrapment in the impulse piping which causes erratic flow readings.

One way to combat this problem is to install Automatic Vent Packages (AVP) on the impulse lines. The vents will purge the gas periodically and keep the impulse lines clear. The key to the installation is installing the vents and impulse piping so that any gas travels up to the vents and away from the transmitter. Vents can usually be installed at any time. Contact your Emerson Process Management representative for more details.

4.5 Dirt accumulation

One inherent advantage of an Annubar primary element over devices such as orifice plates is the ability to function in flows carrying dirt and grease. However, under extreme cases, some of the sensing ports are completely obstructed or the outside shape is drastically changed by buildup.

There are two methods of cleaning the Annubar primary element to restore performance. Mechanical cleaning is the more certain method, but does require removal of the Annubar primary element. Purging is effective if the accumulation covers the sensing ports or blocks internal passages.

In applications where a large amount of foreign material exists, it may be necessary to perform a routine preventative maintenance by removing the Annubar primary element for cleaning. The outer surfaces should be cleaned with a soft wire brush. The internal passages should be cleaned with compressed air. If necessary, a solvent for dissolving foreign material may be appropriate.

Purging with an external fluid source under a higher pressure is an effective means of retaining clear pressure pathways in the Annubar primary element.

The following precautions should be taken:

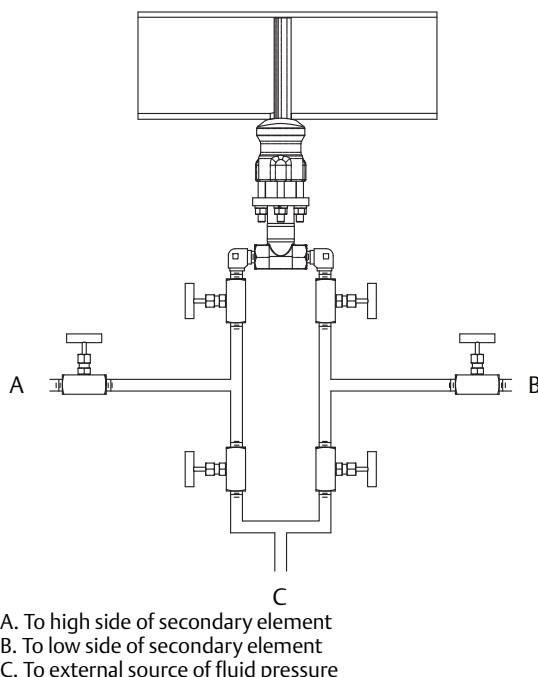
1. The purging fluid must be compatible with the process fluid and shouldn't cause other problems such as contamination.
2. The purging fluid should be preheated or pre-cooled if the temperature difference of the fluid and the process exceeds 150 °F (66 °C).
3. The differential pressure transmitter or meter should be isolated from the purge fluid to prevent over-ranging.
4. Continuous purging is not recommended.

The length of time between purges, or the cycle time, as well as the length and volume of the purge cycle must be determined experimentally. Some guidelines established as a starting point for experimentation are as follows:

1. Supply pressure of at least 60 PSIG (415 kPa-g) and not exceeding 115 PSIG (795 kPa).
2. Purge air flow rate of at least 40 SCFM (68 Nm³/h) when flowing at 60 PSIG (415 kPa).
3. Purge duration of at least 60 seconds.

4. Purge with dry air (less than 5% moisture by weight).
5. Stainless steel purge tubing should have a minimum of 1/2-in. (12.5 mm) O.D. and at least 0.035-in. (0.89 mm) wall thickness. Care must be taken to protect the secondary instrumentation from high pressures and temperatures when purging an Annubar primary element. Ear protection is also recommended for all personnel in the vicinity of the system being purged. See figure for sample set-up.

Figure 4-4. Impulse Tube Arrangement for Purge



4.6 Main steam line Annubar sensor maintenance

Due to the extreme conditions that the Rosemount® 585 Main Steam Line Annubar Flowmeters come into contact with, it should be removed and inspected annually to check for wear. Emerson Process Management recommends a visual inspection and a Dye Penetrant; examine to identify any cracks or wear on the Annubar sensor. After the Annubar sensor is inspected, it is recommended to replace the packing rings to ensure a proper seal. [Table 4-1](#) shows the replacement part numbers for the packing rings and other spare parts.

Table 4-2. Replacement Part Numbers for the Packing Rings and Other Spare Parts

Packing kits	Part number	Quantity
Packing Rings – Split	19006-67	2
Packing Rings – Solid Carbon/Graphite	19006-04	3
Packing Gland Stud	16147-07	16
Packing Gland/Support Plate Nuts	16068-06	16
Support Plate Lock Washers	00-101005-01	8

Table 4-2. Replacement Part Numbers for the Packing Rings and Other Spare Parts

Packing kits	Part number	Quantity
Packing Gland Washers	16103-01	8
Locking Rod	30343-02	2
Roll Pins for Locking Rod	00-101007-01	4
Locking Nuts	16068-01	8
Locking Washers	00-101005-03	8

Emerson Process Management also recommends that the Annubar sensor is removed for steam blow down and other maintenance procedures. The sensor must be replaced with the packing gland plug to seal the mounting hardware.

Removal procedures

1. Allow the Annubar sensor and the mounting hardware to cool.
2. Loosen the Packing Gland Nuts.
3. Remove the Locking Nuts and Washers from the top of the Locking Rods.
4. Slide the Annubar Sensor out of the mounting hardware.

Installation of the packing gland plug

1. Place the packing into the packing gland with the two split rings (Garlock style 1303FEP) on the outside and the three Garlock Carbon/Graphite solid die-formed rings on the inside. Make sure the splits in the outer packing are 180° apart.
2. Slide the Packing Gland Plug through the packing and install the locking rods, nuts, and washers.
3. Tighten the packing gland nuts to 25 to 30 ft.-lbs. (34 to 41 Nm).

Refer to [Section 2: Installation](#) of this manual for re-installation procedures of the Annubar sensor.

Section 5 Troubleshooting

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5.1 Basic troubleshooting

If a malfunction is suspected despite the absence of a diagnostic message on the communicator display, follow the procedures described below to verify that the flowmeter hardware and process connections are in good working order. Always approach the most likely and easiest-to-check conditions first.

Table 5-1. Troubleshooting Guide

Symptom	Possible cause	Corrective action
Low Reading	Annubar sensor not fully installed (not spanning the inner diameter of the pipe)	- Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. - Consult Factory if dimensions do not match. - During re-installation mark tip of Annubar® sensor, install, remove and inspect marking to insure contact with opposite side of the pipe.
	Annubar sensor not aligned properly in flow profile	Refer to the installation instructions in Section 2: Installation of this manual for proper alignment straight across pipe I.D., with upstream sensing holes facing straight upstream in flow profile.
	Annubar sensor not installed in proper pipe size	- Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. - Consult Factory if dimensions do not match.
	Annubar sensor installed too close to an upstream flow disturbance, such as a pipe elbow.	Compare installation to recommended straight pipe run referenced in the installation instructions in Section 2: Installation of this manual.
	DP Transmitter not zeroed properly, or not configured correctly	- Verify DP sensor has been zeroed properly. - Verify transmitter range is correct, and if square root output is correct. - Verify Annubar sensor calc sheet represents fluid density properly so that transmitter is configured correctly for the application.
High Reading	Annubar sensor not installed in proper pipe size	- Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. - Consult Factory if dimensions do not match.
	DP transmitter not zeroed properly or not configured properly	- Verify DP sensor has been zeroed properly. - Verify transmitter range is correct, and if square root output is correct. - Verify Annubar sensor calc sheet represents fluid density properly so that transmitter is configured correctly for the application.

Table 5-1. Troubleshooting Guide

Symptom	Possible cause	Corrective action
Erratic Signal/ Negative Reading/ No reading	Annubar sensor is installed backwards	Verify that the flow arrow on the instrument connections of the Annubar sensor is pointing in the direction of flow.
	Annubar sensor is broken or missing	Remove sensor and verify that the Annubar sensing element is in tact and undamaged.
	Instrument valves are closed	Verify the high and low instrument valves are open.
	Annubar Flowmeter is mounted too close to flow disturbance	Verify the installation and compare with recommended installation distances from disturbances as shown in Installation section of this manual.
	Air in instrument impulse lines (liquid applications)	Reinstall impulse lines, eliminating high areas in which air can collect.
	Noisy DP signal from vertical down steam or liquid application	Relocate Annubar sensor to a location that is not vertical down or use the transmitter dampening to smooth out the DP signal.
Annubar sensor too long or too short	Pipe dimensions were not properly supplied	- Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. - Consult Factory if dimensions do not match.
	The mounting hardware supplied is not the correct length	- Check mounting height and compare to the dimensions shown in the Dimensional Drawings. - Consult factory if dimensions do not match.
	Annubar sensor looks too long (Pak-lok or Flange-lok Models)	- Verify the actual pipe ID and wall dimensions and compare to the Calculation Data Sheet. - Consult factory if dimensions do not match. - Review the installation instructions found in section 2 and review the images of a proper installation.
	Opposite Side Support is not installed on pipe	Install Opposite side support (if required by Annubar sensor model) as specified in the installation instructions found in Section 2: Installation.
Annubar sensor won't fit in the drilled hole	Drill hole is not the proper size	- Verify that the drill hole matches the size specified in the installation instructions found in Section 2: Installation. - Re-drill the mounting hole with proper drill hole size.
	Drill hole is not aligned properly with Annubar sensor mounting hardware	- Verify that the mounting hardware is centered over pipe hole. - If necessary, re-install mounting hardware.
	Hole was torch-cut (pipe fragments blocking hole)	Re-Drill the hole in a different location as specified in the installation instructions found in Section 2: Installation.

Table 5-1. Troubleshooting Guide

Symptom	Possible cause	Corrective action
Severe Vibration of the Sensor	Annubar sensor is not properly sized for the application	• Verify process conditions on the Calculation Data Sheet are accurate. • Consult Factory if process conditions have changed.
	The tip of the Annubar Flowmeter is not properly bottomed for Pak-lok, Flange-lok or Flo-tap Models	• For Flo-tap models, turn crank handle until the sensor is bottomed per the installation instructions found in Section 2: Installation. • For Pak-lok and Flange-lok models, tighten the nuts per the installation instructions found in Section 2: Installation.
	Excessive Pipe Vibration	• Check vibration on pipe and install additional supports for Annubar sensor if necessary. Consult factory.
Incorrect Measurement	Failed RTD	• See maintenance section for removal and testing of RTD element.
	Transmitter out of calibration	• See calibration procedures for the appropriate style transmitter.
	Transmitter improperly configured	• Verify flow configuration information for MultiVariable™ Mass Flow Transmitters or scaled variable information for 3051S DP transmitters. • Also verify the 20 mA point set in the transmitter corresponds to the 20 mA point in the control system.

5.2 Return of materials

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

 The center will ask for the following information:

- Product model
- Serial numbers
- The last process material to which the product was exposed

The center will provide:

- A Return Material Authorization (RMA) number
- Instructions and procedures that are necessary to return goods that were exposed to hazardous substances

Note

If a hazardous substance is identified, a Material Safety Data Sheet (MSDS), required by law to be available to people exposed to specific hazardous substances, must be included with the returned materials.

Appendix A Specifications and Reference Data

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A.1 3051SFA ordering information



A.1.1 Rosemount® 3051SFA Annubar® Flowmeter

- Annubar flowmeters reduce permanent pressure loss by creating less blockage in the pipe.
- Ideal for large line size installations when cost, size and weight of the flowmeter are concerns.

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

• = Available
— = Unavailable

Model	Product description	Measurement type		
		D	1-7	
3051SFA	Annubar Flowmeter	•	•	
Measurement type				
1	Fully Compensated Mass & Energy Flow Calculations – Differential & Static Pressures w/ Temperature	—	•	★
2	Compensated Flow Calculations – Differential & Static Pressures	—	•	★
3	Compensated Flow Calculations – Differential Pressure & Temperature	—	•	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Measurement type		D	1-7	
4	Compensated Flow Calculations – Differential Pressure	—	•	★
D	Differential Pressure	•	—	
5	Process Variables Only (No Flow Calculations) – Differential & Static Pressures w/ Temperature	—	•	★
6	Process Variables Only (No Flow Calculations) – Differential & Static Pressures	—	•	★
7	Process Variables Only (No Flow Calculations) – Differential Pressure & Temperature	—	•	★
Fluid type				
L	Liquid	•	•	★
G	Gas	•	•	★
S	Steam	•	•	★
Line size				
020	2-in. (50 mm)	•	•	★
025	2½-in. (63.5 mm)	•	•	★
030	3-in. (80 mm)	•	•	★
035	3½-in. (89 mm)	•	•	★
040	4-in. (100 mm)	•	•	★
050	5-in. (125 mm)	•	•	★
060	6-in. (150 mm)	•	•	★
070	7-in. (175 mm)	•	•	★
080	8-in. (200 mm)	•	•	★
100	10-in. (250 mm)	•	•	★
120	12-in. (300 mm)	•	•	★
140	14-in. (350 mm)	•	•	
160	16-in. (400 mm)	•	•	
180	18-in. (450 mm)	•	•	
200	20-in. (500 mm)	•	•	
240	24-in. (600 mm)	•	•	
300	30-in. (750 mm)	•	•	
360	36-in. (900 mm)	•	•	

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Line size		D	1-7	
420	42-in. (1066 mm)	•	•	
480	48-in. (1210 mm)	•	•	
600	60-in. (1520 mm)	•	•	
720	72-in. (1820 mm)	•	•	
780	78-in (1950 mm)	•	•	
840	84-in. (2100 mm)	•	•	
900	90-in. (2250 mm)	•	•	
960	96-in. (2400 mm)	•	•	
Pipe I.D. range⁽¹⁾				
C	Range C from the Pipe I.D. table	•	•	★
D	Range D from the Pipe I.D. table	•	•	★
A	Range A from the Pipe I.D. table	•	•	
B	Range B from the Pipe I.D. table	•	•	
E	Range E from the Pipe I.D. table	•	•	
Z	Non-standard Pipe I.D. range or line sizes greater than 12-in. (300 mm)	•	•	
Pipe material/Mounting assembly material				
C	Carbon steel (A105)	•	•	★
S	316 Stainless Steel	•	•	★
0 ⁽²⁾	No mounting (customer supplied)	•	•	★
G	Chrome-Moly Grade F-11	•	•	
N	Chrome-Moly Grade F-22	•	•	
J	Chrome-Moly Grade F-91	•	•	
Piping orientation				
H	Horizontal piping	•	•	★
D	Vertical piping with downwards flow	•	•	★
U	Vertical piping with upwards flow	•	•	★
Annubar type				
P	Pak-Lok	•	•	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Annubar type		D	1-7	
F	Flanged with opposite side support	•	•	★
L	Flange-Lok	•	•	
G	Gear-Drive Flo-Tap	•	•	
M	Manual Flo-Tap	•	•	
Sensor material				
S	316 Stainless Steel	•	•	★
H	Alloy C-276	•	•	
Sensor size				
1	Sensor size 1 — Line sizes 2-in. (50 mm) to 8-in. (200 mm)	•	•	★
2	Sensor size 2 — Line sizes 6-in. (150 mm) to 96-in. (2400 mm)	•	•	★
3	Sensor size 3 — Line sizes greater than 12-in. (300 mm)	•	•	★
Mounting type				
T1	Compression or threaded connection	•	•	★
A1	150# RF ANSI	•	•	★
A3	300# RF ANSI	•	•	★
A6	600# RF ANSI	•	•	★
D1	DN PN16 flange	•	•	★
D3	DN PN40 flange	•	•	★
D6	DN PN100 flange	•	•	★
A9 ⁽³⁾	900# RF ANSI	•	•	
AF ⁽³⁾	1500# RF ANSI	•	•	
AT ⁽³⁾	2500 # RF ANSI	•	•	
R1	150# RTJ flange	•	•	
R3	300# RTJ flange	•	•	
R6	600# RTJ flange	•	•	
R9 ⁽³⁾	900# RTJ flange	•	•	
RF ⁽³⁾	1500# RTJ flange	•	•	
RT ⁽³⁾	2500# RTJ flange	•	•	

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Opposite side support or packing gland				D	1-7	
0	No opposite side support or packing gland (Required for Pak-Lok and Flange-Lok models)			•	•	★
Opposite side support – required for flanged models						
C	NPT threaded opposite support assembly – extended tip			•	•	★
D	Welded opposite support assembly – extended tip			•	•	★
Packing gland – required for Flo-Tap models						
	Packing gland material	Rod material	Packing material			
J ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Carbon Steel	PTFE	•	•	
K ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Stainless Steel	PTFE	•	•	
L ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Carbon Steel	Graphite	•	•	
N ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Stainless Steel	Graphite	•	•	
R	Alloy C-276 packing gland/cage nipple	Stainless Steel	Graphite	•	•	
Isolation valve for Flo-Tap models						
0 ⁽²⁾	Not applicable or customer supplied			•	•	★
1	Gate valve, Carbon Steel			•	•	
2	Gate valve, Stainless Steel			•	•	
5	Ball valve, Carbon Steel			•	•	
6	Ball valve, Stainless Steel			•	•	
Temperature measurement						
T ⁽⁵⁾	Integral RTD – not available with flanged model greater than class 600#			•	•	★
0 ⁽⁶⁾	No temperature sensor			•	•	★
R ⁽⁵⁾	Remote thermowell and RTD			•	•	
Transmitter connection platform						
3	Direct-mount, Integral 3-valve Manifold– not available with flanged model greater than class 600			•	•	★
5	Direct -mount, 5-valve Manifold – not available with flanged model greater than class 600			•	•	★
7	Remote-mount NPT connections (1/2-in. FNPT)			•	•	★
6	Direct-mount, High Temperature 5-valve Manifold – not available with flanged model greater than class 600			•	•	

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Transmitter connection platform				D	1-7		
8	Remote-mount SW connections (¹ / ₂ -in.)			•	•		
Differential pressure range							
1	0 to 25 inH ₂ O (0 to 62,3 mbar)			•	•	★	
2	0 to 250 inH ₂ O (0 to 623 mbar)			•	•	★	
3	0 to 1000 inH ₂ O (0 to 2,5 bar)			•	•	★	
Static pressure range							
A ⁽⁷⁾	None			•	•	★	
D	Absolute 0.5 to 800 psia (0,033 to 55,2 bar)			—	•	★	
E ⁽⁸⁾	Absolute 0.5 to 3626 psia (0,033 to 250 bar)			—	•	★	
J	Gage -14.2 to 800 psig (-0,979 to 55,2 bar)			—	•	★	
K ⁽⁸⁾	Gage -14.2 to 3626 psig (-0,979 to 250 bar)			—	•	★	
Transmitter output							
A	4–20 mA with digital signal based on HART® protocol			•	•	★	
F	FOUNDATION Fieldbus™ protocol (requires PlantWeb® housing)			•	—	★	
X ⁽⁹⁾⁽¹⁰⁾	Wireless (requires wireless options and Wireless PlantWeb housing)			•	—	★	
Transmitter housing style			Material	Conduit entry size			
00	None (Customer-supplied electrical connection)		N/A	N/A	•	—	★
1A	PlantWeb housing		Aluminum	¹ / ₂ -14 NPT	•	•	★
1B	PlantWeb housing		Aluminum	M20 × 1.5	•	•	★
1J	PlantWeb housing		SST	¹ / ₂ -14 NPT	•	•	★
1K	PlantWeb housing		SST	M20 × 1.5	•	•	★
2A	Junction Box housing		Aluminum	¹ / ₂ -14 NPT	•	—	★
2B	Junction Box housing		Aluminum	M20 × 1.5	•	—	★
2E	Junction Box housing with output for remote display and interface		Aluminum	¹ / ₂ -14 NPT	•	—	★
2F	Junction Box housing with output for remote display and interface		Aluminum	M20 × 1.5	•	—	★
2J	Junction Box housing		SST	¹ / ₂ -14 NPT	•	—	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Transmitter housing style		Material	Conduit entry size	D	1-7	
2M	Junction Box housing with output for remote display and interface	SST	1/2-14 NPT	•	—	★
5A ⁽¹¹⁾	Wireless PlantWeb housing	Aluminum	1/2-14 NPT	•	—	★
5J ⁽¹¹⁾	Wireless PlantWeb housing	SST	1/2-14 NPT	•	—	★
7J ⁽⁹⁾⁽¹²⁾	Quick Connect (A size Mini, 4-pin male termination)	N/A	N/A	•	—	★
1C	PlantWeb housing	Aluminum	G1/2	•	•	
1L	PlantWeb housing	SST	G1/2	•	•	
2C	Junction Box housing	Aluminum	G1/2	•	—	
2G	Junction Box housing with output for remote display and interface	Aluminum	G1/2	•	—	
Performance class⁽¹³⁾						
3051S MultiVariable SuperModule, measurement types 1, 2, 5, and 6						
3 ⁽¹⁴⁾	Ultra for Flow: 0.8% flow rate accuracy, 14:1 flow turndown, 10-year stability. limited 12-year warranty			•	•	★
5	Classic MV: 0.85% flow rate accuracy, 8:1 flow turndown, 5-yr. stability			—	•	★
3051S Single Variable SuperModule, measurement types 3, 4, 7, and D						
1	Ultra: up to 0.9% flow rate accuracy, 8:1 flow turndown, 10-year stability, limited 12-year warranty			•	—	★
2	Classic: up to 1.1% flow rate accuracy, 8:1 flow turndown, 5-year stability			•	—	★
3	Ultra for Flow: 0.8% flow rate accuracy, 14:1 flow turndown, 10-year stability,. limited 12-year warranty			•	•	★

Wireless options⁽¹⁰⁾ (requires option code X and wireless PlantWeb housing)

Update rate, operating frequency and protocol		D	1-7	
WA	User configurable update rate	•	—	★
Operating frequency and protocol				
3	2.4 GHz DSSS, IEC 62591 (WirelessHART®)	•	—	★
Omni-directional wireless antenna				
WK	External antenna	•	—	★
WM	Extended range, external antenna	•	—	

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Omni-directional wireless antenna		D	1-7	
WN	High-Gain, remote antenna	•	—	
SmartPower™ Adapter⁽¹⁵⁾				
1	Adapter for Black Power Module (I.S. Power Module sold separately)	•	—	★

Other options (include with selected model number)

Extended product warranty		D	1-7	
WR3	3-year limited warranty	•	•	★
WR5	5-year limited warranty	•	•	★
Pressure testing⁽¹⁶⁾				
P1	Hydrostatic testing with certificate	•	•	
PX	Extended hydrostatic testing	•	•	
Special cleaning				
P2	Cleaning for special services	•	•	
PA	Cleaning per ASTM G93 level D (section 11.4)	•	•	
Material testing				
V1	Dye penetrant exam	•	•	
Material examination				
V2	Radiographic examination	•	•	
Flow calibration				
W1	Flow calibration (average K)	•	•	
Special inspection				
QC1	Visual and dimensional inspection with certificate	•	•	★
QC7	Inspection and performance certificate	•	•	★
Surface finish				
RL	Surface finish for low pipe Reynolds number in gas and steam	•	•	★
RH	Surface finish for high pipe Reynolds number in liquid	•	•	★
Material traceability certification⁽¹⁷⁾				
Q8	Material traceability certificate per EN 10204:2004 3.1	•	•	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Code conformance ⁽¹⁸⁾		D	1-7	
J2	ANSI/ASME B31.1	•	•	
J3	ANSI/ASME B31.3	•	•	
Material conformance ⁽¹⁹⁾				
J5	NACE MR-0175/ISO 15156	•	•	
Country certification				
J6	European Pressure Directive (PED)	•	•	★
J1	Canadian Registration	•	•	
Installed in flanged pipe spool section				
H3	150# Flanged connection with Rosemount standard length and schedule	•	•	
H4	300# Flanged connection with Rosemount standard length and schedule	•	•	
H5	600# Flanged connection with Rosemount standard length and schedule	•	•	
Instrument connections for remote mount option				
G2	Needle valves, Stainless Steel	•	•	★
G6	OS&Y gate valve, Stainless Steel	•	•	★
G1	Needle valves, Carbon Steel	•	•	
G3	Needle valves, Alloy C-276	•	•	
G5	OS&Y gate valve, Carbon Steel	•	•	
G7	OS&Y gate valve, Alloy C-276	•	•	
Special shipment				
Y1	Mounting hardware shipped separately	•	•	★
Special dimensions				
VM	Variable mounting	•	•	
VT	Variable tip	•	•	
VS	Variable length spool section	•	•	
Transmitter calibration certification				
Q4	Calibration certificate for transmitter	•	•	★
QP	Calibration Certificate & Tamper Evident Seal	•	•	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Quality certification for safety ⁽²²⁾⁽³⁰⁾		D	1-7	
QS	Certificate of FMEDA data	•	—	★
QT ⁽²¹⁾	Safety certified to IEC 61508 with certificate of FMEDA data	•	—	★
Product certifications				
E1	ATEX Flameproof	•	•	★
I1	ATEX Intrinsic Safety	•	•	★
IA	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus protocol only	•	—	★
N1	ATEX Type n	•	•	★
ND	ATEX Dust	•	•	★
K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E1, I1, N1, and ND)	•	•	★
E4	TIIS Flameproof	•	•	★
E5	FM Explosion-proof, Dust Ignition-proof	•	•	★
I5	FM Intrinsically Safe; Nonincendive	•	•	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	•	•	★
E6 ⁽²⁰⁾	CSA Explosion-proof, Dust Ignition-proof, Division 2	•	•	★
I6	CSA Intrinsically Safe	•	•	★
K6 ⁽²⁰⁾	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	•	•	★
E7	IECEx Flameproof, Dust Ignition-proof	•	•	★
I7	IECEx Intrinsic Safety	•	•	★
K7	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	•	•	★
E3	China Flameproof	•	•	★
EM	Technical Regulations Customs Union (EAC) Flameproof	•	•	★
IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	•	•	★
KM	Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety	•	•	★
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2 (combination of E5, E1, I5, and I1)	•	•	★
KD ⁽²⁰⁾	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)	•	•	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Shipboard approvals		D	1-7	
SBS	American Bureau of Shipping	•	•	
SBV	Bureau Veritas (BV) Type Approval	•	•	
SDN	Det Norske Veritas (DNV) Type Approval	•	•	
SLL	Lloyds Register (LR) Type Approval	•	•	
Sensor fill fluid and O-ring options				
L1	Inert sensor fill fluid	•	•	★
L2	Graphite-filled (PTFE) O-ring	•	•	★
LA	Inert sensor fill fluid and Graphite-filled (PTFE) O-ring	•	•	★
Digital display ⁽²¹⁾				
M5	PlantWeb LCD display (requires PlantWeb housing)	•	•	★
M7 ⁽²²⁾⁽²³⁾⁽²⁴⁾	Remote mount LCD display and interface, no cable; PlantWeb housing, SST bracket	•	•	★
M8 ⁽²²⁾⁽²³⁾	Remote mount LCD display and interface, 50-ft. (15 m) cable; PlantWeb housing, SST bracket	•	•	★
M9 ⁽²²⁾⁽²³⁾⁽²⁴⁾	Remote mount LCD display and interface, 100-ft. (31 m) cable; PlantWeb housing, SST bracket	•	•	★
Transient protection ⁽²⁵⁾				
T1	Transient terminal block	•	•	★
Manifold for remote mount option				
F2	3-Valve Manifold, Stainless Steel	•	•	★
F6	5-Valve Manifold, Stainless Steel	•	•	★
F1	3-Valve Manifold, Carbon Steel	•	•	
F3	3-Valve Manifold, Alloy C-276	•	•	
F5	5-Valve Manifold, Carbon Steel	•	•	
F7	5-Valve Manifold, Alloy C-276	•	•	
PlantWeb control functionality				
A01	FOUNDATION Fieldbus™ advanced control function block suite	•	—	★
PlantWeb diagnostic functionality				
D01	FOUNDATION Fieldbus diagnostics suite	•	—	★
DA2 ⁽²⁶⁾	Advanced HART diagnostic suite	•	—	★

Table 1. Rosemount 3051SFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

PlantWeb enhanced measurement functionality ⁽²⁷⁾		D	1-7	
H01	FOUNDATION Fieldbus fully compensated mass flow block	•	—	★
Cold temperature ⁽²⁸⁾				
BRR	-60 °F (-51 °C) Cold temperature start-up	•	•	★
Alarm limit ⁽²²⁾⁽²⁹⁾				
C4	NAMUR alarm and saturation levels, high alarm	•	•	★
C5	NAMUR alarm and saturation levels, low alarm	•	•	★
C6	Custom alarm and saturation levels, high alarm	•	•	★
C7	Custom alarm and saturation levels, low alarm	•	•	★
C8	Low alarm (standard Rosemount alarm and saturation levels)	•	•	★
Hardware adjustments and ground screw				
D1 ⁽²²⁾⁽²⁹⁾⁽³⁰⁾	Hardware adjustments (zero, span, alarm, security)	•	—	★
D4 ⁽³¹⁾	External ground screw assembly	•	•	★
DA ⁽²²⁾⁽²⁹⁾⁽³⁰⁾	Hardware adjustments (zero, span, alarm, security) and external ground screw assembly	•	—	★
Conduit plug				
DO	316 SST conduit plug	•	•	★
Conduit electrical connector ⁽³²⁾				
GE	M12, 4-pin, Male Connector (eurofast [®])	•	•	★
GM	A size Mini, 4-pin, Male Connector (minifast [®])	•	•	★
Typical model number: 3051SFA D L 060 D C H P S 2 T1 0 0 0 3 2A A 1A 3				

1. See the DP Flow Product Data Sheet (document number 00813-0100-4485) for Pipe I.D. table.
2. Provide the "A" dimension for Flanged (page 181), Flange-Lok (page 179), and Threaded Flo-Tap (page 185) models. Provide the "B" dimension for Flange Flo-Tap models (page 183).
3. Available in remote mount applications only.
4. The cage nipple is constructed of 304SST.
5. Temperature Measurement Option code T or R is required for Measurement Type codes 1, 3, 5, and 7.
6. Required for Measurement Type codes 2, 4, 6, and D.
7. Required for Measurement Type codes 3, 4, 7, and D.
8. For Measurement Type 1, 2, 5, and 6 with DP range 1, absolute limits are 0.5 to 2000 psi (0,03 to 137,9 bar) and gage limits are -14.2 to 2000 psig (-0,98 to 137,9 bar).
9. Only intrinsically safe approval codes apply.
10. Only available with Measurement Types D and 6.
11. Only available with output code X.
12. Available with output code A only.
13. For detailed specifications see "Performance specifications" on page 109.
14. Only available with differential pressure ranges 2 and 3, and silicone fill fluid.
15. Long-life Power Module must be shipped separately, order Power Module 701PBKKE.
16. Applies to assembled flowmeter only, mounting not tested.
17. Instrument Connections for Remote Mount Options and Isolation Valves for Flo-Tap Models are not included in the Material Traceability Certification.
18. Not available with Transmitter Connection Platform 6.

19. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
20. Not available with M20 or G ¹/₂ conduit entry size.
21. Not available with housing code 7J.
22. Not available with output code X. Only available with Measurement Type D.
23. Not available with output code F, option code DA2, or option code QT.
24. See the 3051S Reference Manual (document number 00809-0100-4801) for cable requirements. Contact an Emerson [™] Process Management representative for additional information.
25. Not available with Housing code 5A, 5J, or 7J. External ground screw assembly (option code D4) is included with the T1 option. The T1 option is not needed with FISCO Product Certifications.
26. Includes Hardware Adjustments (option code D1) as standard. Not available with output code X. Only available with Measurement Type D.
27. Requires Rosemount Engineering Assistant version 5.5.1 to configure.
28. -58 °F (50 °C) for Measurement Type 1-7.
29. Not available with output code F.
30. Not available with housing codes 2E, 2F, 2G, 2M, 5A, 5J, or 7J.
31. This assembly is included with options E1, N1, K1, ND, E4, E7, N7, K7, E2, E3, KA, KC, KD, IA, IE, N3, T1, EM, and KM.
32. Not available with Housing code 5A, 5J, or 7J. Available with Intrinsically Safe approvals only. For FM Intrinsically Safe; Nonincendive (option code I5) or FM FISCO Intrinsically Safe (option code IE), install in accordance with Rosemount drawing 03151-1009.

A.2 3051SFC ordering information



Rosemount 3051SFC Compact Flowmeter

- Compact conditioning flowmeters reduce straight piping requirements to 2D upstream and 2D downstream from most flow disturbances
- Simple installation of compact flowmeters between any existing raised-face flanges

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

• = Available
— = Unavailable

Model	Product description	Measurement Type		
		D	1-7	
3051SFC	Compact Orifice Flowmeter	•	•	
Measurement type				
1	Fully Compensated Mass & Energy Flow Calculations – Differential & Static Pressures w/ Temperature	—	•	★
2	Compensated Flow Calculations – Differential & Static Pressures	—	•	★
3	Compensated Flow Calculations – Differential Pressure & Temperature	—	•	★
4	Compensated Flow Calculations – Differential Pressure	—	•	★
D	Differential Pressure	—	•	★
5	Process Variables Only (No Flow Calculations) – Differential & Static Pressures w/ Temperature	—	•	★
6	Process Variables Only (No Flow Calculations) – Differential & Static Pressures	—	•	★
7	Process Variables Only (No Flow Calculations) – Differential Pressure & Temperature	•	—	★
Primary element technology				
A	Annubar averaging pitot tube	•	•	★
C	Conditioning orifice plate	•	•	★
P	Orifice plate	•	•	★
Material type				
S	316 SST	•	•	★

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Line size		D	1-7	
005 ⁽¹⁾	1/2-in. (15 mm)	•	•	★
010 ⁽¹⁾	1-in. (25 mm)	•	•	★
015 ⁽¹⁾	1 1/2-in. (40 mm)	•	•	★
020	2-in. (50 mm)	•	•	★
030	3-in. (80 mm)	•	•	★
040	4-in. (100 mm)	•	•	★
060	6-in. (150 mm)	•	•	★
080	8-in. (200 mm)	•	•	★
100 ⁽²⁾⁽³⁾	10-in. (250 mm)	•	•	★
120 ⁽²⁾⁽³⁾	12-in. (300 mm)	•	•	★
Primary element type				
N000	Annubar sensor size 1	•	•	★
N040	0.40 Beta ratio (β)	•	•	★
N050	0.50 Beta ratio (β)	•	•	★
N065 ⁽⁴⁾	0.65 Beta ratio (β)	•	•	★
Temperature measurement				
T ⁽⁶⁾	Integral RTD	—	•	★
0 ⁽⁵⁾	No temperature sensor	•	•	★
R ⁽⁶⁾	Remote thermowell and RTD	•	•	
Transmitter connection platform				
3	Direct-mount	•	•	★
7	Remote-mount, NPT connections	•	•	★
Differential pressure range				
1	0 to 25 inH ₂ O (0 to 62.3 mbar)	•	•	★
2	0 to 250 inH ₂ O (0 to 623 mbar)	•	•	★
3	0 to 1000 inH ₂ O (0 to 2.5 bar)	•	•	★

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Static pressure range				D	1-7	
A ⁽⁷⁾	None			•	•	★
D	Absolute 0 to 800 psia (0 to 55.2 bar)			—	•	★
E ⁽⁸⁾	Absolute 0 to 3626 psia (0 to 250 bar)			—	•	★
J	Gage -14.2 to 800 psig (-0.979 to 55.2 bar)			—	•	★
K ⁽⁸⁾	Gage -14.2 to 3626 psig (-0.979 to 250 bar)			—	•	★
Transmitter output						
A	4–20 mA with digital signal based on HART protocol			•	•	★
F ⁽⁹⁾	FOUNDATION Fieldbus protocol			•	—	★
X ⁽¹⁰⁾⁽¹¹⁾	Wireless			•	—	★
Transmitter housing style		Material	Conduit entry size			
00	None (customer-supplied electrical connection)	N/A	N/A	•	—	★
1A	PlantWeb housing	Aluminum	1/2-14 NPT	•	•	★
1B	PlantWeb housing	Aluminum	M20 × 1.5	•	•	★
1J	PlantWeb housing	SST	1/2-14 NPT	•	•	★
1K	PlantWeb housing	SST	M20 × 1.5	•	•	★
2A	Junction Box housing	Aluminum	1/2-14 NPT	•	—	★
2B	Junction Box housing	Aluminum	M20 × 1.5	•	—	★
2E	Junction Box housing with output for remote display and interface	Aluminum	1/2-14 NPT	•	—	★
2F	Junction Box housing with output for remote display and interface	Aluminum	M20 × 1.5	•	—	★
2J	Junction Box housing	SST	1/2-14 NPT	•	—	★
2M	Junction Box housing with output for remote display and interface	SST	1/2-14 NPT	•	—	★
5A ⁽¹²⁾	Wireless PlantWeb housing	Aluminum	1/2-14 NPT	•	—	★
5J ⁽¹²⁾	Wireless PlantWeb housing	SST	1/2-14 NPT	•	—	★
7J ⁽¹⁰⁾⁽¹³⁾	Quick Connect (A size Mini, 4-pin male termination)	N/A	N/A	•	—	★
1C	PlantWeb housing	Aluminum	G1/2	•	•	

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Transmitter housing style		Material	Conduit entry size	D	1-7	
1L	PlantWeb housing	SST	G ¹ / ₂	•	•	
2C	Junction Box housing	Aluminum	G ¹ / ₂	•	—	
2G	Junction Box housing with output for remote display and interface	Aluminum	G ¹ / ₂	•	—	
Performance class ⁽¹⁴⁾						
3051S MultiVariable SuperModule, measurement types 1, 2, 5, and 6				•	•	
3 ⁽¹⁵⁾	Ultra for Flow: up to 0.75% flow rate accuracy, 14:1 flow turndown, 10-yr stability, limited 12-yr warranty			•	•	★
5	Classic MV: up to 1.10% flow rate accuracy, 8:1 flow turndown, 5-yr stability			—	•	★
3051S Single Variable SuperModule, measurement types 3, 4, 7, and D				•	•	
1	Ultra: up to 0.90% flow rate accuracy, 8:1 flow turndown, 10-yr stability, limited 12-yr warranty			•	—	★
2	Classic: up to 1.40% flow rate accuracy, 8:1 flow turndown, 5-yr stability			•	—	★
3 ⁽¹⁵⁾	Ultra for Flow: up to 0.75% flow rate accuracy, 14:1 flow turndown, 10-yr stability, limited 12-yr warranty			•	•	★

Wireless Options (Requires option code X and wireless PlantWeb housing)

Update rate, operating frequency, and protocol		D	1-7	
WA	User configurable update rate	•	—	★
Operating Frequency and protocol				
3	2.4 GHz DSSS, IEC 62591 (<i>WirelessHART</i>)	•	—	★
Omni-directional Wireless Antenna				
WK	External antenna	•	—	★
WM	Extended range, external antenna	•	—	★
WN	High-Gain, remote antenna	•	—	
SmartPower ⁽¹⁶⁾				
1	Adapter for Black Power Module (I.S. Power Module sold separately)	•	—	★

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Other Options (Include with selected model number)

Extended product warranty		D	1-7	
WR3	3-year limited warranty	•	•	★
WR5	5-year limited warranty	•	•	★
Installation accessories				
A	ANSI alignment ring (150#) (only required for 10-in. (250 mm) and 12-in. (300mm) line sizes)	•	•	★
C	ANSI alignment ring (300#) (only required for 10-in. (250 mm) and 12-in. (300mm) line sizes)	•	•	★
D	ANSI alignment ring (600#) (only required for 10-in. (250 mm) and 12-in. (300mm) line sizes)	•	•	★
G	DIN alignment ring (PN 16)	•	•	★
H	DIN alignment ring (PN 40)	•	•	★
J	DIN alignment ring (PN 100)	•	•	★
B	JIS alignment ring (10K)	•	•	
R	JIS alignment ring (20K)	•	•	
S	JIS alignment ring (40K)	•	•	
Remote adapters				
E	Flange adapters 316 SST (1/2-in. NPT)	•	•	★
High temperature applications				
T	Graphite valve packing ($T_{\max} = 850^{\circ}\text{F}$)	•	•	
Flow calibration				
WC ⁽¹⁷⁾	Discharge coefficient verification (3 point)	•	•	
WD ⁽¹⁸⁾⁽¹⁹⁾	Discharge coefficient verification (full 10 point)	•	•	
Pressure testing				
P1	Hydrostatic testing with certificate	•	•	
Special cleaning				
P2 ⁽²⁰⁾	Cleaning for special processes	•	•	
PA	Cleaning per ASTM G93 level D (section 11.4)	•	•	

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Special inspection		D	1-7	
QC1	Visual and dimensional inspection with certificate	•	•	★
QC7	Inspection and performance certificate	•	•	★
Transmitter calibration certification				
Q4	Calibration Data Certificate for Transmitter	•	•	★
QP	Calibration Certificate and Tamper Evident Seal	•	•	★
Quality certification for safety				
QS ⁽²¹⁾⁽²²⁾	Prior-use certificate of FMEDA data	•	—	★
QT ⁽²¹⁾⁽²²⁾⁽²⁵⁾	Safety certified to IEC 61508 with certificate of FMEDA data	•	—	★
Material traceability certifications				
Q8	Material traceability certification per EN 10204:2004 3.1	•	•	★
Code conformance				
J2	ANSI/ASME B31.1	•	•	
J3	ANSI/ASME B31.3	•	•	
J4	ANSI/ASME B31.8	•	•	
Material conformance ⁽²³⁾				
J5	NACE MR-0175/ISO 15156	•	•	
Country certification				
J1	Canadian Registration	•	•	
Product certifications				
E1	ATEX Flameproof	•	•	★
I1	ATEX Intrinsic Safety	•	•	★
IA	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus protocol only	•	—	★
N1	ATEX Type n	•	•	★
ND	ATEX Dust	•	•	★
K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E1, I1, N1, and ND)	•	•	★
E4	TIIS Flameproof	•	•	★
E5	FM Explosion-proof, Dust Ignition-proof	•	•	★

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Product certifications		D	1-7	
I5	FM Intrinsically Safe, Division 2	•	•	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	•	•	★
E6 ⁽²⁴⁾	CSA Explosion-proof, Dust Ignition-proof, Division 2	•	•	★
I6	CSA Intrinsically Safe	•	•	★
K6 ⁽²⁴⁾	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	•	•	★
E7	IECEx Flameproof, Dust Ignition-proof	•	•	★
I7	IECEx Intrinsic Safety	•	•	★
K7	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	•	•	★
E3	China Flameproof	•	•	★
I3	China Intrinsic Safety	•	•	★
EM	Technical Regulations Customs Union (EAC) Flameproof	•	•	★
IM	Technical Regulations Customs Union (EAC) Intrinsic Safety	•	•	★
KM	Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety	•	•	★
KA ⁽²⁴⁾	ATEX and CSA Flameproof, Intrinsically Safe, Division 2 (combination of E1, I1, E6, and I6)	•	•	★
KB ⁽²⁴⁾	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)	•	•	★
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2 (combination of E5, E1, I5, and I1)	•	•	★
KD ⁽²⁴⁾	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, E6, E1, I5, I6, and I1)	•	•	★
Shipboard approvals				
SBS	American Bureau of Shipping	•	•	★
SBV	Bureau Veritas (BV) Type Approval	•	•	★
SDN	Det Norske Veritas (DNV) Type Approval	•	•	★
SLL	Lloyds Register (LR) Type Approval	•	•	★
Sensor fill fluid and O-ring options				
L1	Inert sensor fill fluid	•	•	★

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Sensor fill fluid and O-ring options		D	1-7	
L2	Graphite-filled (PTFE) O-ring	•	•	★
LA	Inert sensor fill fluid and Graphite-filled (PTFE) O-ring	•	•	★
Digital display⁽²⁵⁾				
M5	PlantWeb LCD display	•	•	★
M7 ⁽²²⁾⁽²⁶⁾⁽²⁷⁾	Remote mount LCD display and interface, PlantWeb housing, no cable, SST bracket	•	—	★
M8 ⁽²²⁾⁽²⁶⁾	Remote mount LCD display and interface, PlantWeb housing, 50-ft. (15m) cable, SST bracket	•	—	★
M9 ⁽²²⁾⁽²⁶⁾	Remote mount LCD display and interface, PlantWeb housing, 100-ft. (31m) cable, SST bracket	•	—	★
Transient protection⁽²⁸⁾				
T1	Transient terminal block	•	•	★
Manifold for remote mount option				
F2	3-Valve Manifold, SST	•	•	★
F6	5-Valve Manifold, SST	•	•	★
PlantWeb control functionality				
A01	FOUNDATION Fieldbus advanced control function block suite	•	—	★
PlantWeb diagnostic functionality				
D01	FOUNDATION Fieldbus diagnostics suite	•	—	★
DA2 ⁽²⁹⁾	Advanced HART diagnostic suite	•	—	★
PlantWeb enhanced measurement functionality⁽³⁰⁾				
H01	FOUNDATION Fieldbus fully compensated mass flow block	•	—	★
Cold temperature⁽³¹⁾				
BRR	-60 °F (-51 °C) Cold Temperature Start-up	•	•	★
Alarm limit⁽²¹⁾⁽²²⁾				
C4	NAMUR alarm and saturation levels, high alarm	•	•	★
C5	NAMUR alarm and saturation levels, low alarm	•	•	★
C6	Custom alarm and saturation levels, high alarm	•	•	★

Table 2. Rosemount 3051SFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Alarm limit ⁽²¹⁾⁽²²⁾		D	1-7	
C7	Custom alarm and saturation levels, low alarm	•	•	★
C8	Low alarm (standard Rosemount alarm and saturation levels)	•	•	★
Hardware adjustments and ground screw				
D1 ⁽²¹⁾⁽²²⁾⁽³²⁾	Hardware adjustments (zero, span, alarm, security)	•	—	★
D4 ⁽³³⁾	External ground screw assembly	•	•	★
DA ⁽²¹⁾⁽²²⁾⁽³²⁾	Hardware adjustments (zero, span, alarm, security) and external ground screw assembly	•	—	★
Conduit plug				
DO	316 SST conduit plug	•	•	★
Conduit electrical connector ⁽³⁴⁾				
ZE	M12, 4-pin, male connector (eurofast [®])	•	•	★
ZM	A size Mini, 4-pin, male connector (minifast [®])	•	•	★
Typical model number: 3051SFC 1 C S 060 N 065 T 3 2 J A 1A 3				

- Available with primary element technology P only.
- For the 10-in. (250 mm) and 12-in. (300 mm) line size, the alignment ring must be ordered (Installation Accessories).
- 10-in. (250 mm) and 12-in. (300 mm) line sizes not available with Primary Element Technology code A.
- For 2-in. (50 mm) line sizes the Primary Element Type is 0.6 for Primary Element Technology Code C.
- Required for Measurement Type codes 2, 4, 6, and D.
- Only available with Transmitter Feature Board Measurement Type: 1, 3, 5, 7.
- Required for Measurement Type codes 3, 4, 7, and D.
- For Measurement Type 1, 2, 5, and 6 with DP range 1, absolute limits are 0.5 to 2000 psi (0,03 to 137,9 bar) and gage limits are -14.2 to 2000 psig (-0,98 to 137,9 bar).
- Requires PlantWeb housing.
- Only intrinsically safe approval codes apply.
- Only available with Measurement Types D and 6.
- Only available with output code X.
- Available with output code A only.
- For detailed specifications see "Performance specifications" on page 109.
- Only available with differential pressure ranges 2 and 3, and silicone fill fluid.
- Long-life Power Module must be shipped separately, order Part No. 00753-9220-0001.
- Available with primary element technology C only.
- Available with primary element technology C or A only.
- For Annubar Option A, consult factory for pipe schedules other than Sch. 40.
- Available with primary element technology C or P only.
- Not available with Output Protocol code F.
- Not available with output code X. Only available with Measurement Type D.
- Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
- Not available with M20 or G 1/2 conduit entry size.
- Not available with housing code 7J.
- Not available with output code F, option code DA2, or option code QT.
- See the 3051S Reference Manual (document number 00809-0100-4801) for cable requirements. Contact an Emerson Process Management representative for additional information.
- Not available with Housing code 00, 5A, 5J, or 7J. External ground screw assembly (option code D4) is included with the T1 option. The T1 option is not needed with FISCO Product Certifications.
- Includes Hardware Adjustments (option code D1) as standard. Not available with output code X. Only available with Measurement Type D.
- Requires Rosemount Engineering Assistant version 5.5.1 to configure.
- 58°F (50°C) for Measurement Type 1-7.
- Not available with housing style codes 2E, 2F, 2G, 2M, 5A, 5J, or 7J.
- This assembly is included with options EP, KP, E1, N1, K1, ND, E4, E7, K7, E3, KA, KC, KD, IA, T1, EM, and KM.
- Not available with Housing code 5A, 5J, or 7J. Available with Intrinsically Safe approvals only. For FM Intrinsically Safe; Nonincendive (option code I5) or FM FISCO Intrinsically Safe (option code IE), install in accordance with Rosemount drawing 03151-1009.

A.3 3051SF specifications

A.3.1 Performance specifications

Performance assumptions include: measured pipe I.D, transmitter is trimmed for optimum flow accuracy, and performance is dependent on application parameters.

Table 3. MultiVariable Flow Performance - Flow Reference Accuracy (Measurement Type1)⁽¹⁾⁽²⁾

3051SFA Annubar Flowmeter			
		Classic MV (8:1 flow turndown)	Ultra for flow (14:1 flow turndown)
Ranges 2-3		±1.15% of flow rate	±0.80% of flow rate
3051SFC_A Compact Annubar Flowmeter - Annubar Option A			
		Classic MV (8:1 flow turndown)	Ultra for Flow (14:1 flow turndown)
Ranges 2-3	Standard	±1.60% of flow rate	±1.55% of flow rate
	Calibrated	±1.00% of flow rate	±0.80% of flow rate

1. Measurement Types 2 - 4 assume that the unmeasured variables are constant. Additional uncertainty will depend on the variation in the unmeasured variables.
2. Range 1 flowmeters experience an additional uncertainty up to 0.9%. Consult your Emerson Process Management Representative.

Table 4. Flow Performance - Flow Reference Accuracy (Measurement Type D)⁽¹⁾⁽²⁾⁽³⁾

3051SFA Annubar Flowmeter				
		Classic (8:1 flow turndown)	Ultra (8:1 flow turndown)	Ultra for flow (14:1 flow turndown)
Ranges 2-3		±1.25% of flow rate	±0.95% of flow rate	±0.80% of flow rate
3051SFC_A Compact Annubar Flowmeter - Annubar Option A				
		Classic (8:1 flow turndown)	Ultra (8:1 flow turndown)	Ultra for flow (14:1 flow turndown)
Ranges 2-3	Uncalibrated	±1.70% of flow rate	±1.65% of flow rate	±1.55% of flow rate
	Calibrated	±1.25% of flow rate	±0.95% of flow rate	±0.80% of flow rate

1. For Measurement Types 5 - 7, refer to the Reference Accuracy specification for the 3051SMV with Measurement Type P.
2. These flow measurement accuracies assume a constant density, viscosity, and expansibility factor.
3. Range 1 flowmeters experience an additional uncertainty up to 0.9%. Consult your Emerson Process Management Representative for exact specifications.

Dynamic performance

Total time response at 75 °F (24 °C), includes dead time⁽¹⁾

3051SF_D	3051SF_1, 2, 5, or 6	3051SF_3, 4, or 7
DP Ranges 2-5: 100 ms Range 1: 255 ms Range 0: 700 ms	DP Range 1: 310 ms DP Range 2: 170 ms DP Range 3: 155 ms AP & GP: 240 ms	DP Ranges 2-5: 145 ms DP Range 1: 300 ms DP Range 0: 745 ms

1. For FOUNDATION Fieldbus (output code F), add 52 ms to stated values (not including segment macro-cycle).
For option code DA2, add 45 ms (nominal) to stated values.

Dead time⁽¹⁾

3051SF_D	3051SF_1-7
45 ms (nominal)	DP: 100 ms AP & GP: 140 ms RTD Interface: 1 s

1. For option code DA2, dead time is 90 milliseconds (nominal).

Update rate⁽¹⁾

3051SF_D	3051SF_1-7	
22 updates per sec.	DP: 22 updates per sec. AP & GP: 11 updates per sec. RTD Interface: 1 update per sec.	Calculated Variables: Mass/Volumetric flow rate: 22 updates per sec. Energy flow rate: 22 updates per sec. Totalized Flow: 1 update per sec.

1. Does not apply to Wireless (output code X). See "Wireless self-organizing networks" on page 114 for wireless update rate.

Mounting position effects

Models	Ultra, Ultra for Flow, Classic and Classic MV
3051SF_3, 4, 7, or D	Zero shifts up to ± 1.25 inH ₂ O (3,11 mbar), which can be zeroed Span: no effect
3051SF_1, 2, 5, or 6 DP Sensor:	Zero shifts up to ± 1.25 inH ₂ O (3,11 mbar), which can be zeroed Span: no effect
GP/AP Sensor:	Zero shifts to ± 2.5 inH ₂ O (6,22 mbar), which can be zeroed Span: no effect

Vibration effect

Less than $\pm 0.1\%$ of URL when tested per the requirements of IEC60770-1 field with general application or pipeline with low vibration level (10-1000 Hz test frequency range, 0.15mm displacement peak amplitude, 20m/s² acceleration amplitude).⁽¹⁾

1. Stainless steel temperature housing is not recommended with primary element technology A in application with mechanical vibration.

Power supply effect

Less than $\pm 0.005\%$ of calibrated span per volt change in voltage at the transmitter terminals

Electro Magnetic Compatibility (EMC)

Meets all relevant requirements of EN 61326 and NAMUR NE-21.⁽¹⁾⁽²⁾

1. NAMUR NE-21 does not apply to wireless output code X.
2. 3051SMV and 3051SF_1, 2, 3, 4, 5, 6, 7 requires shielded cable for both temperature and loop wiring.

Transient protection (option T1)

Meets IEEE C62.41.2-2002, Location Category B

6 kV crest (0.5 μ s - 100 kHz)

3 kA crest (8 $\times$ 20 microseconds)

6 kV crest (1.2 $\times$ 50 microseconds)

Meets IEEE C37.90.1-2002 Surge Withstand Capability
SWC 2.5 kV crest, 1.0 MHz wave form

A.3.2 Functional specifications

Range and sensor limits

Flowmeter with coplanar sensor module

Range	DP Sensor (3051SF_3, 4, or 7)	
	Lower (LRL)	Upper (URL)
1	0 inH ₂ O (0 mbar)	25.00 inH ₂ O (62,16 mbar)
2	0 inH ₂ O (0 bar)	250.00 inH ₂ O (621,60 bar)
3	0 inH ₂ O (0 bar)	1000.00 inH ₂ O (2,48 bar)

Flowmeter with MultiVariable sensor module

Range	DP Sensor (3051SF1, 2, 5, or 6)	
	Lower (LRL)	Upper (URL)
1	0 inH ₂ O (0 mbar)	25.00 inH ₂ O (62,16 mbar)
2	0 inH ₂ O (0 bar)	250.00 inH ₂ O (621,60 bar)
3	0 inH ₂ O (0 bar)	1000.00 inH ₂ O (2,48 bar)

Range	Static Pressure Sensor (GP/AP)	
	Lower (LRL)	Upper (URL) ⁽¹⁾
3	GP ⁽²⁾ : -14.2 psig (0,97 bar) AP: 0.5 psia (34,47 mbar)	GP: 800.00 psig (55,15 bar) AP: 800.00 psia (55,15 bar)
4	GP ⁽²⁾ : -14.2 psig (0,97 bar) AP: 0.5 psia (34,47 mbar)	GP: 3626.00 psig (250,00 bar) AP: 3626.00 psia (250,00 bar)

- For SP Range 4 with DP Range 1, the URL is 2000 psi (137,9 bar).
- Inert Fill: Minimum pressure = 1.5 psia (0,10 bar) or -13.2 psig (-0,91 bar).

Process temperature RTD interface (3051SF_1, 3, 5 or 7)⁽¹⁾

Lower (LRL)	Upper (URL)
-328 °F (-200 °C)	1562 °F (850 °C)

- Transmitter is compatible with any Pt 100 RTD sensor. Examples of compatible RTDs include Rosemount Series 68 and 78 RTD Temperature Sensors.

Minimum span limits

Transmitter with coplanar sensor module (single variable)

Range	DP Sensor (3051SF_D, 3, 4 or 7)	
	Ultra & Ultra for Flow	Classic
1	0.5 inH ₂ O (1,24 mbar)	0.5 inH ₂ O (1,24 mbar)
2	1.3 inH ₂ O (3,23 mbar)	2.5 inH ₂ O (6,22 mbar)
3	5.0 inH ₂ O (12,43 mbar)	10.0 inH ₂ O (24,86 mbar)

Transmitter with multi-variable sensor module

Range	DP Sensor (3051SF_1, 2, 5, or 6)	
	Ultra for Flow	Classic MV
1	0.5 inH ₂ O (1,24 mbar)	0.5 inH ₂ O (1,24 mbar)
2	1.3 inH ₂ O (3,23 mbar)	2.5 inH ₂ O (6,22 mbar)
3	5.0 inH ₂ O (12,43 mbar)	10.0 inH ₂ O (24,86 mbar)

Range	Static pressure sensor (GP/AP)	
	Ultra for Flow	Classic MV
3	4.0 psi (275,79 mbar)	8.0 psi (551,58 mbar)
4	18.13 psi (1,25 bar)	36.26 psi (2,50 bar)

Process temperature RTD interface (3051SF_1, 3, 5, or 7)

Minimum span = 50 °F (28 °C)

Service

3051SF_5, 6, 7, or D (direct process variable output)

Liquid, gas, and steam applications

3051SF_1, 2, 3, or 4 (mass and energy flow output)

Some fluid types are only supported by certain measurement types.

Fluid Compatibility with Pressure and Temperature Compensation

- Available
- Not available

Ordering code	Fluid types				
	Measurement type	Liquids	Saturated steam	Superheated steam	Gas and natural gas
1	DP/P/T (Full Compensation)	•	•	•	•
2	DP/P	•	•	•	•
3	DP/T	•	•	—	—
4	DP only	•	•	—	—

4–20 mA/HART

Zero and span adjustment

Zero and span values can be set anywhere within the range.

Span must be greater than or equal to the minimum span.

Output

Two-wire 4–20 mA is user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART protocol.

Power supply

External power supply required

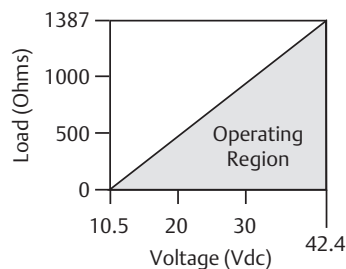
- 3051SF_D: 10.5 to 42.4 Vdc with no load
- 3051SF_D with Advanced HART Diagnostics Suite: 12 to 42.4 Vdc with no load
- 3051SF_1-7: 12 to 42.4 Vdc with no load

Load limitations

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

Figure 1. 3051SF_D

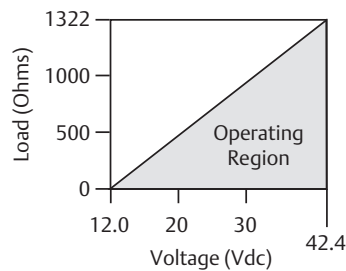
Maximum Loop Resistance = $43.5 \times (\text{Power Supply Voltage} - 10.5)$



The Field Communicator requires a minimum loop resistance of 250Ω for communication.

Figure 2. 3051SF_1-7 and 3051SF_D with HART Diagnostics (Option Code DA2)

Maximum Loop Resistance = $43.5 \times (\text{Power Supply Voltage} - 12.0)$



The Field Communicator requires a minimum loop resistance of 250Ω for communication.

Advanced HART diagnostics suite (option code DA2)

The 3051SF provides Abnormal Situation Prevention indication for a breakthrough in diagnostic capability. The 3051SF ASP Diagnostics Suite for HART includes Statistical Process Monitoring (SPM), variable logging with time stamp and advanced process alerts. The enhanced EDDL graphic display provides an intuitive and user-friendly interface to better visualize these diagnostics.

The integral SPM technology calculates the mean and standard deviation of the process variable 22 times per second and makes them available to the user. The 3051SF uses these values and highly flexible configuration options for customization to detect many user-defined or application specific abnormal situations (e.g. detecting plugged impulse lines and fluid composition change). Variable logging with time stamp and advanced process alerts capture valuable process and sensor data to enable quick troubleshooting of application and installation issues.

FOUNDATION Fieldbus

Power supply

External power supply required; transmitters operate on 9.0 to 32.0 Vdc transmitter terminal voltage.

Current draw

17.5 mA for all configurations (including LCD display option)

FOUNDATION Fieldbus Parameters

Schedule Entries	14 (max.)
Links	30 (max.)
Virtual Communications Relationships (VCR)	20 (max.)

Standard function blocks

Resource block

- Contains hardware, electronics, and diagnostic information.

Transducer block

- Contains actual sensor measurement data including the sensor diagnostics and the ability to trim the pressure sensor or recall factory defaults.

LCD block

- Configures the local display.

2 Analog input blocks

- Processes the measurements for input into other function blocks. The output value is in engineering or custom units and contains a status indicating measurement quality.

PID block with auto-tune

- Contains all logic to perform PID control in the field including cascade and feedforward. Auto-tune capability allows for superior tuning for optimized control performance.

Backup Link Active Scheduler (LAS)

The transmitter can function as a Link Active Scheduler if the current link master device fails or is removed from the segment.

Software upgrade in the field

Software for the 3051SF with FOUNDATION Fieldbus is easy to upgrade in the field using the FOUNDATION Fieldbus Common Device Software Download procedure.

PlantWeb alerts

Enable the full power of the PlantWeb digital architecture by diagnosing instrumentation issues, communicating advisory, maintenance, and failure details, and recommending a solution.

Advanced control function block suite (option code A01)

Input selector block

- Selects between inputs and generates an output using specific selection strategies such as minimum, maximum, midpoint, average, or first "good."

Arithmetic block

- Provides pre-defined application-based equations including flow with partial density compensation, electronic remote seals, hydrostatic tank gauging, ratio control, and others.

Signal characterizer block

- Characterizes or approximates any function that defines an input/output relationship by configuring up to twenty X, Y coordinates. The block interpolates an output value for a given input value using the curve defined by the configured coordinates.

Integrator block

- Compares the integrated or accumulated value from one or two variables to pre-trip and trip limits and generates discrete output signals when the limits are reached. This block is useful for calculating total flow, total mass, or volume over time.

Output splitter block

- Splits the output of one PID or other control block so that the PID will control two valves or other actuators.
- Control Selector Block
- Selects one of up to three inputs (highest, middle, or lowest) that are normally connected to the outputs of PID or other control function blocks.

Block	Execution time
Resource	N/A
Transducer	N/A
LCD Block	N/A
Analog Input 1, 2	20 milliseconds
PID with Auto-tune	35 milliseconds
Input Selector	20 milliseconds

Block	Execution time
Arithmetic	20 milliseconds
Signal Characterizer	20 milliseconds
Integrator	20 milliseconds
Output Splitter	20 milliseconds
Control Selector	20 milliseconds

Fully compensated mass flow block (option code H01)

Calculates fully compensated mass flow based on differential pressure with external process pressure and temperature measurements over the Fieldbus segment. Configuration for the mass flow calculation is easily accomplished using the Rosemount Engineering Assistant.

ASP diagnostics suite for FOUNDATION Fieldbus (option Code D01)

The 3051SF ASP Diagnostics Suite for FOUNDATION Fieldbus provides Abnormal Situation Prevention indication and enhanced EDDL graphic displays for easy visual analysis.

The integral Statistical Process Monitoring (SPM) technology calculates the mean and standard deviation of the process variable 22 times per second and makes them available to the user. The 3051SF uses these values and highly flexible configuration options for customization to detect many user-defined or application specific abnormal situations (e.g. detecting plugged impulse lines and fluid composition change).

Wireless self-organizing networks

Output

WirelessHART, 2.4 GHz DSSS.

Local display

The optional five-digit LCD can display user-selectable information such as primary variable in engineering units, percent of range, sensor module temperature, and electronics temperature. Display updates at up to once per minute.

Update rate

WirelessHART, user selectable 8 sec. to 60 min.

Power module

Field replaceable, keyed connection eliminates the risk of incorrect installation, Intrinsically Safe Lithium-thionyl chloride Power Module with polybutadine terephthalate (PBT) enclosure. Ten-year life at one minute update rate.⁽¹⁾

- Reference conditions are 70 °F (21 °C), and routing data for three additional network devices.
Note: Continuous exposure to ambient temperature limits of -40 °F or 185 °F (-40 °C or 85 °C) may reduce specified life by less than 20 percent.

Overpressure limits

Transmitters withstand the following limits without damage:

Coplanar sensor module (single variable)

Range	DP ⁽¹⁾
	3051SF_3, 4, 7, or D
1	2000 psi (137,90 bar)
2	3626 psi (250,00 bar)
3	3626 psi (250,00 bar)

- The overpressure limit of a DP Sensor with the P9 option is 4500 psig (310,26 bar). The overpressure limit of a DP Sensor with the P0 option is 6092 psig (420,00 bar).

Coplanar multi-variable sensor module (3051SF_1, 2, 5, or 6)

Static pressure	Differential pressure		
	Range 1	Range 2	Range 3
Range 3 GP/AP	1600 psi (110,32 bar)	1600 psi (110,32 bar)	1600 psi (110,32 bar)
Range 4 GP/AP	2000 psi (137,90 bar)	3626 psi (250,00 bar)	3626 psi (250,00 bar)

Static pressure limits

Coplanar sensor module

Operates within specifications between static line pressures of:

Range	DP Sensor ⁽¹⁾
	3051SF_3, 4, 7, or D
1	0.5 psia to 2000 psig (0,03 to 137,90 bar)
2	0.5 psia to 3626 psig (0,03 to 250,00 bar)
3	0.5 psia to 3626 psig (0,03 to 250,00 bar)

- The static pressure limit of a DP Sensor with the P9 option is 4500 psig (310,26 bar). The static pressure limit of a DP Sensor with the P0 option is 6092 psig (420,00 bar).

Coplanar MultiVariable sensor module (3051SF_1, 2, 5, or 6)

Operates within specifications between static line pressures of 0.5 psia (0,03 bar) and the values in the table below:

Static pressure	Differential pressure		
	Range 1	Range 2	Range 3
Range 3 GP/AP	800 psi (55,15 bar)	800 psi (55,15 bar)	800 psi (55,15 bar)
Range 4 GP/AP	2000 psi (137,90 bar)	3626 psi (250,00 bar)	3626 psi (250,00 bar)

Burst pressure limits

Coplanar sensor module

10000 psig (689,5 bar)

Temperature limits

Ambient

-40 to 185 °F (-40 to 85 °C)

With LCD display⁽¹⁾: -40 to 175 °F (-40 to 80 °C)

With option code P0: -20 to 185 °F (-29 to 85 °C)

1. LCD display may not be readable and LCD updates will be slower at temperatures below -4 °F (-20 °C).

Storage

-50 to 185 °F (-46 to 85 °C)

With LCD display: -40 to 185 °F (-40 to 85 °C)

With Wireless Output: -40 to 185 °F (-40 to 85 °C)

Process temperature limits

For 3051SFA Temperature Limits, see [page 161](#).

Humidity limits

0–100% relative humidity

When power is applied to the transmitter during startup, performance will be within specifications per the time period described in [Table 5](#).

Table 5. Turn-On Time⁽¹⁾

Transmitter	Turn-on time (typical)
3051S, 3051SF_D	2 seconds
Diagnostics	5 seconds
3051SMV, 3051SF_1-7	5 seconds

1. Does not apply to wireless option code X.

Volumetric displacement

Less than 0.005 in³ (0,08 cm³)

Damping⁽¹⁾

Analog output response time to a step change is user-selectable from 0 to 60 seconds for one time constant. For 3051SF_1-7, each variable can be individually adjusted. Software damping is in addition to sensor module response time.

1. Does not apply to wireless option code X.

Failure mode alarm

HART 4-20 mA (output option code A)

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven offscale to alert the user. Rosemount standard (default), NAMUR, and custom alarm levels are available (see [Alarm configuration](#) below).

High or low alarm signal is software-selectable or hardware-selectable via the optional switch (option D1).

Alarm configuration

	High alarm	Low alarm
Default	≥ 21.75 mA	≤ 3.75 mA
NAMUR compliant ⁽¹⁾	≥ 22.5 mA	≤ 3.6 mA
Custom levels ⁽²⁾	20.2 - 23.0 mA	3.4 - 3.8 mA

1. Analog output levels are compliant with NAMUR recommendation NE 43, see option codes C4 or C5.
2. Low alarm must be 0.1 mA less than low saturation and high alarm must be 0.1 mA greater than high saturation.

Safety-certified transmitter failure values⁽¹⁾

Safety accuracy: 2.0%⁽²⁾

Safety response time: 1.5 seconds

1. Does not apply to wireless option code X.
2. A 2% variation of the transmitter mA output is allowed before a safety trip. Trip values in the DCS or safety logic solver should be derated by 2%.

A.3.3 Physical specifications

Electrical connections

$1/2$ -14 NPT, $G^{1/2}$, and $M20 \times 1.5$ conduit. HART interface connections fixed to terminal block for Output code A and X.

Process connections

Coplanar sensor module	
Standard	$1/4$ -18 NPT on 2 $1/8$ -in. centers

Process-wetted parts

3051SFA wetted parts - Annubar sensor material

- 316 Stainless Steel
- Alloy C-276

3051SFC wetted parts - material of construction

Body/plate

- 316/316L SST
- 50 micro-inch Ra surface finish

Manifold head/valves

- 316 SST

Flange studs and nuts

- Customer supplied
- Available as a spare part

Transmitter connection studs and nuts

- Studs – A193 Grade B8M
- Nuts – A194 Grade 8M

Gasket and O-rings

- Gaskets are customer supplied.
- Durlon 8500 fiber gaskets are recommended. Consult an Emerson Process Management representative for use with other gaskets.
- Available as a spare part

Note

Gaskets and O-rings should be replaced when the 405 is disassembled.

Process isolating diaphragms

Coplanar sensor module

316L SST (UNS S31603), Alloy C-276 (UNS N10276), Alloy 400 (UNS N04400), Tantalum (UNS R05440), Gold-Plated Alloy 400, Gold-plated 316L SST

Drain/vent valves

316 SST, Alloy C-276, or Alloy 400/K-500 material
(Drain vent seat: Alloy 400, Drain vent stem: Alloy K-500)

Process flanges and adapters

Plated carbon steel

SST: CF-8M (Cast 316 SST) per ASTM A743

Cast C-276: CW-12MW per ASTM A494

Cast Alloy 400: M-30C per ASTM A494

Non-wetted parts

Electronics housing

Low-copper aluminum alloy or CF-8M (Cast 316 SST)
NEMA 4X, IP 66, IP 68 (66-ft. [20 m] for 168 hours)

Note: IP 68 not available with Wireless Output.

Paint for aluminum housing

Polyurethane

Coplanar sensor module housing

SST: CF-3M (Cast 316L SST)

Bolts

Plated carbon steel per ASTM A449, Type 1

Austenitic 316 SST per ASTM F593

ASTM A453, Class D, Grade 660 SST

ASTM A193, Grade B7M alloy steel

ASTM A193, Class 2, Grade B8M SST

Alloy K-500

Sensor module fill fluid

Silicone or inert halocarbon

Cover O-rings

Nitrile Butadiene (NBR)

Wireless antenna

PBT/polycarbonate (PC) integrated omni-directional antenna

Power module

Field replaceable, keyed connection eliminates the risk of incorrect installation, Intrinsically Safe Lithium-thionyl chloride Power Module with PBT enclosure.

A.4 3051CFA ordering information

A.4.1 Rosemount 3051CFA Annubar Flowmeter



The Rosemount 3051CFA Annubar Flowmeter utilizes the T-shaped sensor design that delivers best in class accuracy and performance while meeting the needs of diverse process applications, whether it is high accuracy for precision control or high strength for severe flow applications. Main capabilities include:

- Up to 1.8% of flow rate accuracy
- Available in 2- to 96-in. (50 to 2400 mm) line sizes
- Fully assembled and leak tested for out-of-the-box installation
- Power Advisory can proactively detect degraded electrical loop integrity issues (Option Code DA0)
- Local Operator Interface with straightforward menus and built-in configuration buttons (Option Code M4)

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model ⁽¹⁾	Product description	
3051CFA	Annubar Flowmeter	
Measurement type		
D	Differential Pressure	★
Fluid type		
L	Liquid	★
G	Gas	★
S	Steam	★
Line size		
020	2-in. (50 mm)	★
025	2½-in. (63.5 mm)	★
030	3-in. (80 mm)	★
035	3½-in. (89 mm)	★
040	4-in. (100 mm)	★
050	5-in. (125 mm)	★
060	6-in. (150 mm)	★
070	7-in. (175 mm)	★
080	8-in. (200 mm)	★
100	10-in. (250 mm)	★
120	12-in. (300 mm)	★
140	14-in. (350 mm)	
160	16-in. (400 mm)	
180	18-in. (450 mm)	

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Line size		
200	20-in. (500 mm)	
240	24-in. (600 mm)	
300	30-in. (750 mm)	
360	36-in. (900 mm)	
420	42-in. (1066 mm)	
480	48-in. (1210 mm)	
600	60-in. (1520 mm)	
720	72-in. (1820 mm)	
780	78-in (1950 mm)	
840	84-in. (2100 mm)	
900	90-in. (2250 mm)	
960	96-in (2400 mm)	
Pipe I.D. range ⁽²⁾		
C	Range C from the Pipe I.D. table	★
D	Range D from the Pipe I.D. table	★
A	Range A from the Pipe I.D. table	
B	Range B from the Pipe I.D. table	
E	Range E from the Pipe I.D. table	
Z	Non-standard Pipe I.D. range or line sizes greater than 12-in. (300 mm)	
Pipe material/Mounting assembly material		
C	Carbon steel (A105)	★
S	316 Stainless Steel	★
O	No Mounting (customer supplied)	★
G	Chrome-Moly Grade F-11	
N	Chrome-Moly Grade F-22	
J	Chrome-Moly Grade F-91	
Piping orientation		
H	Horizontal piping	★
D	Vertical piping with downwards flow	★
U	Vertical piping with upwards flow	★
Annubar type		
P	Pak-Lok	★
F	Flanged with opposite side support	★
L	Flange-Lok	

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Annubar type		
G	Gear-Drive Flo-Tap	
M	Manual Flo-Tap	
Sensor material		
S	316 Stainless Steel	★
H	Alloy C-276	
Sensor size		
1	Sensor size 1 — Line sizes 2-in. (50 mm) to 8-in. (200 mm)	★
2	Sensor size 2 — Line sizes 6-in. (150 mm) to 96-in. (2400 mm)	★
3	Sensor size 3 — Line sizes greater than 12-in. (300 mm)	★
Mounting type		
T1	Compression or threaded connection	★
A1	150# RF ANSI	★
A3	300# RF ANSI	★
A6	600# RF ANSI	★
D1	DN PN16 flange	★
D3	DN PN40 flange	★
D6	DN PN100 flange	★
A9 ⁽³⁾	900# RF ANSI	
AF ⁽³⁾	1500# RF ANSI	
AT ⁽³⁾	2500 # RF ANSI	
R1	150# RTJ flange	
R3	300# RTJ flange	
R6	600# RTJ flange	
R9 ⁽³⁾	900# RTJ flange	
RF ⁽³⁾	1500# RTJ flange	
RT ⁽³⁾	2500# RTJ flange	
Opposite side support or packing gland		
0	No opposite side support or packing gland (required for Pak-Lok and Flange-Lok models)	★
Opposite side support – required for flanged models		
C	NPT threaded opposite support assembly – extended tip	★
D	Welded opposite support assembly – extended tip	★

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Packing gland – required for Flo-Tap models				
	Packing gland material	Rod material	Packing material	
J ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Carbon Steel	PTFE	
K ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Stainless Steel	PTFE	
L ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Carbon Steel	Graphite	
N ⁽⁴⁾	Stainless Steel packing gland/cage nipple	Stainless Steel	Graphite	
R	Alloy C-276 packing gland/cage nipple	Stainless Steel	Graphite	
Isolation valve for Flo-Tap models				
0	Not Applicable or customer supplied			★
1	Gate Valve, Carbon Steel			
2	Gate Valve, Stainless Steel			
5	Ball Valve, Carbon Steel			
6	Ball Valve, Stainless Steel			
Temperature measurement				
T	Integral RTD – not available with flanged model greater than class 600#			★
0	No temperature sensor			★
R	Remote thermowell and RTD			
Transmitter connection platform				
3	Direct-mount, Integral 3-valve Manifold– not available with flanged model greater than class 600			★
5	Direct -mount, 5-valve Manifold – not available with flanged model greater than class 600			★
7	Remote-mount NPT connections (1/2-in. NPT)			★
6	Direct-mount, high temperature 5-valve Manifold – not available with flanged model greater than class 600			
8	Remote-mount SW connections (1/2-in.)			
Differential pressure range				
1	0 to 25 inH ₂ O (0 to 62,16 mbar)			★
2	0 to 250 inH ₂ O (0 to 621,60 mbar)			★
3	0 to 1000 inH ₂ O (0 to 2,48 bar)			★
Transmitter output				
A ⁽⁵⁾	4–20 mA with digital signal based on HART Protocol			★
F	FOUNDATION Fieldbus Protocol			★
W ⁽⁶⁾	PROFIBUS® PA Protocol			★
X ⁽⁷⁾	Wireless (requires wireless options and engineered polymer housing)			★
M ⁽⁸⁾	Low-Power, 1-5 Vdc with digital signal based on HART Protocol			

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Transmitter housing material		Conduit entry size	
A	Aluminum	1/2-14 NPT	★
B	Aluminum	M20 × 1.5	★
J	SST	1/2-14 NPT	★
K	SST	M20 × 1.5	★
P ⁽⁹⁾	Engineered polymer	No conduit entries	★
D ⁽¹⁰⁾	Aluminum	G1/2	
M ⁽¹⁰⁾	SST	G1/2	
Transmitter performance class			
1	1.6% flow rate accuracy, 8:1 flow turndown, 5-yr. stability		★

Wireless options (requires wireless output code X and Engineered Polymer housing code P)

Wireless transmit rate, operating frequency, and protocol		
WA3	User configurable transmit rate, 2.4GHz WirelessHART	★
Antenna and SmartPower		
WP5	Internal antenna, compatible with Green Power Module (I.S. Power Module sold separately)	★

HART Revision configuration⁽⁵⁾ (requires HART Protocol output code A)

HR5	Configured for HART Revision 5	★
HR7	Configured for HART Revision 7	★

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Pressure testing ⁽¹¹⁾		
P1	Hydrostatic testing with certificate	
PX	Extended hydrostatic testing	
Special cleaning		
P2	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (Section 11.4)	
Material testing		
V1	Dye penetrant exam	
Material examination		
V2	Radiographic examination	

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Flow calibration		
W1	Flow calibration (average K)	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and performance certificate	★
Surface finish		
RL	Surface finish for low pipe Reynolds number in gas and steam	★
RH	Surface finish for high Pipe Reynolds number in liquid	★
Material traceability certification⁽¹²⁾		
Q8	Material traceability certification per EN 10474:2004 3.1	★
Code conformance⁽¹³⁾		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
Materials conformance⁽¹⁴⁾		
J5	NACE MR-0175/ISO 15156	
Country certification		
J6	European Pressure Directive (PED)	★
J1	Canadian Registration	
Installed in flanged pipe spool section		
H3	150# Flanged connection with Rosemount standard length and schedule	
H4	300# Flanged connection with Rosemount standard length and schedule	
H5	600# Flanged connection with Rosemount standard length and schedule	
Instrument connections for remote mount options		
G2	Needle valves, Stainless Steel	★
G6	OS&Y gate valve, Stainless Steel	★
G1	Needle valves, Carbon Steel	
G3	Needle valves, Alloy C-276	
G5	OS&Y gate valve, Carbon Steel	
G7	OS&Y gate valve, Alloy C-276	
Special shipment		
Y1	Mounting hardware shipped separately	★
Special dimensions		
VM	Variable mounting	

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Special dimensions		
VT	Variable tip	
VS	Variable length spool section	
PlantWeb control functionality ⁽¹⁵⁾		
A01	FOUNDATION Fieldbus advanced control function block suite	★
PlantWeb diagnostic functionality		
DA0 ⁽¹⁶⁾	Power advisory HART diagnostic	★
D01 ⁽¹⁵⁾	FOUNDATION Fieldbus diagnostics suite	★
Product certifications		
E8	ATEX Flameproof, Dust	★
I1 ⁽¹⁷⁾	ATEX Intrinsic Safety and Dust	★
IA	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
N1	ATEX Type n and Dust	★
K8	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	★
E5	FM Explosion-proof, Dust Ignition-proof	★
I5 ⁽¹⁸⁾	FM Intrinsically Safe, Nonincendive	★
IE	FM FISCO Intrinsically Safe; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	★
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
I6 ⁽⁹⁾	CSA Intrinsically Safe	★
K6	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6, E8, and I1)	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I7	IECEx Intrinsic Safety	★
N7	IECEx Type n	★
K7	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7 and E7)	★
E2	INMETRO Flameproof	★
I2	INMETRO Intrinsic Safety	★
IB	INMETRO FISCO Intrinsically Safe; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
K2	INMETRO Flameproof, Intrinsic Safety	★
E3	China Flameproof	★
I3	China Intrinsic Safety	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	★
KD	CSA, FM, and ATEX Explosion-proof, Intrinsically Safe (combination of K5, C6, I1, and E8)	★

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Sensor fill fluid and O-ring options		
L1 ⁽¹⁹⁾	Inert sensor fill fluid (silicone fill fluid is standard)	★
L2	Graphite-filled (PTFE) O-ring	★
LA ⁽¹⁹⁾	Inert sensor fill fluid and Graphite-filled (PTFE) O-ring	★
Shipboard approvals⁽¹⁹⁾		
SBS	American Bureau of Shipping	★
SLL ⁽²⁰⁾	Lloyds Register (LR)	★
Display and interface options		
M4 ⁽²¹⁾	LCD display with Local Operator Interface	★
M5	LCD display	★
Transmitter calibration certification		
Q4	Calibration certificate for transmitter	★
Quality certification for safety⁽¹⁶⁾		
QS	Prior-use certificate of FMEDA data	★
QT	Safety certified to IEC 61508 with certificate of FMEDA	★
Transient protection⁽¹⁹⁾⁽²²⁾		
T1	Transient terminal block	★
Manifold for Remote Mount option		
F2	3-Valve Manifold, Stainless Steel	★
F6	5-Valve Manifold, Stainless Steel	★
F1	3-Valve Manifold, Carbon Steel	
F3	3-Valve Manifold, Alloy C-276	
F5	5-Valve Manifold, Carbon Steel	
F7	5-Valve Manifold, Alloy C-276	
Lower power output		
C2	0.8-3.2 Vdc output with digital signal based on HART Protocol (Available with Output code M only)	★
Alarm levels⁽¹⁶⁾		
C4	NAMUR alarm and saturation levels, high alarm	★
CN	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm	
CS	Custom alarm and saturation signal levels, low alarm	
CT	Rosemount standard low alarm	

Table 6. Rosemount 3051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Configuration buttons		
D4 ⁽¹⁶⁾	Analog zero and span	
DZ ⁽²³⁾	Digital zero trim	
Ground screw ⁽¹⁹⁾⁽²⁴⁾		
V5	External ground screw assembly	★
Typical model number: 3051CFA D L 060 D C H P S 2 T1 0 0 0 3 2 A A 1		

1. Select Configuration Buttons (option code D4 or DZ) or Local Operator Interface (option code M4) if local configuration buttons are required.
2. See the DP Flow Product Data Sheet (document number 00813-0100-4485) for Pipe I.D. table.
3. Available in remote mount applications only.
4. The cage nipple is constructed of 304 SST.
5. Option HR5 configures the HART output to HART Revision 5. Option HR7 configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 or 7 if desired. HART Revision 5 is the default HART output.
6. For local addressing and configuration, M4 (Local Operator Interface) is required.
7. Requires wireless options and engineered polymer housing. Available approvals are FM Intrinsically Safe, (option code I5), CSA Intrinsically Safe (option code I6), ATEX Intrinsic Safety (option code I1), and IECEx Intrinsic Safety (option code I7).
8. Only available with C6, E2, E5, I5, K5, KB and E8 approval. Not available with GE, GM, SBS, DA0, M4, D4, DZ, QT, HR5, HR7, CR, CS, CT.
9. Only available with Wireless Output (output code X).
10. Not available with Product certifications options E8, K8, E5, K5, C6, K6, E7, K7, E2, K2, E3, KB, KD.
11. Applies to assembled flowmeter only, mounting not tested.
12. Instrument Connections for Remote Mount Options and Isolation Valves for Flo-tap Models are not included in the Material Traceability Certification.
13. Not available with Transmitter Connection Platform 6.
14. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
15. Only valid with FOUNDATION Fieldbus output (output code F).
16. Only available with 4-20 mA HART output (output Code A).
17. Dust approval not applicable to output code X.
18. Nonincendive certification not provided with Wireless output option code (X). Not available with Wireless Output (output code X).
19. Not available with Wireless Output (output code X).
20. Only available with product certifications E7, E8, I1, I7, IA, K7, K8, KD, N1, N7.
21. Not available with FOUNDATION Fieldbus (Output Code F) or Wireless Output (output code X) or Low Power (output code M).
22. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification codes IA, IB, and IE.
23. Only available with 4-20 mA HART Output (output code A) and Wireless output (Output Code X).
24. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.

A.5 3051CFC ordering information



A.5.1 Rosemount 3051CFC Compact Flowmeter

- Compact Conditioning flowmeters reduce straight piping requirements to 2D upstream and 2D downstream from most disturbances.
- Simple installation of Compact flowmeters between any existing raised-face flanges.

Table 7. Rosemount 3051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model ⁽¹⁾	Product description	
3051CFC	Compact Flowmeter	
Measurement type		
D	Differential Pressure	★
Primary element technology		
A	Annubar averaging pitot tube	★
C	Conditioning orifice plate	★
P	Orifice plate	★
Material type		
S	316 SST	★
Line size		
005 ⁽²⁾	1/2-in. (15 mm)	★
010 ⁽²⁾	1-in. (25 mm)	★
015 ⁽²⁾	1 1/2-in. (40 mm)	★
020	2-in. (50 mm)	★
030	3-in. (80 mm)	★
040	4-in. (100 mm)	★
060	6-in. (150 mm)	★
080	8-in. (200 mm)	★
100 ⁽³⁾⁽⁴⁾	10-in. (250 mm)	★
120 ⁽³⁾⁽⁴⁾	12-in. (300 mm)	★
Primary element type		
N000	Annubar sensor size 1	★
N040	0.40 Beta ratio	★
N065 ⁽⁵⁾	0.65 Beta ratio	★
Temperature measurement		
0	No temperature sensor	★
R	Remote thermowell and RTD	
T ⁽⁶⁾	Integral temperature	

Table 7. Rosemount 3051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Transmitter connection platform			
3	Direct-mount		★
7	Remote-mount, NPT connections		★
Differential pressure range			
1	0 to 25 in H ₂ O (0 to 62,3 mbar)		★
2	0 to 250 in H ₂ O (0 to 623 mbar)		★
3	0 to 1000 in H ₂ O (0 to 2,5 bar)		★
Transmitter output			
A ⁽⁷⁾	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W ⁽⁸⁾	PROFIBUS PA Protocol		★
X ⁽⁹⁾	Wireless (requires wireless options and Engineered Polymer housing)		
M ⁽¹⁰⁾	Low-Power, 1-5 Vdc with digital signal based on HART Protocol		
Transmitter housing material		Conduit entry size	
A	Aluminum	1/2-14 NPT	★
B	Aluminum	M20 × 1.5	★
J	SST	1/2-14 NPT	★
K	SST	M20 × 1.5	★
P ⁽¹¹⁾	Engineered polymer	No conduit entries	★
D ⁽¹²⁾	Aluminum	G ¹ /2	
M ⁽¹²⁾	SST	G ¹ /2	
Transmitter performance class			
1	Up to ±1.65% flow rate accuracy, 8:1 flow turndown, 5-year stability		★

Wireless options (requires wireless output code X and Engineered Polymer housing code P)

Wireless transmit rate, operating frequency, and protocol			
WA3	User configurable transmit rate, 2.4GHz WirelessHART		★
Antenna and SmartPower			
WP5	Internal antenna, compatible with Green Power Module (I.S. Power Module sold separately)		★

HART Revision configuration⁽⁷⁾ (requires HART Protocol output code A)

HR5	Configured for HART Revision 5		★
HR7	Configured for HART Revision 7		★

Table 7. Rosemount 3051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Installation accessories		
AB	ANSI alignment ring (150#) (only required for 10-in. [250 mm] and 12-in. [300mm] line sizes)	★
AC	ANSI alignment ring (300#) (only required for 10-in. [250 mm] and 12-in. [300mm] line sizes)	★
AD	ANSI alignment ring (600#) (only required for 10-in. [250 mm] and 12-in. [300mm] line sizes)	★
DG	DIN alignment ring (PN16)	★
DH	DIN alignment ring (PN40)	★
DJ	DIN alignment ring (PN100)	★
JB	JIS alignment ring (10K)	
JR	JIS alignment ring (20K)	
JS	JIS alignment ring (40K)	
Remote adapters		
FE	Flange adapters 316 SST (1/2-in. NPT)	★
High temperature application		
HT	Graphite valve packing ($T_{\max} = 850^{\circ}\text{F}$)	
Flow calibration⁽¹³⁾		
WC	Flow calibration, 3 pt, Conditioning orifice option C (all pipe schedules)	
WD ⁽¹⁴⁾	Flow calibration, 10 pt, Conditioning option C (all schedules), Annubar option A (Schedule 40)	
Pressure testing		
P1	Hydrostatic testing with certificate	
Special cleaning		
P2 ⁽¹⁵⁾	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (Section 11.4)	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and Performance Certificate	★
Transmitter calibration certification		
Q4	Calibration certificate for transmitter	★
Quality certification for safety⁽¹⁶⁾		
QS	Prior-use Certificate of FMEDA data	★
QT	Safety certified to IEC 61508 with certificate of FMEDA	★

Table 7. Rosemount 3051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Material traceability certification		
Q8	Material traceability certification per EN 10204:2004 3.1	★
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
J4	ANSI/ASME B31.8	
Materials conformance ⁽¹⁷⁾		
J5	NACE MR-0175/ISO 15156	
Country certification		
J1	Canadian Registration	
Product certifications		
E8	ATEX Flameproof, Dust	★
I1 ⁽¹⁸⁾	ATEX Intrinsic Safety and Dust	★
IA	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
N1	ATEX Type n and Dust	★
K8	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E8, I1 and N1)	★
E5	FM Explosion-proof, Dust Ignition-proof	★
I5 ⁽¹⁹⁾	FM Intrinsically Safe, Nonincendive	★
IE	FM FISCO Intrinsically Safe; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2 (combination of E5 and I5)	★
C6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2	★
I6 ⁽¹¹⁾	CSA Intrinsically Safe	★
K6	CSA and ATEX Explosion-proof, Intrinsically Safe, and Division 2 (combination of C6, E8, and I1)	★
E7	IECEx Flameproof, Dust Ignition-proof	★
I7	IECEx Intrinsic Safety	★
N7	IECEx Type n	★
K7	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, and Type n (combination of I7, N7 and E7)	★
E2	INMETRO Flameproof	★
I2	INMETRO Intrinsic Safety	★
IB	INMETRO FISCO intrinsically safe; for FOUNDATION Fieldbus or PROFIBUS PA protocols only	★
K2	INMETRO Flameproof, Intrinsic Safety	★
E3	China Flameproof	★
I3	China Intrinsic Safety	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, and Division 2 (combination of K5 and C6)	★
KD	CSA, FM, and ATEX Explosion-proof, Intrinsically Safe (combination of K5, C6, I1, and E8)	★

Table 7. Rosemount 3051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Sensor fill fluid and O-ring options		
L1 ⁽²⁰⁾	Inert sensor fill fluid	★
L2	Graphite-filled (PTFE) O-ring	★
LA ⁽²⁰⁾	Inert sensor fill fluid and Graphite-filled (PTFE) O-ring	★
Shipboard approvals⁽²⁰⁾		
SBS	American Bureau of Shipping	★
SLL ⁽²¹⁾	Lloyds Register (LR)	
Display and interface options		
M4 ⁽²²⁾	LCD display with Local Operator Interface	★
M5	LCD display	★
Transient protection⁽²⁰⁾⁽²³⁾		
T1	Transient terminal block	★
Manifold for remote mount option		
F2	3-valve Manifold, Stainless Steel	★
F6	5-valve Manifold, Stainless Steel	★
PlantWeb control functionality⁽²⁴⁾		
A01	FOUNDATION Fieldbus advanced control function block suite	★
PlantWeb diagnostic functionality		
DA0 ⁽¹⁵⁾	Power advisory HART diagnostic	
D01 ⁽²⁴⁾	FOUNDATION Fieldbus diagnostic suite	★
Low power output		
C2	0.8-3.2 Vdc output with digital signal based on HART Protocol (available with output code M only)	★
Alarm levels⁽¹⁶⁾		
C4	NAMUR alarm and saturation levels, high alarm	★
CN	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm	★
CS	Custom alarm and saturation signal levels, low alarm	★
CT	Rosemount standard low alarm	★
Ground screw⁽²⁰⁾⁽²⁵⁾		
V5	External ground screw assembly	★

Table 7. Rosemount 3051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Configuration buttons		
D4 ⁽¹⁶⁾	Analog zero and span	★
DZ ⁽²⁶⁾	Analog zero and span	★
Typical model number: 3051CFC D C S 060 N 065 0 3 2 A A 1 WC E5 M5		

1. Select Configuration Buttons (option code D4 or DZ) or Local Operator Interface (option code M4) if local configuration buttons are required.
2. Available with primary element technology P only.
3. 10-in. (250 mm) and 12-in. (300 mm) line sizes not available with Primary Element Technology A.
4. For the 10-in. (250 mm) and 12-in. (300 mm) line size, the alignment ring must be ordered (Installation Accessories).
5. For 2-in. (50 mm) line sizes the Primary Element Type is 0.6 for Primary Element Technology Code C.
6. Available with Primary Element Technology A only.
7. Option HR5 configures the HART output to HART Revision 5. Option HR7 configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 or 7 if desired. HART Revision 5 is the default HART output.
8. For local addressing and configuration, M4 (Local Operator Interface) is required.
9. Requires wireless options and engineered polymer housing. Available approvals are FM Intrinsically Safe, (option code I5), CSA Intrinsically Safe (option code I6), ATEX Intrinsic Safety (option code I1), and IECEx Intrinsic Safety (option code I7).
10. Only available with C6, E2, E5, I5, K5, KB and E8 approval. Not available with GE, GM, SBS, DA0, M4, D4, DZ, QT, HR5, HR7, CR, CS, CT.
11. Only available with Wireless Output (output code X).
12. Not available with Product certifications options E8, K8, E5, K5, C6, K6, E7, K7, E2, K2, E3, KB, KD.
13. Available with Primary Element Technology C only.
14. For Annubar option A, consult factory for pipe schedules other than schedule 40.
15. Available with Primary Element Technology C or P only.
16. Only available with HART 4-20 mA Output (output code A).
17. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
18. Dust approval not applicable to output code X.
19. Nonincendive certification not provided with Wireless output option code (X).
20. Not available with Wireless output (output code X).
21. Only available with product certifications E7, E8, I1, I7, IA, K7, K8, KD, N1, N7.
22. Not available with output code F - FOUNDATION Fieldbus or Wireless output (output code X) or Low Power (output code M).
23. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification code IA, IB, and IE.
24. Only valid with FOUNDATION Fieldbus (output code F).
25. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
26. Only available with 4-20 mA HART Output (output code A) and Wireless output (output code X).

A.6 3051CF specifications

A.6.1 Performance specifications

Performance assumptions include: measured pipe I.D, transmitter is trimmed for optimum flow accuracy, and performance is dependent on application parameters.

Table 8. Flow Performance - Flow Reference Accuracy⁽¹⁾

3051CFA Annubar Flowmeter		
Ranges 2-3		±1.80% of flow rate at 8:1 flow turndown
3051CFC_A Compact Annubar Flowmeter - Annubar option A		
Ranges 2-3	Standard	±2.10% of flow rate at 8:1 flow turndown
	Calibrated	±1.80% of flow rate at 8:1 flow turndown

1. Range 1 flowmeters may experience an additional uncertainty up to 0.9%. Consult your Emerson Process Management Representative for exact specifications.

A.6.2 Functional specifications

Range and sensor limits

Table 9. 3051CF Range and Sensor Limits

Range	3051CF minimum span	Range and sensor limits
1	0.5 inH ₂ O (1,2 mbar)	0 to 25 inH ₂ O (62,3 mbar)
2	2.5 inH ₂ O (6,2 mbar)	0 to 250 inH ₂ O (0,63 bar)
3	10 inH ₂ O (24,9 mbar)	0 to 1000 inH ₂ O (2,49 bar)

Zero and span adjustment requirements (HART and low power)

Zero and span values can be set anywhere within the range limits stated in Table 9 and Table 10.

Span must be greater than or equal to the minimum span stated in Table 9 and Table 10.

Service

Liquid, gas, and vapor applications

4–20 mA (output code A)

Output

Two-wire 4–20 mA, user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART protocol.

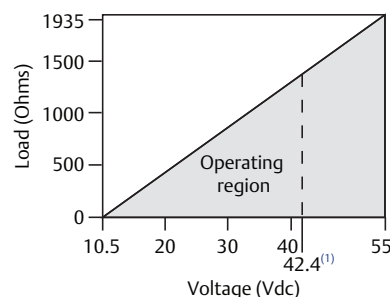
Power supply

External power supply required. Standard transmitter (4–20 mA) operates on 10.5 to 55 Vdc with no load.

Load limitations

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

$$\text{Max. Loop Resistance} = 43.5 \times (\text{Power Supply Voltage} - 10.5)$$



Communication requires a minimum loop resistance of 250 Ω.
1. For CSA approval, power supply must not exceed 42.4 V.

FOUNDATION Fieldbus (output code F) and PROFIBUS (output code W)

Power supply

External power supply required; transmitters operate on 9.0 to 32.0 Vdc transmitter terminal voltage.

Current draw

17.5 mA for all configurations (including LCD display option)

FOUNDATION Fieldbus function block execution times

Block	Execution time
Resource	N/A
Transducer	N/A
LCD Block	N/A
Analog Input 1, 2	30 milliseconds
PID	45 milliseconds
Input Selector	30 milliseconds
Arithmetic	35 milliseconds
Signal Characterizer	40 milliseconds
Integrator	35 milliseconds

FOUNDATION Fieldbus parameters

Schedule Entries	7 (max.)
Links	20 (max.)
Virtual Communications Relationships (VCR)	12 (max.)

Standard function blocks

Resource block

- Contains hardware, electronics, and diagnostic information.

Transducer block

- Contains actual sensor measurement data including the sensor diagnostics and the ability to trim the pressure sensor or recall factory defaults.

LCD block

- Configures the local display.

2 Analog input blocks

- Processes the measurements for input into other function blocks. The output value is in engineering units or custom and contains a status indicating measurement quality.

PID block

- Contains all logic to perform PID control in the field including cascade and feedforward.

Backup Link Active Scheduler (LAS)

The transmitter can function as a Link Active Scheduler if the current link master device fails or is removed from the segment.

Advanced control function block suite (option code A01)

Input selector block

- Selects between inputs and generates an output using specific selection strategies such as minimum, maximum, midpoint, average, or first "good."

Arithmetic block

- Provides pre-defined application-based equations including flow with partial density compensation, electronic remote seals, hydrostatic tank gauging, ratio control, and others.

Signal characterizer block

- Characterizes or approximates any function that defines an input/output relationship by configuring up to twenty X, Y coordinates. The block interpolates an output value for a given input value using the curve defined by the configured coordinates.

Integrator block

- Compares the integrated or accumulated value from one or two variables to pre-trip and trip limits and generates discrete output signals when the limits are reached. This block is useful for calculating total flow, total mass, or volume over time.

FOUNDATION Fieldbus diagnostics suite (option code D01)

The 3051C FOUNDATION Fieldbus Diagnostics provide Abnormal Situation Prevention (ASP) indication. The integral statistical process monitoring (SPM) technology calculates the mean and standard deviation of the process variable 22 times per second. The 3051C ASP algorithm uses these values and highly flexible configuration options for customization to many user-defined or application specific abnormal situations. The detection of plugged impulse lines is the first available predefined application.

Low power (output code M)

Output

Three wire 1–5 Vdc or 0.8–3.2 Vdc (option Code C2) user-selectable output. Also user selectable for linear or square root output configuration. Digital process variable superimposed on voltage signal, available to any host conforming to the HART protocol. Low-power transmitter operates on 6–12 Vdc with no load.

Power consumption

3.0 mA, 18–36 mW

Minimum load impedance

100 k Ω (V_{out} wiring)

Indication

Optional 5-digit LCD display

Overpressure limits

Rosemount 3051CF

- Range 0: 750 psi (51,7 bar)
- Range 1: 2000 psig (137,9 bar)
- Ranges 2–5: 3626 psig (250 bar)
4500 psig (310,3 bar) for option code P9

Static pressure limit

Operates within specifications between static line pressures of 0.5 psia and 3626 psig.

Range 1: 0.5 psia and 2000 psig (3, 4 bar and 137, 9 bar)

Burst pressure limits

Burst pressure on Coplanar process flange is 10000 psig (69 MPa).

Failure mode alarm

Output code A

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 3.75 mA or to 21.75 mA to alert the user. NAMUR-compliant values are available, option code C4. High or low alarm signal is user-selectable by internal jumper.

Output code M

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 0.94 V or above 5.4 V to alert the user (below 0.75 V or above 4.4 V for Option C2). High or low alarm signal is user-selectable by internal jumper.

Output code F and W

If self-diagnostics detect a gross transmitter failure, that information gets passed as a status along with the process variable.

Process temperature limits

For 3051CFA Temperature Limits, see [page 161](#).

Table 10. 3051CF Process Temperature Limits⁽¹⁾

3051CF	
Silicone Fill Sensor	–40 to 250 °F (–40 to 121 °C)
Inert Fill Sensor	0 to 185 °F (–18 to 85 °C)

1. Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio (0.6:1 ratio for the 3051H).

Transmitter temperature limits

Ambient

–40 to 185 °F (–40 to 85 °C)

With LCD display⁽¹⁾: –4 to 175 °F (–20 to 80 °C)

Storage

–50 to 230 °F (–46 to 110 °C)

With LCD display: –40 to 185 °F (–40 to 85 °C)

Process

At atmospheric pressures and above. See [Table 10](#).

1. LCD display may not be readable and LCD updates will be slower at temperatures below –4 °F (–20 °C).

Humidity limits

0–100% relative humidity

Turn-on time

Performance within specifications less than 2.0 seconds (10.0 s for Profibus protocol) after power is applied to the transmitter

Volumetric displacement

Less than 0.005 in.³ (0,08 cm³)

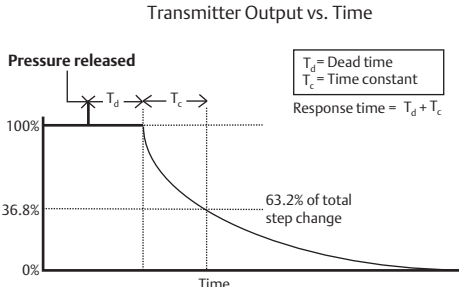
Damping

Analog output response to a step input change is user-selectable from 0 to 36 seconds for one time constant. This software damping is in addition to sensor module response time.

Long term stability

Models	Long term stability
3051CF Ranges 2-3	±0.125% of URL for 5 years ±50 °F (28 °C) temperature changes, and up to 1000 psi (6,9 MPa) line pressure
3051CF Low/Draft Range Range 1	±0.2% of URL for 1 year

Dynamic performance

	4 - 20 mA (HART protocol) ⁽¹⁾	Fieldbus protocol ⁽³⁾	Typical HART transmitter response time
Total Response Time ($T_d + T_c$) ⁽²⁾ :			 Transmitter Output vs. Time Pressure released 100% 36.8% 0% Time T_d = Dead time T_c = Time constant Response time = $T_d + T_c$ 63.2% of total step change
3051CF, Ranges 2-5: Range 1:	100 ms 255 ms	152 ms 307 ms	
Dead Time (T_d)	45 ms (nominal)	97 ms	
Update Rate	22 times per second	22 times per second	

1. Dead time and update rate apply to all models and ranges; analog output only.
2. Nominal total response time at 75 °F (24 °C) reference conditions.
3. Transmitter Fieldbus output only, segment macro-cycle not included.

Vibration effect

Less than ±0.1% of URL when tested per the requirements of IEC60770-1 field or pipeline with high vibration level (10-60 Hz 0.21 mm displacement peak amplitude/60-2000 Hz 3g).

A.6.3 Physical specifications

Electrical connections

$1/2$ –14 NPT, PG 13.5, G $1/2$, and M20 × 1.5 conduit. HART interface connections fixed to terminal block.

Process-wetted parts

Drain/vent valves

316 SST, Alloy C-276, or Alloy 400 material (Alloy 400 not available with 3051L)

Process flanges and adapters

Plated carbon steel, SST cast CF-8M (cast version of 316 SST, material per ASTM-A743), C-Type cast alloy CW12MW, or cast alloy M30C

Wetted O-rings

Glass-filled PTFE or Graphite-filled PTFE

Process Isolating Diaphragms

Alloy C-276, Alloy 400, Tantalum, Gold-plated Alloy 400, Gold-plate SST

Non-wetted parts

Electronics housing

Low-copper aluminum or CF-8M (Cast version of 316 SST). Enclosure Type 4X, IP 65, IP 66, IP 68

Coplanar sensor module housing

CF-3M (Cast version of 316L SST, material per ASTM-A743)

Bolts

ASTM A449, Type 1 (zinc-cobalt plated carbon steel)
ASTM F593G, Condition CW1 (Austenitic 316 SST)
ASTM A193, Grade B7M (zinc plated alloy steel)
Alloy K-500

Sensor module fill fluid

Silicone oil (D.C. 200)

Paint

Polyurethane

Cover o-rings

Buna-N

A.7 2051CFA ordering information

Table 11. Rosemount 2051CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product description	
2051CFA	Annubar Flowmeter	
Measurement type		
D	Differential Pressure	★
Fluid type		
L	Liquid	★
G	Gas	★
S	Steam	★
Line size		
020	2-in. (50 mm)	★
025	2½-in. (63.5 mm)	★
030	3-in. (80 mm)	★
035	3½-in. (89 mm)	★
040	4-in. (100 mm)	★
050	5-in. (125 mm)	★
060	6-in. (150 mm)	★
070	7-in. (175 mm)	★
080	8-in. (200 mm)	★
100	10-in. (250 mm)	★
120	12-in. (300 mm)	★
Pipe I.D. range⁽¹⁾		
C	Range C from the Pipe I.D. table	★
D	Range D from the Pipe I.D. table	★
A	Range A from the Pipe I.D. table	
B	Range B from the Pipe I.D. table	
E	Range E from the Pipe I.D. table	
Z	Non-standard Pipe I.D. range or line sizes greater than 12-in. (300 mm)	
Pipe material/mounting assembly material		
C	Carbon steel (A105)	★
S	316 Stainless Steel	★
0 ⁽²⁾	No mounting (customer supplied)	
G	Chrome-Moly Grade F-11	
N	Chrome-Moly Grade F-22	
J	Chrome-Moly Grade F-91	

Table 11. Rosemount 2051 CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Piping orientation		
H	Horizontal piping	★
D	Vertical piping with downwards flow	★
U	Vertical piping with upwards flow	★
Annubar type		
P	Pak-Lok	★
F	Flanged with opposite side support	★
Sensor material		
S	316 Stainless Steel	★
Sensor size		
1	Sensor size 1 — Line sizes 2-in. (50 mm) to 8-in. (200 mm)	★
2	Sensor size 2 — Line sizes 6-in. (150 mm) to 96-in. (2400 mm)	★
3	Sensor size 3 — Line sizes greater than 12-in. (300 mm)	★
Mounting type		
T1	Compression or threaded connection	★
A1	150# RF ANSI	★
A3	300# RF ANSI	★
A6	600# RF ANSI	★
D1	DN PN16 flange	★
D3	DN PN40 flange	★
D6	DN PN100 flange	★
R1	150# RTJ flange	
R3	300# RTJ flange	
R6	600# RTJ flange	
Opposite side support or packing gland		
0	No opposite side support or packing gland (required for Pak-Lok and Flange-Lok models)	★
Opposite side support (required for flanged models)		
C	NPT threaded opposite support assembly – extended tip	★
D	Welded opposite support assembly – extended tip	★
Isolation valve for Flo-Tap models		
0	Not applicable or customer supplied	★
Temperature measurement		
T	Integral RTD – not available with flanged model greater than class 600#	★
0	No temperature sensor	★

Table 11. Rosemount 2051 CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Temperature measurement			
R	Remote thermowell and RTD		
Transmitter connection platform			
3	Direct-mount, Integral 3-valve Manifold – not available with flanged model greater than class 600		★
5	Direct -mount, 5-valve Manifold – not available with flanged model greater than class 600		★
7	Remote-mount NPT connections (1/2-in. FNPT)		★
8	Remote-mount SW Connections (1/2-in.)		
Differential pressure range			
1	0 to 25 inH ₂ O (0 to 62,3 mbar)		★
2	0 to 250 inH ₂ O (0 to 623 mbar)		★
3	0 to 1000 inH ₂ O (0 to 2,5 bar)		★
Transmitter output			
A ⁽³⁾	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
X	Wireless		★
M	Low-Power, 1-5 Vdc with digital signal based on HART Protocol		
Transmitter housing material		Conduit entry size	
A	Aluminum	1/2-14 NPT	★
B	Aluminum	M20 × 1.5	★
J	SST	1/2-14 NPT	★
K ⁽⁴⁾	SST	M20 × 1.5	★
P ⁽⁵⁾	Engineered Polymer	No conduit entries	★
D	Aluminum	G1/2	
M ⁽⁴⁾	SST	G1/2	
Transmitter performance class			
1	2.3% flow rate accuracy, 5:1 flow turndown, 2-year stability		★

Wireless options (requires wireless output code X and Engineered Polymer housing code P)

Wireless transmit rate, operating frequency, and protocol			
WA3	User configurable transmit rate, 2.4GHz WirelessHART		★
Antenna and SmartPower			
WP5	Internal antenna, compatible with Green Power Module (I.S. Power Module sold separately)		★

Table 11. Rosemount 2051 CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Special cleaning		
P2	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (Section 11.4)	
Material testing		
V1	Dye penetrant exam	
Material examination		
V2	Radiographic examination	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and performance certificate	★
Surface finish		
RL	Surface finish for low pipe Reynolds number in gas and steam	★
RH	Surface finish for high pipe Reynolds number in liquid	★
Material traceability certification⁽⁶⁾		
Q8	Material traceability certification per EN 10474:2004 3.1	★
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
Materials conformance⁽⁷⁾		
J5	NACE MR-0175/ISO 15156	
Country certification		
J6	European Pressure Directive (PED)	★
J1	Canadian Registration	
Instrument connections for remote mount options		
G2	Needle valves, Stainless Steel	★
G6	OS&Y gate valve, Stainless Steel	★
G1	Needle valves, Carbon Steel	
G3	Needle valves, Alloy C-276	
G5	OS&Y gate valve, Carbon Steel	

Table 11. Rosemount 2051 CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Instrument connections for remote mount options		
G7	OS&Y gate valve, Alloy C-276	
Special shipment		
Y1	Mounting hardware shipped separately	★
Product certifications		
E1 ⁽⁴⁾	ATEX Flameproof	★
E2 ⁽⁴⁾	INMETRO Flameproof	★
E3 ⁽⁴⁾	China Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7 ⁽⁴⁾	IECEx Flameproof, Dust Ignition-proof	★
I1 ⁽⁴⁾	ATEX Intrinsic Safety	★
I2 ⁽⁴⁾	INMETRO Intrinsically Safe	★
I3 ⁽⁴⁾	China Intrinsic Safety	★
I5	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7 ⁽⁵⁾⁽⁸⁾	IECEx Intrinsic Safety	★
IA ⁽⁵⁾⁽⁸⁾	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus protocol only	★
IE ⁽⁵⁾⁽⁸⁾	FM FISCO Intrinsically Safe	★
IF ⁽⁵⁾⁽⁸⁾	CSA FISCO Intrinsically Safe	★
IG ⁽⁵⁾⁽⁸⁾	IECEx FISCO Intrinsically Safe	★
K1 ⁽⁴⁾	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	★
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	★
K7 ⁽⁴⁾	IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	★
KA ⁽⁴⁾	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)	★
KC ⁽⁴⁾	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD ⁽⁴⁾	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)	★
N1 ⁽⁴⁾	ATEX Type n	★
N7 ⁽⁴⁾	IECEx Type n	★
ND ⁽⁴⁾	ATEX Dust	★
Sensor fill fluid and O-ring options		
L1 ⁽⁹⁾	Inert sensor fill fluid	★
L2	Graphite-filled (PTFE) O-ring	★

Table 11. Rosemount 2051 CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Sensor fill fluid and O-ring options⁽⁹⁾		
LA	Inert sensor fill fluid and Graphite-filled (PTFE) O-ring	★
Display and interface options		
M4 ⁽¹⁰⁾	LCD display with Local Operator Interface	★
M5	LCD display	★
Transmitter calibration certification		
Q4	Calibration certificate for transmitter	★
Quality certification for safety⁽¹¹⁾		
QS	Certificate of FMEDA data	★
QT	Safety certified to IEC 61508 with certificate of FMEDA	
Transient protection⁽⁹⁾⁽¹²⁾		
T1	Transient terminal block	★
Manifold for remote Mount option		
F2	3-valve Manifold, Stainless Steel	★
F6	5-valve Manifold, Stainless Steel	★
F1	3-valve Manifold, Carbon Steel	
F5	5-valve Manifold, Carbon Steel	
PlantWeb control functionality⁽⁸⁾		
A01	FOUNDATION Fieldbus advanced control function block suite	★
Hardware adjustments		
D4 ⁽¹³⁾	Zero and span hardware adjustments	★
DZ ⁽¹⁴⁾	Digital zero trim	★
Alarm limit⁽¹³⁾		
C4 ⁽¹⁵⁾	NAMUR alarm and saturation levels, high alarm	★
CN ⁽¹⁵⁾	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
Ground screw⁽⁹⁾⁽¹⁶⁾		
V5	External ground screw assembly	★

Table 11. Rosemount 2051 CFA Annubar Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

HART revision configuration ⁽¹³⁾		
HR5 ⁽¹⁷⁾	Configured for HART Revision 5	
HR7 ⁽¹⁸⁾	Configured for HART Revision 7	
Typical model number: 2051CFA D L 060 D C H P S 2 T1 0 0 0 3 2A A 1A 3		

1. See the DP Flow Product Data Sheet (document number 00813-0100-4485) for Pipe I.D. table.
2. Provide the "A" dimension for Flanged (page 203) and Pak-Lok (page 196).
3. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
4. Not available with Low Power Output Code M.
5. Only available with output code X.
6. Instrument Connections for Remote Mount Options and Isolation Valves for Flo-tap Models are not included in the Material Traceability Certification.
7. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
8. Only valid with FOUNDATION Fieldbus Output Code F.
9. Not available with output code X.
10. Not available with FOUNDATION Fieldbus (Output Code F) or Wireless (Output Code X).
11. Only available with 4-20 mA HART (Output Code A).
12. Not available with Housing code 00, 5A or 7J. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification code IA.
13. Only available with 4-20 mA HART (output codes A and M).
14. Only available with HART 4-20 mA Output (output codes A and M) and Wireless Output (output code X).
15. NAMUR-Compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
16. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
17. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 if needed.
18. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 if needed.

A.8 2051CFC ordering information



A.8.1 Rosemount 2051CFC Compact Flowmeter

- Compact Conditioning flowmeters reduce straight piping requirements to 2D upstream and 2D downstream from most flow disturbances.
- Simple installation of Compact flowmeters between any existing raised-face flanges.

Table 12. Rosemount 2051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model	Product description	
2051CFC	Compact Flowmeter	
Measurement type		
D	Differential Pressure	★
Primary element technology		
A	Annubar averaging pitot tube	★
C	Conditioning orifice plate	★
P	Orifice plate	★
Material type		
S	316 SST	★
Line size		
005 ⁽¹⁾	1/2-in. (15 mm)	★
010 ⁽¹⁾	1-in. (25 mm)	★
015 ⁽¹⁾	1 1/2-in. (40 mm)	★
020	2-in. (50 mm)	★
030	3-in. (80 mm)	★
040	4-in. (100 mm)	★
060	6-in. (150 mm)	★
080	8-in. (200 mm)	★
100 ⁽²⁾⁽³⁾	10-in. (250 mm)	★
120 ⁽²⁾⁽³⁾	12-in. (300 mm)	★
Primary element type		
N000	Annubar sensor size 1	★
N040	0.40 Beta ratio	★
N050	0.50 Beta ratio	★
N065 ⁽⁴⁾	0.65 Beta ratio	★

Table 12. Rosemount 2051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Temperature measurement			
0	No temperature sensor		★
T ⁽⁵⁾	Integral RTD		
R	Remote thermowell and RTD		
3	Direct-mount		★
Transmitter connection platform			
7	Remote-mount, NPT connections		★
Differential pressure range			
1	0 to 25 inH ₂ O (0 to 62,3 mbar)		★
2	0 to 250 inH ₂ O (0 to 623 mbar)		★
3	0 to 1000 inH ₂ O (0 to 2,5 bar)		★
Transmitter output			
A ⁽⁶⁾	4–20 mA with digital signal based on HART Protocol		★
F	FOUNDATION Fieldbus Protocol		★
W	PROFIBUS PA Protocol		★
X	Wireless		★
M	Low-Power, 1-5 Vdc with digital signal based on HART Protocol		
Transmitter housing material		Conduit entry size	
A	Aluminum	1/2-14 NPT	★
B	Aluminum	M20 × 1.5	★
J	SST	1/2-14 NPT	★
K ⁽⁷⁾	SST	M20 × 1.5	★
p ⁽⁸⁾	Engineered Polymer	No conduit entries	★
D	Aluminum	G1/2	
M ⁽⁷⁾	SST	G1/2	
Transmitter performance class			
1	up to ±2.00% flow rate accuracy, 5:1 flow turndown, 2-year stability		★

Wireless options (requires wireless output code X and Engineered Polymer housing code P)

Wireless transmit rate, operating frequency, and protocol			
WA3	User configurable transmit rate, 2.4GHz WirelessHART		★
Antenna and SmartPower			
WP5	Internal antenna, compatible with Green Power Module (I.S. Power Module sold separately)		★

Table 12. Rosemount 2051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Installation accessories		
AB	ANSI alignment ring (150#) (only required for 10-in. [250 mm] and 12-in. [300mm] line sizes)	★
AC	ANSI alignment ring (300#) (only required for 10-in. [250 mm] and 12-in. [300mm] line sizes)	★
AD	ANSI alignment ring (600#) (only required for 10-in. [250 mm] and 12-in. [300mm] line sizes)	★
DG	DIN alignment ring (PN16)	★
DH	DIN alignment ring (PN40)	★
DJ	DIN alignment ring (PN100)	★
JB	JIS alignment ring (10K)	
JR	JIS alignment ring (20K)	
JS	JIS alignment ring (40K)	
Remote adapters		
FE	Flange adapters 316 SST (1/2-in NPT)	★
High temperature application		
HT	Graphite valve packing ($T_{max} = 850^{\circ}\text{F}$)	
Flow calibration		
WC ⁽⁹⁾	Flow calibration, 3 Pt, Conditioning orifice option C (all pipe schedules)	
WD ⁽¹⁰⁾⁽¹¹⁾	Flow calibration, 10 Pt, Conditioning option C (all schedules), Annubar option A (schedule 40)	
Pressure testing		
P1	Hydrostatic testing with certificate	
Special cleaning		
P2 ⁽¹²⁾	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (Section 11.4)	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and performance certificate	★
Transmitter calibration certification		
Q4	Calibration certificate for transmitter	★
Quality certification for safety		
QS ⁽¹³⁾	Prior-use certificate of FMEDA data	★
QT ⁽¹⁴⁾	Safety certified to IEC 61508 with certificate of FMEDA	★

Table 12. Rosemount 2051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Material traceability certification		
Q8	Material traceability certification per EN 10204:2004 3.1	★
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
J4	ANSI/ASME B31.8	
Materials conformance		
J5 ⁽¹⁵⁾	NACE MR-0175/ISO 15156	
Country certification		
J1	Canadian Registration	
Product certifications		
E1 ⁽⁷⁾	ATEX Flameproof	★
E2 ⁽⁷⁾	INMETRO Flameproof	★
E3 ⁽⁷⁾	China Flameproof	★
E5	FM Explosion-proof, Dust Ignition-proof	★
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2	★
E7 ⁽⁷⁾	IECEX Flameproof, Dust Ignition-proof	★
I1 ⁽⁷⁾	ATEX Intrinsic Safety	★
I2 ⁽⁷⁾	INMETRO Intrinsically Safe	★
I3 ⁽⁷⁾	China Intrinsic Safety	★
I5	FM Intrinsically Safe, Division 2	★
I6	CSA Intrinsically Safe	★
I7 ⁽⁷⁾	IECEX Intrinsic Safety	★
IA ⁽⁷⁾	ATEX FISCO Intrinsic Safety; for FOUNDATION Fieldbus protocol only	★
IE ⁽⁷⁾⁽¹⁶⁾	FM FISCO Intrinsically Safe	★
IF ⁽⁷⁾⁽¹³⁾	CSA FISCO Intrinsically Safe	★
IG ⁽⁷⁾⁽¹³⁾	IECEX FISCO Intrinsically Safe	★
K1 ⁽⁷⁾	ATEX Flameproof, Intrinsic Safety, Type n, Dust	★
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)	★
K6	CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)	★
K7 ⁽⁷⁾	IECEX Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)	★
KA ⁽⁷⁾	ATEX and CSA Flameproof, Intrinsically Safe, Division 2	★
KB	FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)	★
KC ⁽⁷⁾	FM and ATEX Explosion-proof, Intrinsically Safe, Division 2	★
KD ⁽⁷⁾	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)	★

Table 12. Rosemount 2051CFC Compact Flowmeter Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Product certifications⁽⁷⁾		
N1	ATEX Type n	★
N7	IECEx Type n	★
ND	ATEX Dust	★
Sensor fill fluid and O-ring options		
L1 ⁽¹⁷⁾	Inert sensor fill fluid	★
L2	Graphite-filled (PTFE) O-ring	★
LA ⁽¹⁷⁾	Inert sensor fill fluid and Graphite-filled (PTFE) O-ring	★
Display and interface options		
M4 ⁽¹⁸⁾	LCD display with Local Operator Interface	★
M5	LCD display	★
Transient protection⁽¹⁷⁾⁽¹⁹⁾		
T1	Transient terminal block	★
Manifold for remote mount option		
F2	3-valve Manifold, Stainless Steel	★
F6	5-valve Manifold, Stainless Steel	★
Alarm limit⁽²⁰⁾		
C4 ⁽²¹⁾	NAMUR alarm and saturation levels, high alarm	★
CN ⁽²¹⁾	NAMUR alarm and saturation levels, low alarm	★
CR	Custom alarm and saturation signal levels, high alarm (requires C1 and Configuration Data Sheet)	★
CS	Custom alarm and saturation signal levels, low alarm (requires C1 and Configuration Data Sheet)	★
CT	Low alarm (standard Rosemount alarm and saturation levels)	★
PlantWeb control functionality⁽¹³⁾		
A01	FOUNDATION Fieldbus advanced control function block suite	★
Hardware adjustments		
D4 ⁽²⁰⁾	Zero and span hardware adjustments	★
DZ ⁽²²⁾	Digital zero trim	★
Ground screw⁽²³⁾		
V5	External ground screw assembly	★
HART revision configuration⁽²⁰⁾		
HR5 ⁽²⁴⁾	Configured for HART Revision 5	
HR7 ⁽²⁵⁾	Configured for HART Revision 7	
Typical model number: 2051CFC D C S 060 N 065 0 3 2 A A 1 WC E5 M5		

1. Not available for Primary Element Technology C.
2. For the 10-in. (250 mm) and 12-in. (300 mm) line size, the alignment ring must be ordered (Installation Accessories).
3. 10-in. (250 mm) and 12-in. (300 mm) line sizes not available with Primary Element Technology A.
4. For 2-in. (50 mm) line sizes the Primary Element Type is 0.6 for Primary Element Technology Code C.
5. Available with Primary Element Technology A only.
6. HART Revision 5 is the default HART output. The Rosemount 2051 with Selectable HART can be factory or field configured to HART Revision 7. To order HART Revision 7 factory configured, add option code HR7.
7. Not available with Low Power Output Code M.
8. Only available with output code X.
9. Available with primary element technology C only.
10. Available with primary element technology C or A only.
11. For Annubar Option A, consult factory for pipe schedules other than Sch. 40.
12. Available with primary element technology C or P only.
13. Only valid with FOUNDATION Fieldbus Output Code F.
14. Only available with 4-20 mA HART output (output code A).
15. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
16. Not available with Primary Element Technology P.
17. Not available with output code X.
18. Not available with FOUNDATION Fieldbus (Output Code F) or Wireless (Output Code X).
19. Not available with Housing code 00, 5A, or 7J. The T1 option is not needed with FISCO Product Certifications, transient protection is included with the FISCO Product Certification code IA.
20. Only available with 4-20 mA HART (output codes A and M).
21. NAMUR-compliant operation is pre-set at the factory and cannot be changed to standard operation in the field.
22. Only available with HART 4-20 mA (Output Codes A and M) and Wireless (Output Code X).
23. The V5 option is not needed with the T1 option; external ground screw assembly is included with the T1 option.
24. Configures the HART output to HART Revision 5. The device can be field configured to HART Revision 7 if needed.
25. Configures the HART output to HART Revision 7. The device can be field configured to HART Revision 5 if 14 needed.

A.9 2051CF specifications

A.9.1 Performance specifications

Performance assumptions include: measured pipe I.D, transmitter is trimmed for optimum flow accuracy, and performance is dependent on application parameters.

Table 13. Flow Performance - Flow Reference Accuracy⁽¹⁾

2051CFA Annubar Flowmeter		
Ranges 2-3		±2.30% of flow rate at 5:1 flow turndown
2051CFC_A Compact Annubar Flowmeter - Annubar option A		
Ranges 2-3	Standard	±2.60% of flow rate at 5:1 flow turndown
	Calibrated	±2.30% of flow rate at 5:1 flow turndown

1. Range 1 flowmeters may experience an additional uncertainty up to 0.9%. Consult your Emerson Process Management Representative for exact specifications.

A.9.2 Functional specifications

Range and sensor limits

Range	2051CF minimum span	Range and sensor limits
1	0.5 inH ₂ O (1,24 mbar)	0 to 25 inH ₂ O (62,16 mbar)
2	2.5 inH ₂ O (4,14 mbar)	0 to 250 inH ₂ O (0,62 bar)
3	6.67 inH ₂ O (16,58 mbar)	0 to 1000 inH ₂ O (2,49 bar)

Service

Liquid, gas, and steam applications

4–20 mA HART (output code A)

Output

Two-wire 4–20 mA, user-selectable for linear or square root output. Digital process variable superimposed on 4–20 mA signal, available to any host that conforms to the HART protocol.

Power supply

External power supply required. Standard transmitter operates on 10.5 to 42.4 Vdc with no load.

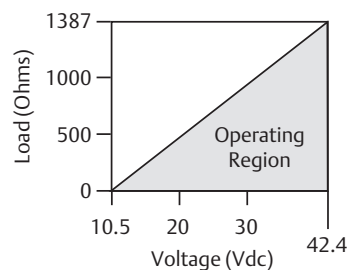
Turn-on time

Performance within specifications less than 2.0 seconds after power is applied to the transmitter.

Load limitations

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

$$\text{Maximum Loop Resistance} = 43.5 \times (\text{Power Supply Voltage} - 10.5)$$



The Field Communicator requires a minimum loop resistance of 250Ω for communication.

FOUNDATION Fieldbus (output code F)

Power supply

External power supply required; transmitters operate on 9.0 to 32.0 Vdc transmitter terminal voltage for non-I.S. applications, 9.0 to 30 Vdc for entity model intrinsically safe applications and 9.0 to 17.5 Vdc for FISCO intrinsically safe applications.

Current draw

17.5 mA for all configurations (including LCD display option)

Indication

Optional 2-line LCD display

FOUNDATION Fieldbus function block execution times

Block	Execution time
Resource	N/A
Transducer	N/A
LCD display Block	N/A
Analog Input 1, 2	20 milliseconds
PID	25 milliseconds
Arithmetic	20 milliseconds
Input Selection	20 milliseconds
Signal Characterizer	20 milliseconds
Integrator	20 milliseconds
Output Splitter	20 milliseconds
Control Selector	20 milliseconds

FOUNDATION Fieldbus parameters

Schedule Entries	7 (max.)
Links	20 (max.)
Virtual Communications Relationships (VCR)	12 (max.)

Standard function blocks

Resource block

- The resource block contains diagnostic, hardware and electronics information. There are no linkable inputs or outputs to the Resource Block.

Transducer block

- The sensor transducer block contains sensor information including the sensor diagnostics and the ability to trim the pressure sensor or recall factory calibration.

LCD display transducer block

- The LCD display transducer block is used to configure the LCD display meter.

Analog input (AI) block

- The AI block processes the measurements from the sensor and makes them available to other function blocks. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement. The AI block is widely used for scaling functionality.

Note

The channel, Set XD_Scale, Set L_Type, and sometimes Set Out_Scale are typically configured by instrument personnel. Other AI block parameters, block links, and schedule are typically configured by the control systems configuration engineer.

Input selector (ISEL) block

- The ISEL block can be used to select the first good, Hot Backup™, maximum, minimum, or average of as many as eight input values and place it at the output. The block supports signal status propagation.

Integrator (INT) block

- The INT block integrates one or two variables over time. The block compares the integrated or accumulated value to pre-trip and trip limits and generates discrete output signals when the limits are reached. The INT block is used as a totalizer. This block will accept up to two inputs, has six options how to totalize the inputs, and two trip outputs.

Arithmetic (ARTH) block

- The ARTH block provides the ability to configure a range extension function for a primary input. It can also be used to compute nine different arithmetic functions including flow with partial density compensation, electronic remote seals, hydrostatic tank gauging, ratio control and others.

Signal characterizer (SGCR) block

- The SGCR block characterizes or approximates any function that defines an input/output relationship. The function is defined by configuring as many as twenty X,Y coordinates. The block interpolates an output value for a given input value using the curve defined by the configured coordinates. Two separate analog input signals can be processed simultaneously to give two corresponding separate output values using the same defined curve.

PID block

- The PID function block combines all of the necessary logic to perform proportional/integral/derivative (PID) control. The block supports mode control, signal scaling and limiting, feed forward control, override tracking, alarm limit detection, and signal status propagation.

Control selector block

- The control selector Function Block selects one of two or three inputs to be the output. The inputs are normally connected to the outputs of PID or other function blocks. One of the inputs would be considered Normal and the other two overrides.

Output splitter block

- The output splitter function block provides the capability to drive two control outputs from a single input. It takes the output of one PID or other control block to control two valves or other actuators.

Backup Link Active Scheduler (LAS)

The transmitter can function as a Link Active Scheduler if the current link master device fails or is removed from the segment.

PROFIBUS PA (output code W)

Profile version

3.02

Power supply

External power supply required; transmitters operate on 9.0 to 32.0 Vdc transmitter terminal voltage for non-I.S. applications, 9.0 to 30 Vdc for entity model intrinsically safe applications and 9.0 to 17.5 Vdc for FISCO intrinsically safe applications.

Current draw

17.5 mA for all configurations (including LCD display option)

Output update rate

Four times per second

Standard function blocks

Analog Input (AI Block)

- The AI function block processes the measurements and makes them available to the host device. The output value from the AI block is in engineering units and contains a status indicating the quality of the measurement.

Physical block

- The physical block defines the physical resources of the device including type of memory, hardware, electronics, and diagnostic information.

Transducer block

- Contains actual sensor measurement data including the sensor diagnostics and the ability to trim the pressure sensor or recall factory defaults.

Indication

- Optional 2-line LCD display

LOI

- Optional external configuration buttons.

Wireless (output code X)

Output

IEC 62591 (*WirelessHART*), 2.4 GHz DSSS

Wireless radio (internal antenna, WP5 option)

- Frequency: 2.400 - 2.485 GHz
- Channels: 15
- Modulation: IEEE 802.15.4 compliant DSSS
- Transmission: Maximum of 10 dBm EIRP

Local display

The optional 3-line, 7-digit LCD display can display user-selectable information such as primary variable in engineering units, scaled variable, percent of range, sensor module temperature, and electronics temperature. The display updates based on the wireless update rate.

Digital zero trim

Digital Zero trim (option DZ) is an offset adjustment to compensate for mounting position effects, up to 5% of URL.

Update rate

User selectable 1 sec. to 60 min.

Wireless sensor module for In-Line transmitters

The 2051 Wireless Transmitter requires the engineered polymer housing to be selected. The standard sensor module will come with aluminum material. If stainless steel is required, the option WSM must be selected.

Power module

Field replaceable, keyed connection eliminates the risk of incorrect installation, Intrinsically Safe Lithium-thionyl chloride Power Module with PBT/PC enclosure. Ten-year life at one minute update rate.⁽¹⁾

1. Reference conditions are 70 °F (21 °C), and routing data for three additional network devices.
Note: Continuous exposure to ambient temperature limits of -40 °F to 185 °F (-40 °C to 85 °C) may reduce specified life by less than 20 percent.

1-5 Vdc HART low power (output code M)

Output

Three wire 1–5 Vdc output, user-selectable for linear or square root output. Digital process variable superimposed on voltage signal, available to any host conforming to the HART protocol.

2051

Digital communications based on HART Revision 5 protocol.

2051 with selectable HART

The 2051 with Selectable HART comes with Selectable HART Revisions. Digital communications based on HART Revision 5 (default) or Revision 7 (option code HR7) protocol can be selected. The HART revision can be switched in the field using any HART based configuration tool or the optional local operator interface (LOI).

LOI

The LOI utilizes a 2 button menu with internal and external configuration buttons. Internal buttons are always configured for Local Operator Interface. External Buttons can be configured for either LOI, (option code M4), Analog zero and span (option code D4) or Digital Zero Trim (option code DZ). See 2051 with Selectable HART product manual (00809-0100-4107) for LOI configuration menu.

Power supply

External power supply required. Standard transmitter operates on 9 to 28 Vdc with no load.

Power consumption

3.0 mA, 27–84 mW

Output load

100 k Ω or greater (meter input impedance)

Turn-on time

Performance within specifications less than 2.0 seconds after power is applied to the transmitter.

Overpressure limits

Transmitters withstand the following limits without damage:

2051CF flowmeters

- Ranges 2–5: 3626 psig (250 bar)
4500 psig (310,3 bar) for option code P9
- Range 1: 2000 psig (137,9 bar)

Static pressure limit

- Operates within specifications between static line pressures of -14.2 psig (0.034 bar) and 3626 psig (250 bar)
- Range 1: 0.5 psia to 2000 psig (34 mbar and 137,9 bar)

Burst pressure limits

2051CF

- 10000 psig (689,5 bar)

Temperature limits

For 2051CFA Temperature Limits, see [page 161](#).

Transmitter temperature limits

Ambient⁽¹⁾

–40 to 185 °F (–40 to 85 °C)
With LCD display⁽²⁾: –40 to 175 °F (–40 to 80 °C)

Storage⁽¹⁾

–50 to 230 °F (–46 to 110 °C)
With LCD display: –40 to 185 °F (–40 to 85 °C)

1. Limits for silicone fill fluid only.
2. LCD display may not be readable and LCD updates will be slower at temperatures below -4 °F (-20 °C).

Remote mount transmitter temperature limits

At atmospheric pressures and above.

2051C	
Silicone Fill Sensor ⁽¹⁾	–40 to 250 °F (–40 to 121 °C)
Inert Fill Sensor ⁽¹⁾	–40 to 185 °F (–40 to 85 °C)

1. Process temperatures above 185 °F (85 °C) require derating the ambient limits by a 1.5:1 ratio.

Humidity limits

0–100% relative humidity

Volumetric displacement

Less than 0.005 in.³ (0,08 cm³)

Damping

Analog output response to a step input change is user-selectable from 0 to 25.6 seconds for one time constant. This software damping is in addition to sensor module response time.

Failure mode alarm

If self-diagnostics detect a sensor or microprocessor failure, the analog signal is driven either high or low to alert the user. High or low failure mode is user-selectable with a jumper on the transmitter. The values to which the transmitter drives its output in failure mode depend on whether it is factory-configured to standard or NAMUR-compliant operation. The values for each are as follows:

Standard operation			
Output code	Linear output	Fail high	Fail low
A	$3.9 \leq I \leq 20.8$	$I \geq 21.75 \text{ mA}$	$I \leq 3.75 \text{ mA}$
M	$0.97 \leq V \leq 5.2$	$V \geq 5.4 \text{ V}$	$V \leq 0.95 \text{ V}$

NAMUR-compliant operation			
Output code	Linear output	Fail high	Fail low
A	$3.8 \leq I \leq 20.5$	$I \geq 22.5 \text{ mA}$	$I \leq 3.6 \text{ mA}$

Dynamic performance

	4-20 mA HART ⁽¹⁾ 1-5 Vdc HART low power	FOUNDATION Fieldbus ⁽²⁾	Typical HART transmitter response time
Total Response Time ($T_d + T_c$) ⁽³⁾ :			Transmitter Output vs. Time Pressure released 100% 36.8% 0% Time T_d = Dead time T_c = Time constant Response time = $T_d + T_c$ 63.2% of total step change
2051CF, Range 3-5	115 milliseconds	152 milliseconds	
Range 1	270 milliseconds	307 milliseconds	
Range 2	130 milliseconds	152 milliseconds	
Dead Time (T_d)	60 milliseconds (nominal)	97 milliseconds	
Update Rate	22 times per second	22 times per second	

1. Dead time and update rate apply to all models and ranges; analog output only.
2. Transmitter Fieldbus output only, segment macro-cycle not included.
3. Nominal total response time at 75 °F (24 °C) reference conditions.

Vibration effect for 2051CFA, 2051CFC, and 2051CFP

Less than $\pm 0.1\%$ of URL when tested per the requirements of IEC60770-1 field or pipeline with high vibration level (10-60 Hz, 0.21 mm displacement peak amplitude/ 60-2000 Hz 3g).

Output code F

If self-diagnostics detect a gross transmitter failure, that information gets passed as a status along with the process variable.

Long term stability

Models	Standard	Performance option, P8
2051CF		
Range 1 (CF)	$\pm 0.2\%$ of URL for 1 year, Reference Stability	$\pm 0.125\%$ of URL for 5 years, Operating Stability
Ranges 2-5	$\pm 0.1\%$ of URL for 2 years, Operating Stability	

Vibration effect for 2051CFC_A

Less than $\pm 0.1\%$ of URL when tested per the requirements of IEC60770-1 field or pipeline with high vibration level (10-60 Hz, 0.15 mm displacement peak amplitude/ 60-2000 Hz 2g).⁽¹⁾

1. Stainless steel temperature housing is not recommended with primary element technology A in applications with mechanical vibration.

A.9.3 Physical specifications

Electrical connections

$1/2$ –14 NPT, G $1/2$, and M20 $\times$ 1.5 conduit

2051CF process-wetted parts

For 2051CFA wetted parts-Annubar sensor material

- 316 Stainless Steel
- Alloy C-276

For 2051CFC wetted parts-material of construction

Body/Plate

- 316/316L SST
- 50 micro-inch Ra surface finish

Manifold head/valves

- 316 SST

Flange studs and nuts

- Customer supplied
- Available as a spare part

Transmitter connection studs and nuts

- Studs – A193 Grade B8M
- Nuts – A194 Grade 8M

Gasket and O-rings

- Gaskets are customer supplied.
- Durlon 8500 fiber gaskets are recommended. Consult an Emerson Process Management representative for use with other gaskets.
- Available as a spare part

Note

Gaskets and O-rings should be replaced when the 405 is disassembled.

Process isolating diaphragms

316L SST, Alloy C-276, or Tantalum

Non-wetted parts for 2051CF

Electronics housing

Low-copper aluminum or CF-8M (Cast version of 316 SST)
Enclosure Type 4X, IP 65, IP 66, IP68

Coplanar sensor module housing

CF-3M (Cast version of 316L SST)

Bolts

ASTM A449, Type 1 (zinc-cobalt plated carbon steel)
ASTM F593G, Condition CW1 (Austenitic 316 SST)
ASTM A193, Grade B7M (zinc plated alloy steel)

Sensor module fill fluid

Silicone oil (D.C. 200) or Fluorocarbon oil

Paint

Polyurethane

Cover o-rings

Buna-N

A.10 485 Annubar primary element ordering information

Table 14. Rosemount 485 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	DP Flow primary type	
485	Annubar Primary Element	
Fluid type		
L	Liquid	★
G	Gas	★
S	Steam	★
Line size		
020	2-in. (50 mm)	★
025	2 1/2-in. (63,5 mm)	★
030	3-in. (80 mm)	★
035	3 1/2-in. (89 mm)	★
040	4-in. (100 mm)	★
050	5-in. (125 mm)	★
060	6-in. (150 mm)	★
070	7-in. (175 mm)	★
080	8-in. (200 mm)	★
100	10-in. (250 mm)	★
120	12-in. (300 mm)	★
140	14-in. (350 mm)	
160	16-in. (400 mm)	
180	18-in. (450 mm)	
200	20-in. (500 mm)	
240	24-in. (600 mm)	
300	30-in. (750 mm)	
360	36-in. (900 mm)	
420	42-in. (1066 mm)	
480	48-in. (1210 mm)	
600	60-in. (1520 mm)	
720	72-in. (1820 mm)	
780	78-in. (1950 mm)	
840	84-in. (2100 mm)	
900	90-in. (2250 mm)	
960	96-in. (2400 mm)	

Table 14. Rosemount 485 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Pipe I.D. range ⁽¹⁾		
C	Range C from the Pipe I.D. table	★
D	Range D from the Pipe I.D. table	★
A	Range A from the Pipe I.D. table	
B	Range B from the Pipe I.D. table	
E	Range E from the Pipe I.D. table	
Z	Non-standard Pipe I.D. range or line sizes greater than 12-in. (300 mm)	
Pipe material/Assembly material		
C	Carbon steel (A105)	★
S	316 Stainless Steel	★
0 ⁽²⁾	No mounting (customer supplied)	★
G	Chrome-Moly Grade F-11	
N	Chrome-Moly Grade F-22	
J	Chrome-Moly Grade F-91	
Piping orientation		
H	Horizontal piping	★
D	Vertical piping with downwards flow	★
U	Vertical piping with upwards flow	★
Annubar type		
P	Pak-Lok	★
F	Flanged with opposite side support	★
T ⁽³⁾	Threaded	★
L	Flange-Lok	
G	Gear-Drive Flo-Tap	
M	Manual Flo-Tap	
Sensor material		
S	316 Stainless Steel	★
H	Alloy C-276	
Sensor size		
1	Sensor size 1 — Line sizes 2-in. (50 mm) to 8-in. (200 mm)	★
2	Sensor size 2 — Line sizes 6-in. (150 mm) to 96-in. (2400 mm)	★
3	Sensor size 3 — Line sizes greater than 12-in. (300 mm)	★
Mounting type		
T1	Compression/Threaded connection	★
A1	150# RF ANSI	★

Table 14. Rosemount 485 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Mounting type				
A3	300# RF ANSI			★
A6	600# RF ANSI			★
D1	DN PN16 flange			★
D3	DN PN40 flange			★
D6	DN PN100 flange			★
A9 ⁽⁴⁾	900# RF ANSI			
AF ⁽⁴⁾	1500# RF ANSI			
AT ⁽⁴⁾	2500 # RF ANSI			
R1	150# RTJ flange			
R3	300# RTJ flange			
R6	600# RTJ flange			
R9 ⁽⁴⁾	900# RTJ flange			
RF ⁽⁴⁾	1500# RTJ flange			
RT ⁽⁴⁾	2500# RTJ flange			
Opposite side support or packing gland				
0	No opposite side support or packing gland (required for Pak-Lok, Flange-Lok, and Threaded models)			★
Opposite side support – required for flanged models				
C	NPT threaded opposite support assembly – extended tip			★
D	Welded opposite support assembly – extended tip			★
Packing gland – required for Flo-Tap models				
	Packing gland material	Rod material	Packing material	
J ⁽⁵⁾	Stainless Steel packing gland/cage nipple	Carbon Steel	PTFE	
K ⁽⁵⁾	Stainless Steel packing gland/cage nipple	Stainless Steel	PTFE	
L ⁽⁵⁾	Stainless Steel packing gland/cage nipple	Carbon Steel	Graphite	
N ⁽⁵⁾	Stainless Steel packing gland/cage nipple	Stainless Steel	Graphite	
R	Alloy C-276 packing gland/cage nipple	Stainless Steel	Graphite	
Isolation valve for Flo-Tap models				
0 ⁽²⁾	Not applicable or customer supplied			★
1	Gate valve, Carbon Steel			
2	Gate valve, Stainless Steel			
5	Ball valve, Carbon Steel			
6	Ball valve, Stainless Steel			

Table 14. Rosemount 485 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Temperature measurement		
T	Integral RTD – not available with flanged model greater than class 600#	★
Temperature measurement		
0	No temperature sensor	★
R	Remote thermowell and RTD	
Transmitter connection platform		
3	Direct-mount, Integral 3-valve manifold– not available with flanged model greater than class 600	★
5	Direct -mount, 5-valve Manifold– not available with flanged model greater than class 600	★
7	Remote-mount NPT connections	★
6	Direct-mount, High Temperature 5-valve Manifold– not available with flanged model greater than class 600	
8	Remote-mount SW connections	
A	Remote-mount NPT connections, Integral needle valves	★
B	Remote-mount SW connections, Integral needle valves	★

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Pressure testing ⁽⁶⁾		
P1	Hydrostatic testing with certificate	
PX	Extended hydrostatic testing	
Special cleaning		
P2	Cleaning for special services	
PA	Cleaning per ASTM G93 level D (Section 11.4)	
Material testing		
V1	Dye penetrant exam	
Material examination		
V2	Radiographic examination	
Flow calibration		
W1	Flow calibration (average K)	
WZ	Special calibration	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and Performance Certificate	★

Table 14. Rosemount 485 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Surface finish		
RL	Surface finish for low pipe Reynolds number in gas and steam	★
RH	Surface finish for high pipe Reynolds number in liquid	★
Material traceability certification ⁽⁷⁾		
Q8	Material certificate per EN 10204:2004 3.1	★
Code conformance ⁽⁸⁾		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
Materials conformance ⁽⁹⁾		
J5	NACE MR-0175/ISO 15156	
Country certification		
J6	European Pressure Directive (PED)	★
J1	Canadian Registration	
Installed in flanged pipe spool section		
H3	150# Flanged connection with Rosemount standard length and schedule	
H4	300# Flanged connection with Rosemount standard length and schedule	
H5	600# Flanged connection with Rosemount standard length and schedule	
Instrument connections for remote mount option ⁽¹⁰⁾		
G2	Needle valves, Stainless Steel	★
G6	OS&Y gate valve, Stainless Steel	★
G1	Needle valves, Carbon Steel	
G3	Needle valves, Alloy C-276	
G5	OS&Y gate valve, Carbon Steel	
G7	OS&Y gate valve, Alloy C-276	
Special shipment		
Y1	Mounting hardware shipped separately	★
Attach to		
H1	Attach to transmitter	
Special dimensions		
VM	Variable mounting	
VT	Variable tip	

Table 14. Rosemount 485 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Special dimensions		
VS	Variable length spool section	
V9	Special dimension	
Typical model number: 485 L 060 D C H P S 2 T1 0 0 0 3		

1. See the DP Flow Product Data Sheet (document number 00813-0100-4485) for Pipe I.D. table.
2. For Pak-Lok, Flanged, Threaded, and Flange-Lok, this note is only applicable if pipe material/assembly material is 0. For Flo-Taps, this note is applicable if either pipe material/assembly material is 0, or if Isolation valve is 0. Provide the "A" dimension for Flanged (page 203), Flange-Lok (page 201), and Threaded Flo-Tap models (page 207). Provide the "B" dimension for Flange Flo-Tap models (page 206).
3. Only available in China.
4. Available in remote mount applications only.
5. The cage nipple is constructed of 304SST.
6. Applies to flow element only, mounting hardware not tested.
7. Instrument Connections for Remote Mount Options and Isolation Valves for Flo-tap Models are not included in the Material Traceability Certification.
8. Not available with Transmitter Connection Platform 6.
9. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
10. Not available with transmitter connections platforms A and B.

A.11 485 specifications

A.11.1 Performance specifications

Performance statement assumptions

Measured pipe I.D. (or Measured pipe cross sectional area)

Discharge coefficient factor

±0.75% of flow rate

Repeatability

±0.1%

Line sizes

- Sensor Size 1: 2-in. to 8-in. (50 to 200 mm)
- Sensor Size 2: 6-in. to 96-in. (150 to 2400 mm)
- Sensor Size 3: 12-in. to 96-in. (300 to 2400 mm)

Note

Some mounting types are not available in larger line sizes.

Table 15. Reynolds Number and Probe Width

Sensor size	Minimum rod Reynolds number (R_d)	Probe width (d) (inches)
1	6500	0.590-in. (14.99 mm)
2	12500	1.060-in. (26.92 mm)
3	25000	1.935-in. (49.15 mm)

$$R_d = \frac{d \times v \times \rho}{\mu}$$

Where
 d = Probe width (feet)
 v = Velocity of fluid (ft/sec)
 ρ = Density of fluid (lbm/ft³)
 μ = Viscosity of the fluid (lbm/ft-sec)

Sizing

Contact an Emerson Process Management representative for assistance. A Configuration Data Sheet is required prior to order for application verification. To complete the Configuration Data Sheet go to:

http://www3.emersonprocess.com/Rosemount/DP_Flow/Application/Pages/PCDefault.aspx

Flow turndown

10:1 or better

Annubar sensor surface finish

The front surface of the Annubar primary element is textured for high Reynolds number applications (typically gas and steam). The surface texture creates a more turbulent boundary layer on the front surface of the sensor. The increased turbulence produces a more predictable and repeatable separation of flow at the edge of the sensor. The appropriate surface finish will be determined for each application by the Emerson Process Management sizing program, Instrument Toolkit software.

A.11.2 Functional specifications

Service

- Liquid
- Gas
- Steam

Process temperature limits

Direct Mount Transmitter

- 500 °F (260 °C)
- 750 °F (398 °C) when used with a direct mount, high temperature 5-valve manifold (Transmitter Connection Platform code 6). Maximum temperature limit for steam processes is 650 °F (343 °C).

Remote Mount Transmitter

- 1250 °F (677 °C) – Alloy C-276 Sensor Material (For superheated steam applications above 1000 °F (538 °C), it is recommended that the Rosemount 585 with Alloy 800H sensor material is used.)
- 850 °F (454 °C) – Stainless Steel Sensor Material

Pressure and temperature limits⁽¹⁾

Direct Mount Transmitter

- Up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °])
- Integral temperature measurement is not available with flanged mounting type greater than class 600

Remote Mount Transmitter

- Up to 2500# ANSI (6000 psig at 100 °F [416 bar at 38 °C]).

1. Static pressure selection may effect pressure limitations.

A.11.3 Physical specifications

Temperature measurement

Integral RTD

- 100 Ohm platinum RTD
- 4-wire RTD ($\alpha = 0.00385$)

Remote RTD

- 100 Ohm platinum RTD, spring loaded with 1/2-in. NPT nipple and union (078 series with Rosemount 644 housing)

Thermowell

- 1/2-in. $\times$ 1/2-in NPT, 316 Stainless Steel with 1/2-in. weld couplet (same as specified pipe material).

Housing connections

- 1/2-14 NPT, G1/2, and M20 $\times$ 1.5 conduit. HART interface connections fixed to terminal block for output code A

Annubar sensor material

- 316 Stainless Steel
- Alloy C-276

Mounting material

- Carbon Steel (A105)
- 316 Stainless Steel
- Chrome-Moly Grade F-11
- Chrome-Moly Grade F-22
- Chrome-Moly Grade F-91

Annubar sensor type

Pak-Lok model (option P)

- Provided with a compression sealing mechanism rated up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C])
- -150 to 850 °F (-101 to 454 °C)
- Not available for steam above 600 °F (315 °C)

Flanged with opposite side support model (option F)

- Provided with opposite side support, which is the same material as the pipe and requires a second pipe penetration
- Sensor flange is the same material as the Annubar sensor and the mounting flange is the same material as the pipe material
- Flanged mounting hardware: nuts, studs, and gaskets (DIN units supplied without nuts, studs, and gaskets)
- SST: (-300 to 850 °F [-184 to 454 °C])
- Alloy C-276: (-150 to 1250 °F [-101 to 677 °C])

Flange-Lok model (option L)

- Flange-Lok assembly is supplied in 316 SST material.
- Flange-Lok mounting hardware: nuts, studs, and gaskets (DIN units supplied without nuts, studs, and gaskets)
- -150 to 850 °F (-101 to 454 °C)
- Not available for steam above 600 °F (315 °C)

Flo-tap models (options G and M)

- Opposite side support is not available
- Threaded connection is not available with sensor size 3
- Gear Drive is not available with sensor size 1
- Packing gland required
- Packing Gland Material Temperature Limits
 - PTFE: -40 to 400 °F (-40 to 204 °C)
 - Graphite: -150 to 850 °F (-101 to 454 °C)
- Isolation valve included
 - The isolation valve will carry the same pressure rating as the sensor flange and mounting flange specified in the mounting type
 - Isolation valves are not supplied with DIN flanges and must be customer supplied
- For threaded Flo-tap models, the isolation valve NPT size is 1 1/4-in. (sensor size 1) and 2-in. (sensor size 2).

Annubar sensor type specification chart

Option code	Description	Pak-Lok ⁽¹⁾	Flange-Lok	Flange	Manual and gear drive Flo-Tap
T1 ⁽¹⁾	Pak-Lok Body	X			
	Threaded connection				X
A1	150# RF ANSI		X	X	X
A3	300# RF ANSI		X	X	X
A6	600# RF ANSI		X	X	X
A9 ⁽²⁾	900# RF ANSI			X	
AF ⁽²⁾	1500# RF ANSI			X	
AT ⁽²⁾	2500# RF ANSI			X	
D1	DN PN 16		X	X	X
D3	DN PN 40		X	X	X
D6	DN PN 100		X	X	X
R1	150# RTJ flange		X	X	X
R3	300# RTJ flange		X	X	X
R6	600# RTJ flange		X	X	X
R9 ⁽²⁾	900# RTJ flange			X	
RF ⁽²⁾	1500# RTJ flange			X	
RT ⁽²⁾	2500# RTJ flange			X	

1. Available up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]) rating.
2. Remote mount only.

RTD temperature limits

Integral and Remote Mounted Thermowell: -100 to 900 °F (-73 to 482 °C)

Instrument connections temperature ranges

Table 16. Minimum/Maximum Temperature Range

Code	Description	Temperature
G1	Needle valves, Carbon Steel	-20 to 500 °F (-29 to 260 °C)
G2	Needle valves, Stainless Steel	-40 to 600 °F (-40 to 316 °C)
G3	Needle valves, Alloy C-276	-40 to 600 °F (-40 to 316 °C)
G5	OS&Y gate valve, Carbon Steel	-20 to 775 °F (-29 to 413 °C)
G6	OS&Y gate valve, Stainless Steel	-40 to 850 °F (-40 to 454 °C)
G7	OS&Y gate valve, Alloy C-276	-40 to 1250 °F (-40 to 677 °C)
A	Integral needle valves, Stainless Steel, Remote-mount NPT connections	-20 to 450 °F (-29 to 232 °C)
B	Integral needle valves, Stainless Steel, Remote-mount SW connections	-20 to 450 °F (-29 to 232 °C)

**Flowmeter installed in flanged pipe spool section
(option codes H3, H4, and H5)**

- All pipe spool sections are flanged pipe sections.
- The flanged pipe spool section is constructed from the same material as the Pipe Material/Mounting Assembly Material.
- Consult the factory for remote temperature measurement and ANSI ratings above 600# and DIN flanges.
- Available in carbon steel (A105) and 316 stainless steel.

Table 17. Flanged Pipe Spool Section Schedule

ANSI	Schedule
150# ANSI	40
300# ANSI	40
600# ANSI	80

Table 18. Flange Pipe Spool Section Length

Nominal pipe size	Length
2-in. (50 mm)	10.52-in. (267.2 mm)
3-in. (80 mm)	11.37-in. (288.8 mm)
4-in. (100 mm)	12.74-in. (323.6 mm)
6-in. (150 mm)	14.33-in. (364.0 mm)
8-in. (200 mm)	16.58-in. (421.1 mm)

A.12 585 Annubar primary element ordering information

Table 19. Rosemount 585 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	DP Flow primary type	
585	Severe Service Annubar Primary Element	
Application type		
S ⁽¹⁾⁽²⁾	Severe Service Annubar	★
M ⁽³⁾	Main Steam Line Annubar	
Fluid type		
L	Liquid	★
G	Gas	★
S	Steam	★
Annubar type		
F	Flanged with opposite side support	★
L	Main Steam Annubar with opposite side support	
G	Gear-Drive Flo-Tap	
Line size		
040	4-in. (100 mm)	★
050	5-in. (125 mm)	★
060	6-in. (150 mm)	★
080	8-in. (200 mm)	★
100	10-in. (250 mm)	★
120	12-in. (300 mm)	★
140	14-in. (350 mm)	
160	16-in. (400 mm)	
180	18-in. (450 mm)	
200	20-in. (500 mm)	
240	24-in. (600 mm)	
300	30-in. (750 mm)	
360	36-in. (900 mm)	
420	42-in. (1066 mm)	
480	48-in. (1210 mm)	
600	60-in. (1520 mm)	
720	72-in. (1820 mm)	
840	84-in. (2100 mm)	
960	96-in. (2400 mm)	

Table 19. Rosemount 585 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Mounting assembly material		
C	Carbon Steel (A105)	★
S	316/316L Stainless Steel	★
L	Carbon Steel (A350 LF2)	
G	Chrome-Moly Grade F-11	
N	Chrome-Moly Grade F-22	
J	Chrome-Moly Grade F-91	
0 ⁽⁴⁾	No mounting (customer supplied)	
Piping orientation		
H	Horizontal piping	★
D	Vertical piping with downwards flow	★
U	Vertical piping with upwards flow	★
Sensor material		
S	316/316L Stainless Steel	★
H ⁽⁵⁾	Alloy C-276	
W ⁽³⁾⁽⁵⁾	Alloy 800H	
K ⁽⁵⁾	PVDF (KYNAR)	
Sensor size		
11	Sensor size 11	★
22 ⁽⁶⁾	Sensor size 22	★
44 ⁽²⁾⁽³⁾	Sensor size 44	
Mounting type		
A	ANSI B16.5 Raised face flanges	★
D ⁽⁷⁾	DIN Raised face flanges	★
R ⁽⁸⁾	ANSI B16.5 Ring type joint flanges	
0 ⁽³⁾	Main steam packing gland	
Mounting pressure class		
1	ANSI 150/DIN PN16	★
3 ⁽⁶⁾	ANSI 300/DIN PN40	★
6 ⁽⁶⁾	ANSI 600/DIN PN100	★
N ⁽⁵⁾⁽⁶⁾	ANSI 900	
F ⁽⁵⁾⁽⁶⁾	ANSI 1500	
T ⁽⁵⁾⁽⁶⁾	ANSI 2500	
0 ⁽³⁾⁽⁵⁾⁽⁶⁾	Main steam packing gland	

Table 19. Rosemount 585 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Opposite side support		
C ⁽⁹⁾	NPT Threaded opposite support assembly	★
D ⁽³⁾	Welded opposite support assembly	★
E	Flanged opposite support assembly	
0 ⁽²⁾	No opposite side support required	
Packing gland		
0 ⁽¹⁾	Not Applicable	★
L ⁽²⁾	SS packing gland/Graphite packing	
T ⁽³⁾	Main steam packing gland/Graphite packing	
Insertion mechanism		
0 ⁽¹⁾⁽³⁾	Not applicable	★
C	Alloy Steel insertion rods/nuts	
S	Stainless Steel insertion rods/nuts	
Isolation valve		
0 ⁽¹⁾⁽³⁾	Not applicable or customer supplied	★
1	Gate valve, Carbon Steel	
2	Gate valve, Stainless Steel	
5	Ball valve, Carbon Steel	
6	Ball valve, Stainless Steel	
Temperature measurement		
0	No temperature sensor required	★
R ⁽⁴⁾⁽⁶⁾⁽⁹⁾	Remote RTD (1/2-in. NPT Aluminum housing) with thermowell	
S ⁽⁴⁾⁽⁶⁾⁽⁹⁾	Remote RTD (1/2-in. NPT Stainless housing) with thermowell	
Transmitter connection platform		
3 ⁽⁶⁾⁽¹⁰⁾⁽¹¹⁾	Direct-Mount, 3-valve Manifold	★
4 ⁽⁶⁾⁽¹⁰⁾⁽¹¹⁾	Direct-Mount, Dual 3-valve Manifolds	
6 ⁽⁶⁾⁽¹⁰⁾⁽¹²⁾	High Temperature Direct-Mount 5-valve Manifold	
7	Remote-Mount 1/2-in. threaded connections	
8 ⁽³⁾	Remote-Mount 1/2-in. welded connections	
Mounting flange bolting materials		
A	193 Gr B7 studs with A194 Gr 2H nuts	★
0	No flange studs/nuts supplied	★
Mounting flange gasket materials		
1	Spiral wound, 304SS, Flexible-Graphite filler	★

Table 19. Rosemount 585 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Mounting flange gasket materials		
0	No Flange gasket supplied	★
2	Ring-Joint, ANSI B16.20, Hexagonal, 316L	
3	Spiral wound, B16.20, 316SS, PTFE filler	

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Optional mounting for rectangular ducts		
RD	Annubar Mounting for rectangular ducts	
Pressure testing		
P1 ⁽¹³⁾	Hydrostatic testing with certificate	
PX	Extended hydrostatic testing	
Special cleaning ⁽⁶⁾⁽¹⁴⁾		
PA	Cleaning per ASTM G93 level D (section 11.4)	
Material testing		
V1	Dye penetrant weld exam	
Material examination		
V2	Radiographic weld examination	
Flow calibration		
W1	Flow calibration (average K)	
Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and performance certificate	★
Material traceability certification ⁽¹⁵⁾		
Q8	Material certificate per ISO 10474 3.1 and EN 10204 3.1	★
Positive material testing ⁽¹⁵⁾		
V4	Positive material identification	
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	

Table 19. Rosemount 585 Annubar Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Materials conformance⁽¹⁶⁾		
J5	NACE MR-0175/ISO 15156	
Country certification		
J6	European Pressure Directive (PED)	★
J1	Canadian Registration Certificate	
Instrument valves for remote mount option		
G2	¹ / ₂ -in. Needle valves, SS	★
G6	¹ / ₂ -in. OS&Y gate valve, SS	★
G1	¹ / ₂ -in. Needle valves, CS	
G3	¹ / ₂ -in. Needle valves, Alloy C-276	
G5	¹ / ₂ -in. OS&Y gate valve, CS	
Instrument valve options⁽¹⁷⁾		
DV	Double instrument valves (4 valves total)	★
Special shipment		
Y1	Mounting hardware shipped separately	★
Assemble mounting hardware⁽¹⁸⁾		
WP	Assemble weldolet to packing body	
Special dimensions		
VM	Variable mounting	
585 Packing gland plug⁽¹⁸⁾		
TP	Packing gland plug for steam blow down	
585 Installation alignment bar⁽¹⁸⁾		
A1	Installation alignment bar	
Typical model number: 585 M S L 120 J H W 44 0 0 0 T 0 0 8 0 0		

1. Required for Annubar sensor type F.
2. Required for Annubar sensor type G.
3. Required for Annubar sensor type L.
4. Not available with Annubar sensor type L.
5. Not available with Annubar sensor type G.
6. Not available with sensor material K.
7. Mounting flange bolting and gasket option code 0 must be selected.
8. Mounting flange gasket material option code 2 or 0 must be selected.
9. Not available with ANSI 2500 mounting pressure class.
10. Not available with mounting pressure class N, T, or F.
11. Not available with sensor material W.
12. Not available with sensor material H or W.
13. Applies to flow element only, mounting not tested.
14. If selected with Annubar sensor type F, mounting flange gasket material option code 3 must be selected.
15. For pressure retaining parts only, isolation and instrument valves are not included.
16. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
17. Only available if Instrument Valves for remote mount option are selected.
18. Only available with Annubar sensor type L.

A.13 585 specifications

A.13.1 Performance specifications

Performance statement assumptions

Measured pipe I.D.

Discharge coefficient factor

±1.50% of flow rate

Repeatability

±0.10%

Line sizes

- Sensor size 11: 4-in. to 24-in. (100 to 600 mm)
- Sensor size 22: 6-in. to 36-in. (150 to 900 mm)
- Sensor size 44: 10-in. to 96-in. (250 to 2400 mm)

Table 20. Reynolds Number and Probe Width

Sensor size	Minimum rod Reynolds number (R_d)	Probe width (d) (inches)
11	6500	0.80-in. (20,32 mm)
22	10000	1.20-in. (30,48 mm)
44	25000	2.28-in. (57,91 mm)

Where

$$R_d = \frac{d \times v \rho}{\mu}$$

d = Probe width (feet)
 v = Velocity of fluid (ft/sec)
 ρ = Density of fluid (lbm/ft³)
 μ = Viscosity of the fluid (lbm/ft-sec)

Sizing

Contact an Emerson Process Management representative for assistance. A Configuration Data Sheet is required prior to order for application verification. To complete the Configuration Data Sheet go to:

http://www3.emersonprocess.com/Rosemount/DP_Flow/Application/Pages/PCDefault.aspx

Pressure and temperature limits

Table 23. Main Steam Line Annubar Sensor

Mounting material	Sensor material	Max. Pressure @ temp.	Max. temp.
Chrome-Moly Grade F-11	Alloy 800H	2317 psig @ 1000 °F (160 bar @ 538 °C)	1100 °F (593 °C)
Chrome-Moly Grade F-22	Alloy 800H	2868 psig @ 1000 °F (198 bar @ 538 °C)	1100 °F (593 °C)
Chrome-Moly Grade F-91	Alloy 800H	3788 psig @ 1100 °F (261 bar @ 593 °C)	1200 °F (649 °C)

Flow turndown

10:1 or better

A.13.2 Functional specifications

Service

- Liquid
- Gas
- Steam

Process temperature limits

Table 21. Direct Mount Transmitter Connection Platform

Transmitter connection platform	Temperature limit
3-valve manifold (Option code 3)	500 °F (260 °C)
5-valve manifold (Option code 6)	750 °F (398 °C)

Note

Specification is 600 °F (315 °C) in steam service.

Table 22. Remote Mount Transmitter Connection Platform

Sensor material	Temperature limit
316 Stainless Steel (Option code S)	850 °F (454 °C)
Alloy C-276 (Option code H)	1250 °F (677 °C)
Alloy 800H (Option code W)	1500 °F (816 °C)
PVDF (KYNAR) (Option code K)	250 °F (121 °C)

Table 24. Severe Service Annubar

Annubar sensor type	Sensor material	Max. flange rating
Flanged (option code F)	316 SST	2500# ANSI
	Alloy C-276	2500# ANSI
	Alloy 800H	2500# ANSI
	PVDF (KYNAR)	150# ANSI
Flanged Flo-Tap (option code G)	316 SST	600# ANSI

A.13.3 Physical specifications

Temperature measurement

Remote RTD

- Series 78 with Rosemount 644 housing 100 Ohm platinum RTD
- Spring loaded with 1/2-in. NPT nipple and union thermowell
- 1/2-in. NPT × 3/4-in. socket weld
- 316 Stainless Steel and Alloy C-276 Material
- 2.5-in. insertion length provided

Annubar sensor material

- 316 Stainless Steel
- Alloy C-276
- Alloy 800H
- PVDF

Mounting material

- Carbon Steel (A105)
- 316 Stainless Steel
- Carbon Steel (A350 LF2)
- Chrome-Moly Grade F-11
- Chrome-Moly Grade F-22
- Chrome-Moly Grade F-91

Annubar sensor type

Flanged with opposite side support model (option F)

- Provided with opposite side support, which is the same material as the pipe and requires a second pipe penetration.
- Sensor flange is the same material as the Annubar sensor and the mounting flange is the same material as the pipe material.
- Flanged mounting hardware: nuts, studs, and gaskets (DIN units supplied without nuts, studs, and gaskets).
- SST: -325 to 850 °F (-198 to 454 °C)
- Alloy C-276: -325 to 1250 °F (-198 to 677 °C)
- PVDF: -40 to 250 °F (-40 to 121 °C)
- Alloy 800H: -325 to 1500 °F (-198 to 816 °C)

Main steam Annubar sensor with opposite side support (option L)

- Provided with opposite side support, which is the same material as the pipe and requires a second pipe penetration.
- Alloy 800H: -325 to 1500 °F (-198 to 816 °C)
- Only available in sensor size 44.

Flanged Flo-tap models (option G)

- Opposite side support is not available.
- Packing Gland Material Temperature Limits.
 - Graphite: -40 to 850 °F (-40 to 454 °C)
- Isolation valve option
 - The isolation valve will carry the same pressure rating as the sensor flange and mounting flange specified in the mounting type.
- SST: -325 to 850 °F (-198 to 454 °C)
- Maximum allowable insertion pressure: 1440 psig (99 bar)
- Only available in sensor size 44.

Annubar sensor type specification chart

Option code	Mounting type/pressure class	Flanged	Main steam	Gear-drive Flo-Tap
A1	150# RF ANSI	X		X
A3	300# RF ANSI	X		X
A6	600# RF ANSI	X		X
AN ⁽¹⁾	900# RF ANSI	X		
AF ⁽¹⁾	1500# RF ANSI	X		
AT ⁽¹⁾	2500# RF ANSI	X		
D1	DIN PN 16	X		X
D3	DIN PN 40	X		X
D6	DIN PN 100	X		X
R1	150# RTJ flange	X		X
R3	300# RTJ flange	X		X
R6	600# RTJ flange	X		X
RN ⁽¹⁾	900# RTJ flange	X		
RF ⁽¹⁾	1500# RTJ flange	X		
RT ⁽¹⁾	2500# RTJ flange	X		
00 ⁽¹⁾	Main steam packing gland		X	

1. Remote mount only.

Instrument connection temperature ranges

Table 25. Minimum/Maximum Temperature Range

Code	Description	Temperature
G1	Needle valves, Carbon Steel	–20 to 550 °F (–29 to 288 °C)
G2	Needle valves, Stainless Steel	–20 to 1000 °F (–29 to 538 °C)
G3	Needle valves, Alloy C-276	–20 to 1000 °F (–29 to 538 °C)
G5	OS&Y gate valve, Carbon Steel	–20 to 800 °F (–29 to 427 °C)
G6	OS&Y gate valve, Stainless Steel	–20 to 850 °F (–29 to 454 °C)

A.14 405 Compact primary element ordering information



Rosemount 405 Compact Primary Element utilizes an easy to install direct mount primary element assembly.

- Available with Conditioning Orifice Plate Primary Element Technology or Compact Annubar Primary Element Technology
- 405P/C orifice primary elements are based on ASME/ISO corner tap design
- Available in 1/2- to 12-in. (15 to 300 mm) line sizes

Table 26. Rosemount 405C Compact Primary Element Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model	Product description	
405	Compact Primary Element	
Primary element technology		
A	Annubar averaging pitot tube	★
C	Conditioning orifice plate	★
P	Orifice plate	★
Material type		
S	316 SST	★
Line size		
005 ⁽¹⁾	1/2-in. (15 mm)	★
010 ⁽¹⁾	1-in. (25 mm)	★
015 ⁽¹⁾	1 1/2-in. (40 mm)	★
020	2-in. (50 mm)	★
030	3-in. (80 mm)	★
040	4-in. (100 mm)	★
060	6-in. (150 mm)	★
080	8-in. (200 mm)	★
100 ⁽²⁾⁽³⁾	10-in. (250 mm)	★
120 ⁽²⁾⁽³⁾	12-in. (300 mm)	★
Temperature measurement		
T ⁽⁴⁾	Integral RTD	★
N	No temperature measurement	★
R	Remote thermowell and RTD	
Primary element type		
000	Annubar sensor size 1	★

Table 26. Rosemount 405C Compact Primary Element Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Primary element type		
040	0.40 Beta ratio (β)	★
065 ⁽⁵⁾	0.65 Beta ratio (β)	★
Transmitter connection		
D3	Direct mount	★
R3	Remote mount, NPT connections	★
A3 ⁽⁶⁾	Traditional, Direct mount, 3-valve Integral Manifold with adapter plate, SST	

Options (include with selected model number)

Extended product warranty		
WR3	3-year limited warranty	★
WR5	5-year limited warranty	★
Installation accessories		
A ⁽²⁾	ANSI alignment ring (150#)	★
C ⁽²⁾	ANSI alignment ring (300#)	★
D ⁽²⁾	ANSI alignment ring (600#)	★
G	DIN alignment ring (PN 16)	★
H	DIN alignment ring (PN 40)	★
J	DIN alignment ring (PN 100)	★
B	JIS alignment ring (10K)	
R	JIS alignment ring (20K)	
S	JIS alignment ring (40K)	
Remote adapters		
E	Flange adapters 316 SST ($1/2$ -in. NPT)	★
High temperature application		
T	Graphite valve packing ($T_{\max} = 850$ °F)	
Flow calibration		
WC ⁽⁷⁾	Discharge coefficient verification (3 point)	
WD ⁽⁸⁾⁽⁹⁾	Discharge coefficient verification (full 10 point)	
Pressure testing		
P1	Hydrostatic testing	
Special cleaning		
P2 ⁽¹⁰⁾	Cleaning for special processes	
PA	Cleaning per ASTM G93 level D (section 11.4)	

Table 26. Rosemount 405C Compact Primary Element Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Special inspection		
QC1	Visual and dimensional inspection with certificate	★
QC7	Inspection and performance certificate	★
Material traceability certification		
Q8	Material traceability certification per EN10204:2004 3.1	★
Code conformance		
J2	ANSI/ASME B31.1	
J3	ANSI/ASME B31.3	
J4	ANSI/ASME B31.8	
Materials conformance ⁽¹¹⁾		
J5	NACE MR-0175/ISO 15156	
Country certification		
J1	Canadian Registration	
Typical model number: 405 C S 040 N 040 D3		

1. Available with primary element technology P only.
2. For the 10-in. (250 mm) and 12-in. (300 mm) line size, the alignment ring must be ordered (Installation Accessories).
3. 10-in. (250 mm) and 12-in. (300 mm) line sizes not available with Primary Element Technology A.
4. Available with primary element technology A only.
5. For 2-in. (50 mm) line sizes the Beta ratio is 0.6 for Primary Element Type code C.
6. A3 transmitter connection available with primary element technology C or P only.
7. Available with primary element technology C only.
8. Available with primary element technology C or A only.
9. For Annubar sensor option A, consult factory for pipe schedules other than Sch. 40.
10. Available with primary element technology C or P only.
11. Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.

A.15 405 Specifications

A.15.1 Performance specifications

Table 27. 405A Compact Annubar Sensor Technology

K Factor uncertainty	
All Sizes	±1.00%

Line sizes

- 2-in. (50 mm)
- 3-in. (80 mm)
- 4-in. (100 mm)
- 6-in. (150 mm)
- 8-in. (200 mm)
- 10-in. (250 mm) special only
- 12-in. (300 mm) special only

Sizing

Contact an Emerson Process Management sales representative assistance. A "Configuration Data Sheet" is required prior to order for application verification.

A.15.2 Functional specifications

Service

- Liquid
- Gas
- Vapor

Process temperature limits

Direct Mount Transmitter

- -40 to 450 °F (-40 to 232 °C)

Remote Mount Transmitter

- -148 to 850 °F (-100 to 454 °C) – Stainless Steel

Differential pressure limits

Primary element technology A

Table 28. Maximum Allowable DP (Measurement in inH₂O [bar])

Line size	Max DP @ < 450 °F (200 °C)	Max DP @ 450-850 °F (200-454 °C)
2 (50 mm)	1500 (3.73)	1500 (3.73)
3 (80 mm)	900 (2.24)	790 (1.97)
4 (100 mm)	570 (1.42)	500 (1.24)
6 (150 mm)	290 (0.72)	250 (0.62)
8 (200 mm)	190 (0.47)	160 (0.40)
10 (250 mm) ⁽¹⁾	130 (0.32)	110 (0.27)
12 (300 mm) ⁽¹⁾	100 (0.25)	80 (0.20)

1. Only available as a special, EXXXX.

Maximum working pressure

Pressure retention per ANSI B16.5 600# or DIN PN100

Vibration limits

405A

Qualified per IEC61298-3 (1998) for field with low vibration level or pipeline with low vibration level (10-60 Hz 0.15 mm displacement peak amplitude/60 - 2000Hz 2g).⁽¹⁾

The weight and length of the transmitter assembly shall not exceed 9.8 lbs (4.45 kg) and 8.60-in. (218.44 mm).

1. Stainless steel temperature housing is not recommended with primary element technology A in applications with mechanical vibration.

Assembly to a transmitter

Select option code C11 for the Rosemount 3051S Transmitter (or option code S3 for the Rosemount 3051C Transmitters) to factory assemble the Rosemount 405 to a Rosemount Pressure Transmitter. If the 405 and transmitter are not factory assembled, they may be shipped separately. For a consolidated shipment, inform the Emerson Process Management representative when placing the order.

A.15.3 Physical specifications

Temperature measurement

Primary element technology A

Integral RTD

- 100 Ohm platinum RTD
- 4-wire RTD ($\alpha = 0.00385$)

Physical details

Body

- 316/316L SST

Manifold head/valves

- 316 SST

Annubar Primary Element for primary element technology A

- Roughened surface finish

Flange studs and nuts

- Customer supplied
- Available as a spare part

Transmitter connection studs and nuts

- Studs— A193 Grade B8M
- Nuts— A194 Grade 8M

Gasket and O-rings

- Gaskets are customer supplied.
- Gaskets and O-rings are available as spare parts.

Note

Gaskets and O-rings should be replaced when the 405 is disassembled.

Transmitter connections

Direct mount

- Available with 3051SMV, 3051S, 3051, 2051 Transmitters, ranges 1, 2, and 3.

Remote mount

- Remote Mount transmitter connections available with $\frac{1}{2}$ -in. NPT for primary element technology A.

Alignment rings

Table 29. Mounts Between the Following Flange Configurations

ASME B16.5 (ANSI)	DIN	JIS
Class 150	PN16 (option code G)	10k (option code B)
Class 300	PN40 (option code H)	20k (option code R)
Class 600	PN100 (option code H)	40k (option code S)

ANSI 150 - 600# alignment ring is included as standard when ordering for up to 8-in. line size. For the 10-in. and 12-in. line size, the alignment ring must be ordered (Installation Accessories).

Table 30. 405A Weight (Measurement in lb. [kg])

Line Size	Direct Mount (D3)	Remote Mount (R3)
2-in. (50 mm)	5.59 (2.53)	7.26 (3.29)
3-in. (80 mm)	7.41 (3.36)	9.08 (4.12)
4-in. (100 mm)	9.18 (4.16)	10.85 (4.92)
6-in. (150 mm)	13.10 (5.94)	14.76 (6.70)
8-in. (200 mm)	17.12 (7.77)	18.78 (8.52)
10-in. (250 mm) ⁽¹⁾	21.26 (9.64)	22.93 (10.40)
12-in. (300 mm) ⁽¹⁾	27.49 (12.47)	29.16 (13.23)

1. Only available as a special, EXXXX.

A.16 Dimensional drawings

A.16.1 3051SF dimensional drawings

Figure 3. Rosemount 3051SFA Pak-Lok Annubar Flowmeter⁽¹⁾

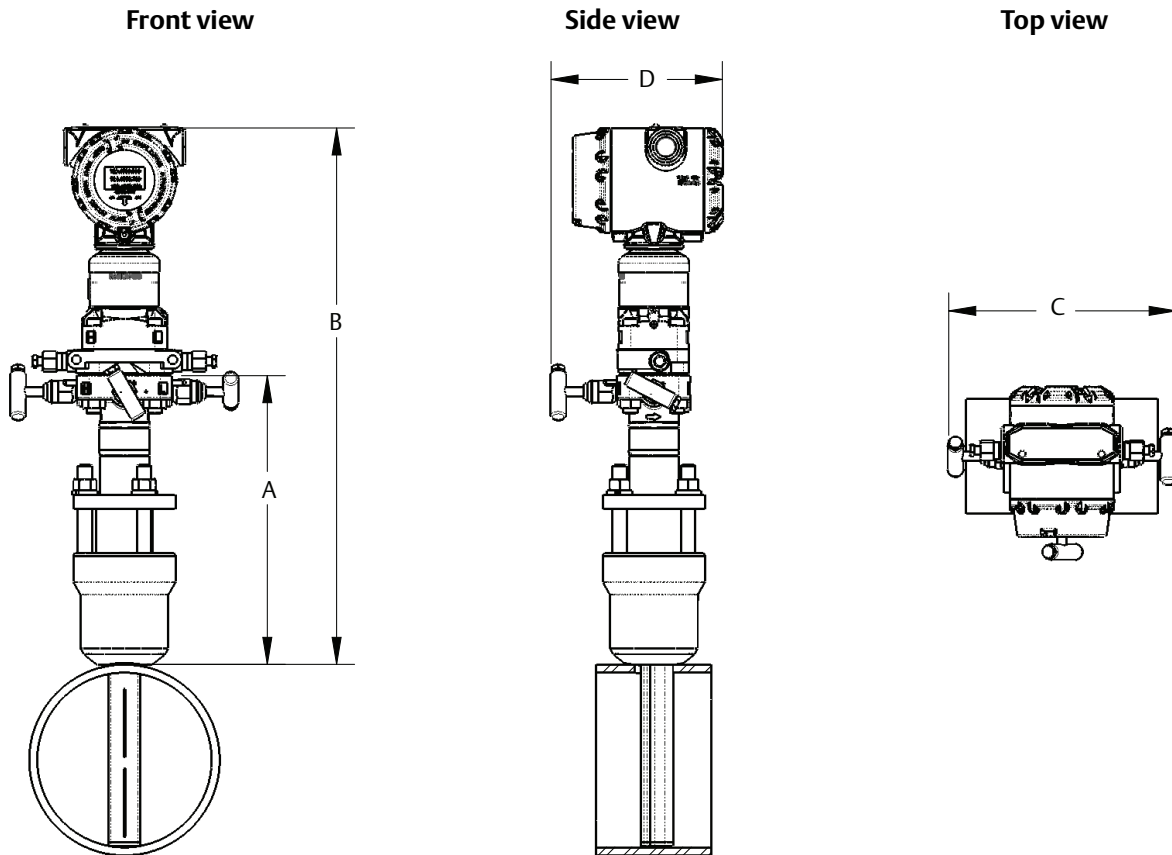


Table 31. 3051SFA Pak-Lok Annubar Flowmeter Dimensional Data

Sensor size	A (Max)	B (Max)	C (Max)	D (Max)
1	8.50 (215.9)	16.03 (407.2)	9.00 (228.6)	6.90 (175.3)
2	11.00 (279.4)	17.78 (451.6)	9.00 (228.6)	6.90 (175.3)
3	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	6.90 (175.3)

Dimensions are in inches (millimeters).

1. The Pak-Lok Annubar model is rated equivalent to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

Figure 4. Rosemount 3051SFA Flange-Lok Annubar Flowmeter⁽¹⁾

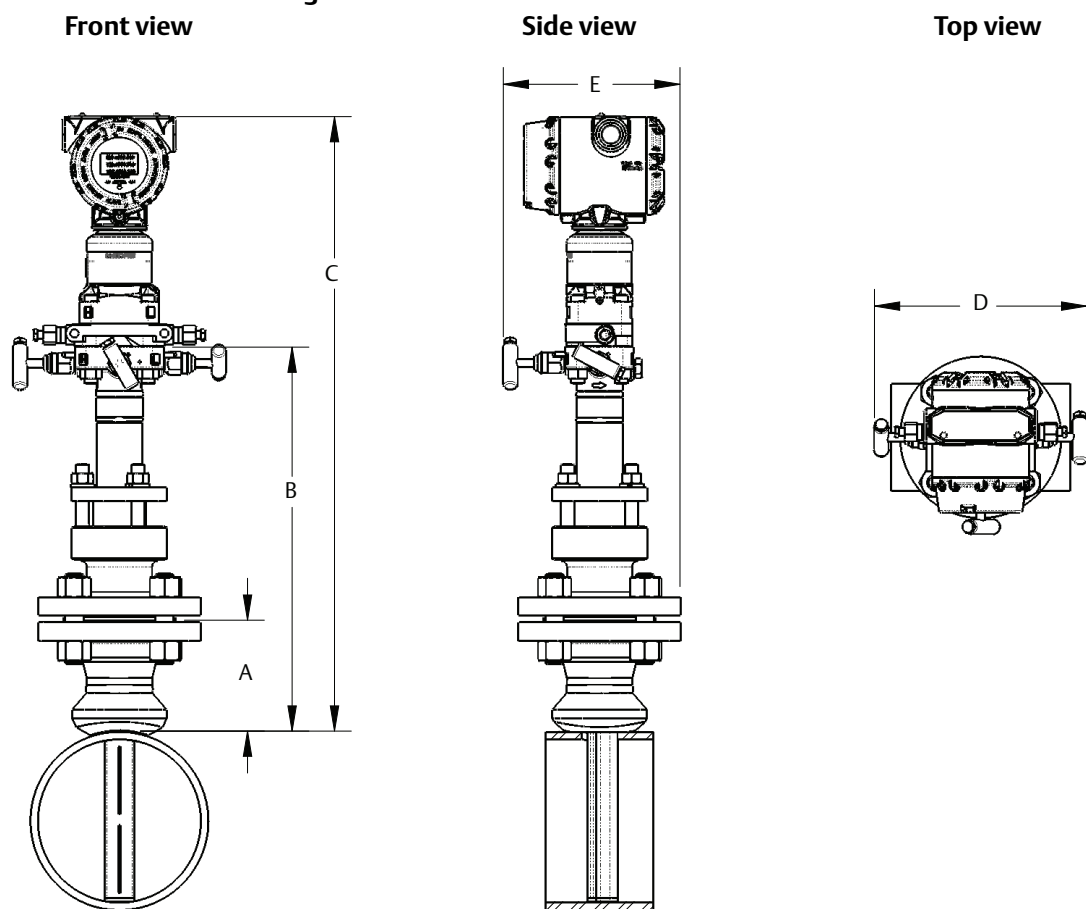


Table 32. 3051SFA Flange-Lok Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C (Max)	D (Max)	E (Max)
1	1 ¹ / ₂ – 150#	3.88 (98.6)	12.25 (311.2)	20.78 (527.8)	9.00 (228.6)	6.30 (160.0)
1	1 ¹ / ₂ – 300#	4.13 (104.9)	12.25 (311.2)	20.78 (527.8)	9.00 (228.6)	6.86 (174.2)
1	1 ¹ / ₂ – 600#	4.44 (112.8)	12.25 (311.2)	20.78 (527.8)	9.00 (228.6)	6.86 (174.2)
1	DN40/PN16	3.09 (78.5)	12.25 (311.2)	20.78 (527.8)	9.00 (228.6)	6.86 (174.2)
1	DN40/PN40	3.21 (81.5)	12.25 (311.2)	20.78 (527.8)	9.00 (228.6)	6.86 (174.2)
1	DN40/ PN100	3.88 (98.6)	12.25 (311.2)	20.78 (527.8)	9.00 (228.6)	6.86 (174.2)
2	2 – 150#	4.13 (104.9)	14.25 (362.0)	22.78 (578.6)	9.00 (228.6)	6.80 (172.7)
2	2 – 300#	4.38 (111.3)	14.25 (362.0)	22.78 (578.6)	9.00 (228.6)	7.05 (179.1)
2	2 – 600#	4.75 (120.7)	14.25 (362.0)	22.78 (578.6)	9.00 (228.6)	7.05 (179.1)
2	DN50/PN16	3.40 (86.4)	14.25 (362.0)	22.78 (578.6)	9.00 (228.6)	7.05 (179.1)
2	DN50/PN40	3.52 (89.4)	14.25 (362.0)	22.78 (578.6)	9.00 (228.6)	7.05 (179.1)

1. The Flange-Lok Annubar model is available up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

Table 32. 3051SFA Flange-Lok Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C (Max)	D (Max)	E (Max)
2	DN50/ PN100	4.30 (109.2)	14.25 (362.0)	22.78 (578.6)	9.00 (228.6)	7.05 (179.1)
3	3 – 150#	4.63 (117.6)	17.50 (444.5)	26.03 (661.2)	9.00 (228.6)	7.55 (191.8)
3	3 – 300#	5.00 (127.0)	17.50 (444.5)	26.03 (661.2)	9.00 (228.6)	7.93 (201.3)
3	3 – 600#	5.38 (136.7)	17.50 (444.5)	26.03 (661.2)	9.00 (228.6)	7.93 (201.3)
3	DN80/PN16	3.85 (97.8)	17.50 (444.5)	26.03 (661.2)	9.00 (228.6)	7.93 (201.3)
3	DN80/PN40	4.16 (105.7)	17.50 (444.5)	26.03 (661.2)	9.00 (228.6)	7.93 (201.3)
3	DN80/ PN100	4.95 (125.7)	17.50 (444.5)	26.03 (661.2)	9.00 (228.6)	7.93 (201.3)

Dimensions are in inches (millimeters).

Figure 5. Rosemount 3051SFA Flanged with Opposite Side Support Annubar Flowmeter

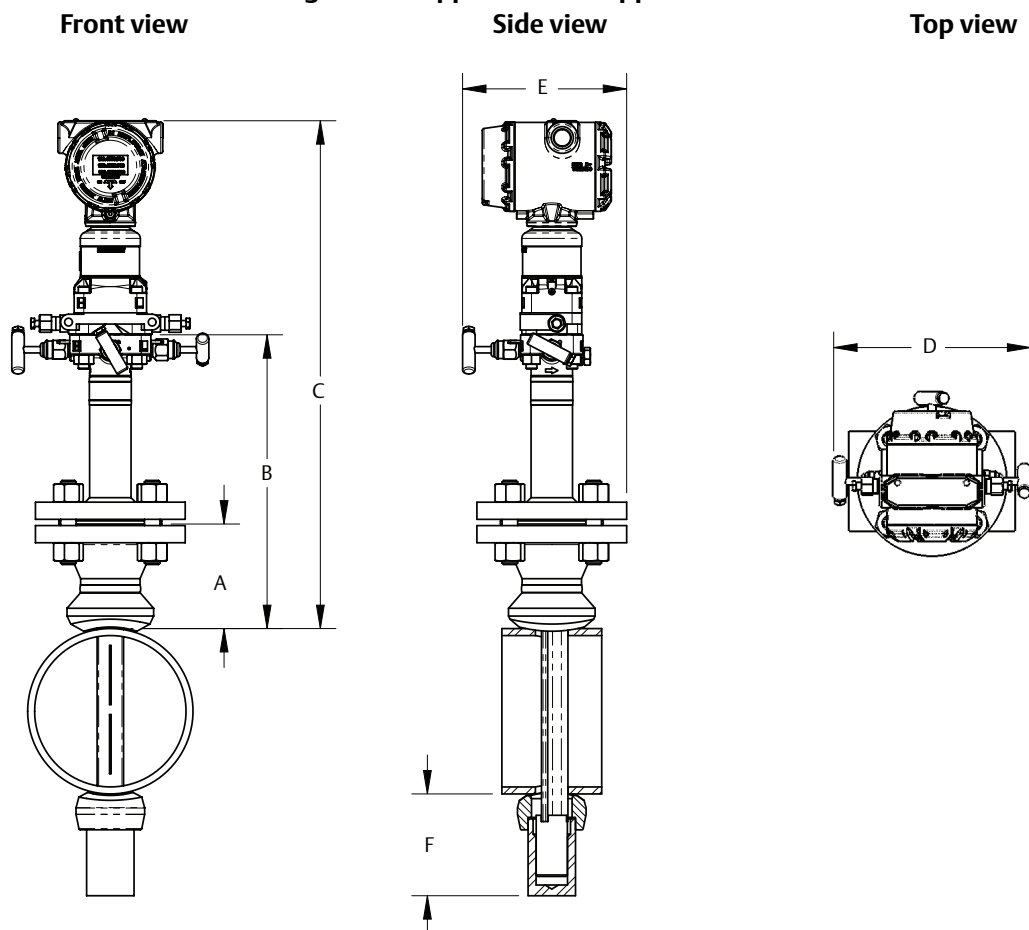


Table 33. 3051SFA Flanged Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ± 0.25 (6.4)	D (Max)	E (Max)	F (Max)
1	1½ – 150#	3.88 (98.6)	11.00 (279.4)	19.53 (496.1)	9.00 (228.6)	6.30 (160.0)	3.50 (88.9)
1	1½ – 300#	4.13 (104.9)	11.00 (279.4)	19.53 (496.1)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	1½ – 600#	4.44 (112.8)	11.00 (279.4)	19.53 (496.1)	9.00(228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/PN16	3.09 (78.5)	11.00 (279.4)	19.53 (496.1)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/PN40	3.21 (81.5)	11.00 (279.4)	19.53 (496.1)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/ PN100	3.88 (98.6)	11.00 (279.4)	19.53 (496.1)	9.00(228.6)	6.86 (174.2)	3.50 (88.9)
1	1½ – 900#	4.94 (125.5)	9.31 (236.5)	N/A	N/A	N/A	3.50 (88.9)
1	1½ – 1500#	4.94 (125.5)	9.31 (236.5)	N/A	N/A	N/A	3.50 (88.9)
1	1½ – 2500#	6.76 (171.7)	11.63 (295.4)	N/A	N/A	N/A	4.00 (101.6)
2	2 – 150#	4.13 (104.9)	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	6.80 (172.7)	5.00 (127.0)
2	2 – 300#	4.38 (111.3)	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	2 – 600#	4.75 (120.7)	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)

Table 33. 3051SFA Flanged Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ± 0.25 (6.4)	D (Max)	E (Max)	F (Max)
2	DN50/PN16	3.40 (86.4)	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	DN50/PN40	3.52 (89.4)	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	DN50/ PN100	4.30 (109.2)	12.00 (304.8)	20.53 (521.5)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	2 – 900#	5.88 (149.4)	10.50 (266.7)	N/A	N/A	N/A	5.00 (127.0)
2	2 – 1500#	5.88 (149.4)	10.50 (266.7)	N/A	N/A	N/A	5.00 (127.0)
2	3 – 2500#	9.88 (251.0)	15.63 (397.0)	N/A	N/A	N/A	4.50 (114.3)
3	3 – 150#	4.63 (117.6)	13.50 (342.9)	22.03 (559.6)	9.00 (228.6)	7.55 (191.8)	4.00 (101.6)
3	3 – 300#	5.00 (127.0)	13.50 (342.9)	22.03 (559.6)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	3 – 600#	5.38 (136.7)	13.50 (342.9)	22.03 (559.6)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	DN80/PN16	3.85 (97.8)	13.50 (342.9)	22.03 (559.6)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	DN80/PN40	4.16 (105.7)	13.50 (342.9)	22.03 (559.6)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	DN80/ PN100	4.95 (125.7)	13.50 (342.9)	22.03 (559.6)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	4 – 900#	8.19 (208.0)	13.06 (331.7)	N/A	N/A	N/A	7.00 (177.8)
3	4 – 1500#	8.56 (217.4)	13.81 (350.8)	N/A	N/A	N/A	7.00 (177.8)
3	4 – 2500#	11.19 (284.2)	17.31 (439.7)	N/A	N/A	N/A	7.00 (177.8)

Dimensions are in inches (millimeters).

Figure 6. Rosemount 3051SFA Flanged Flo-Tap Annubar Flowmeter⁽¹⁾

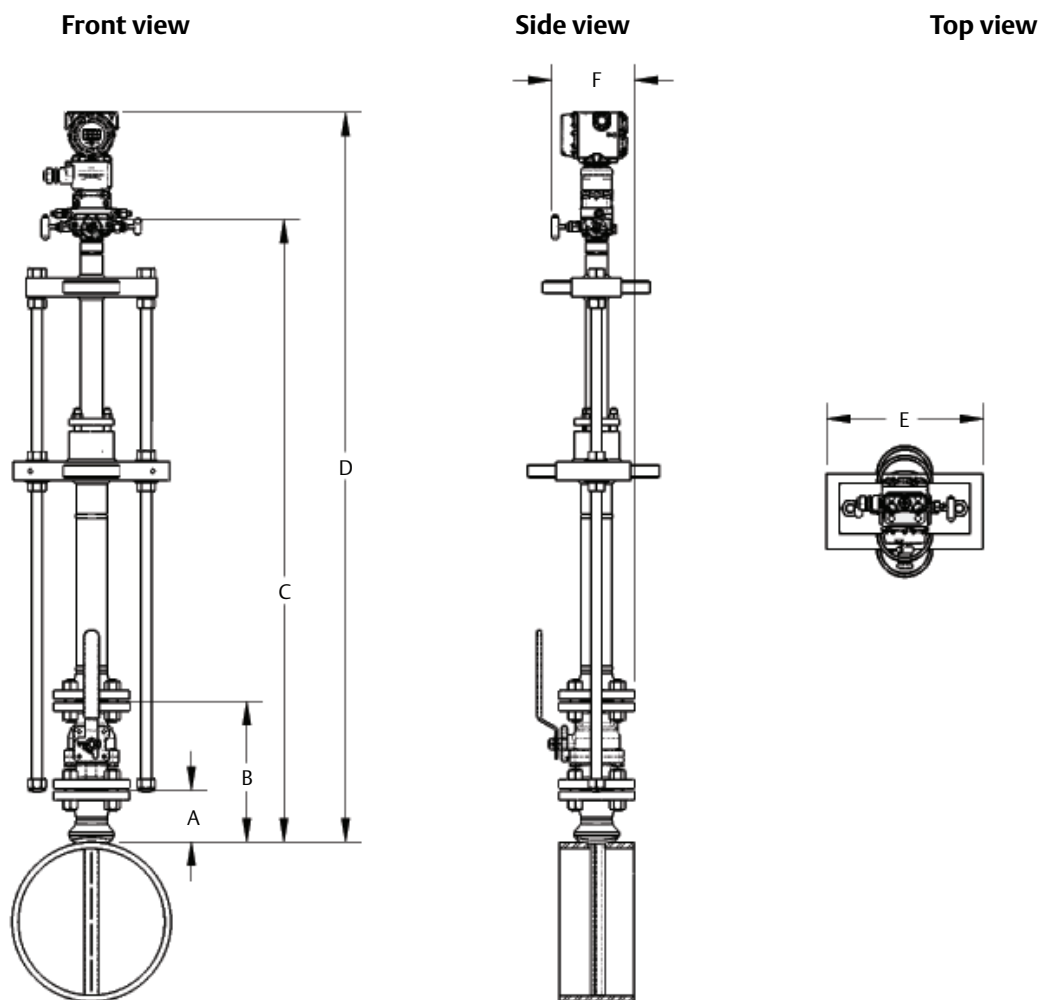


Table 34. 3051SFA Flanged Flo-Tap Annubar Flowmeter Dimensional Data⁽¹⁾⁽²⁾

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ¹ (Max) (Gear drive)	C ¹ (Max) (Manual)	D (Max)	E (Max)	F (Max)
1	1½ – 150#	3.88 (98.6)	10.50 (266.7)	N/A	17.77 (451.4)	C + 8.53 (216.7)	10.50 (266.7)	6.30 (160.0)
1	1½ – 300#	4.13 (104.9)	11.75 (298.5)	N/A	17.77 (451.4)	C + 8.53 (216.7)	10.50 (266.7)	6.86 (174.2)
1	1½ – 600#	4.44 (112.8)	14.06 (357.2)	N/A	17.77 (451.4)	C + 8.53 (216.7)	10.50 (266.7)	6.86 (174.2)
1	DN40/PN16 ⁽³⁾	3.09 (78.5)	See Footnote 3	N/A	17.77 (451.4)	C + 8.53 (216.7)	10.50 (266.7)	6.86 (174.2)
1	DN40/PN40 ⁽³⁾	3.21 (81.5)	See Footnote 3	N/A	17.77 (451.4)	C + 8.53 (216.7)	10.50 (266.7)	6.86 (174.2)
1	DN40/PN100 ⁽³⁾	3.88 (98.6)	See Footnote 3	N/A	17.77 (451.4)	C + 8.53 (216.7)	10.50 (266.7)	6.86 (174.2)

1. The Flanged Flo-Tap Annubar Flowmeter is available with either the manual or gear drive options.

Table 34. 3051SFA Flanged Flo-Tap Annubar Flowmeter Dimensional Data⁽¹⁾⁽²⁾

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ¹ (Max) (Gear drive)	C ¹ (Max) (Manual)	D (Max)	E (Max)	F (Max)
2	2 – 150#	4.13 (104.9)	11.25 (285.8)	24.44 (620.8)	21.20 (538.5)	C + 8.53 (216.7)	12.56 (319.0)	6.80 (172.7)
2	2 – 300#	4.38 (111.3)	13.00 (330.2)	24.44 (620.8)	21.20 (538.5)	C + 8.53 (216.7)	12.56 (319.0)	7.05 (179.1)
2	2 – 600#	4.75 (120.7)	16.38 (416.0)	24.44 (620.8)	21.20 (538.5)	C + 8.53 (216.7)	12.56 (319.0)	7.05 (179.1)
2	DN50/PN16 ⁽³⁾	3.40 (86.4)	See Footnote 3	24.44 (620.8)	21.20 (538.5)	C + 8.53 (216.7)	12.56 (319.0)	7.05 (179.1)
2	DN50/PN40 ⁽³⁾	3.52 (89.4)	See Footnote 3	24.44 (620.8)	21.20 (538.5)	C + 8.53 (216.7)	12.56 (319.0)	7.05 (179.1)
2	DN50/PN100 ⁽³⁾	4.30 (109.2)	See Footnote 3	24.44 (620.8)	21.20 (538.5)	C + 8.53 (216.7)	12.56 (319.0)	7.05 (179.1)
3	3 – 150#	4.63 (117.6)	12.75 (323.9)	26.37 (669.8)	23.14 (587.8)	C + 8.53 (216.7)	14.13 (358.9)	7.55 (191.8)
3	3 – 300#	5.00 (127.0)	16.25 (412.8)	26.37 (669.8)	23.14 (587.8)	C + 8.53 (216.7)	14.13 (358.9)	7.93 (201.3)
3	3 – 600#	5.38 (136.7)	19.50 (495.3)	26.37 (669.8)	23.14 (587.8)	C + 8.53 (216.7)	14.13 (358.9)	7.93 (201.3)
3	DN80/PN16 ⁽³⁾	3.85 (97.8)	Customer Supplied	26.37 (669.8)	23.14 (587.8)	C + 8.53 (216.7)	14.13 (358.9)	7.93 (201.3)
3	DN80/PN40 ⁽³⁾	4.16 (105.7)	Customer Supplied	26.37 (669.8)	23.14 (587.8)	C + 8.53 (216.7)	14.13 (358.9)	7.93 (201.3)
3	DN80/PN100 ⁽³⁾	4.95 (125.7)	Customer Supplied	26.37 (669.8)	23.14 (587.8)	C + 8.53 (216.7)	14.13 (358.9)	7.93 (201.3)

Dimensions are in inches (millimeters).

1. Inserted, C Dimension = Pipe I.D. + Wall Thickness + B + C¹
2. Retracted, C Dimension = 2 × (Pipe I.D. + Wall Thickness + B) + C¹
3. DIN Valves are not offered.

Figure 7. Rosemount 3051SFA Threaded Flo-Tap Annubar Flowmeter⁽¹⁾

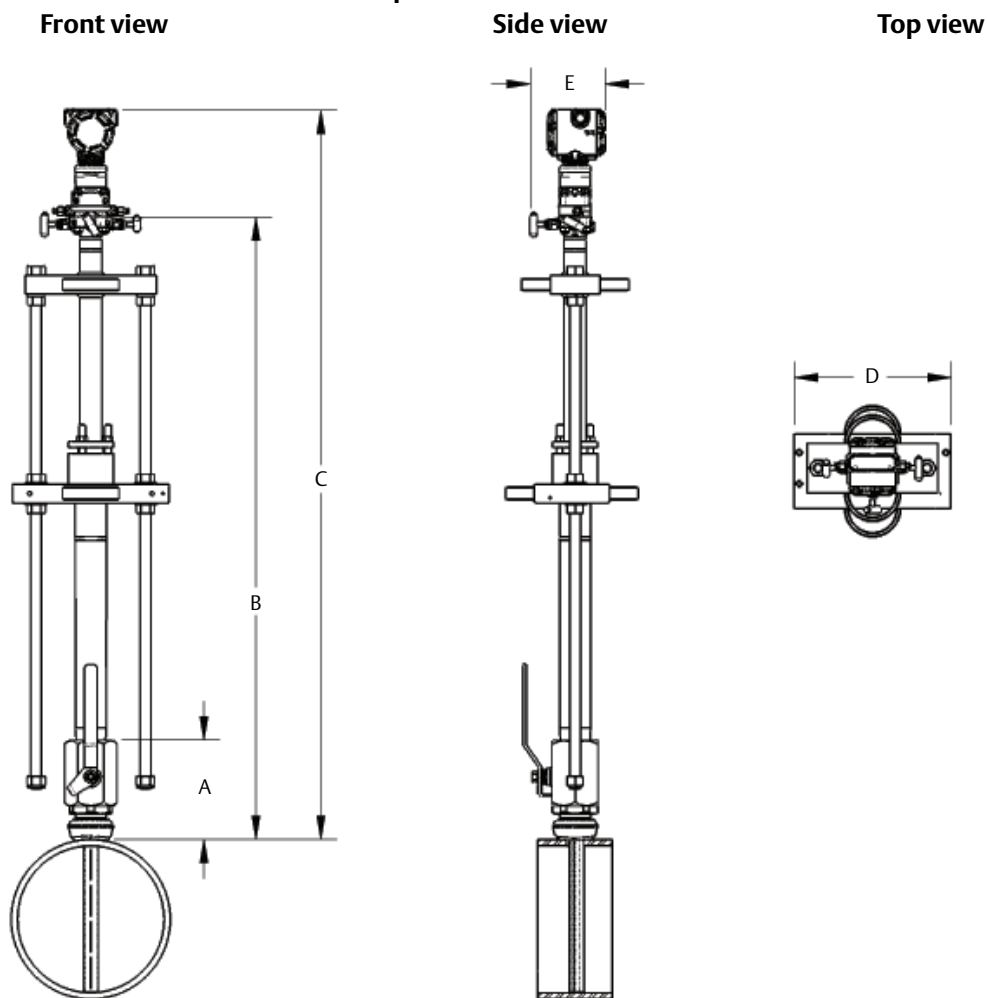


Table 35. 3051SFA Threaded Flo-Tap Annubar Flowmeter Dimensional Data⁽¹⁾⁽²⁾

Sensor size	A ± 0.50 (12.7)	B ¹ (Max) (Gear drive)	B ¹ (Max) (Manual)	C (Max)	D (Max)	E (Max)
1	7.51 (190.9)	N/A	16.96 (430.8)	B + 8.53 (216.7)	10.50 (266.7)	6.90 (175.3)
2 ⁽³⁾	8.17 (207.5)	23.62 (599.9)	20.39 (517.9)	B + 8.53 (216.7)	12.56 (319.0)	6.90 (175.3)

Dimensions are in inches (millimeters).

1. Inserted, B Dimension = Pipe I.D. + Wall Thickness + A + B¹
2. Retracted, B Dimension = 2 × (Pipe I.D. + Wall Thickness + A) + B¹
3. Sensor Size 3 is not available in a Threaded Flo-Tap.

1. The Threaded Flo-Tap Annubar Flowmeter is available with both the manual and gear drive options.

Figure 8. Rosemount 3051SFC Compact Flowmeter

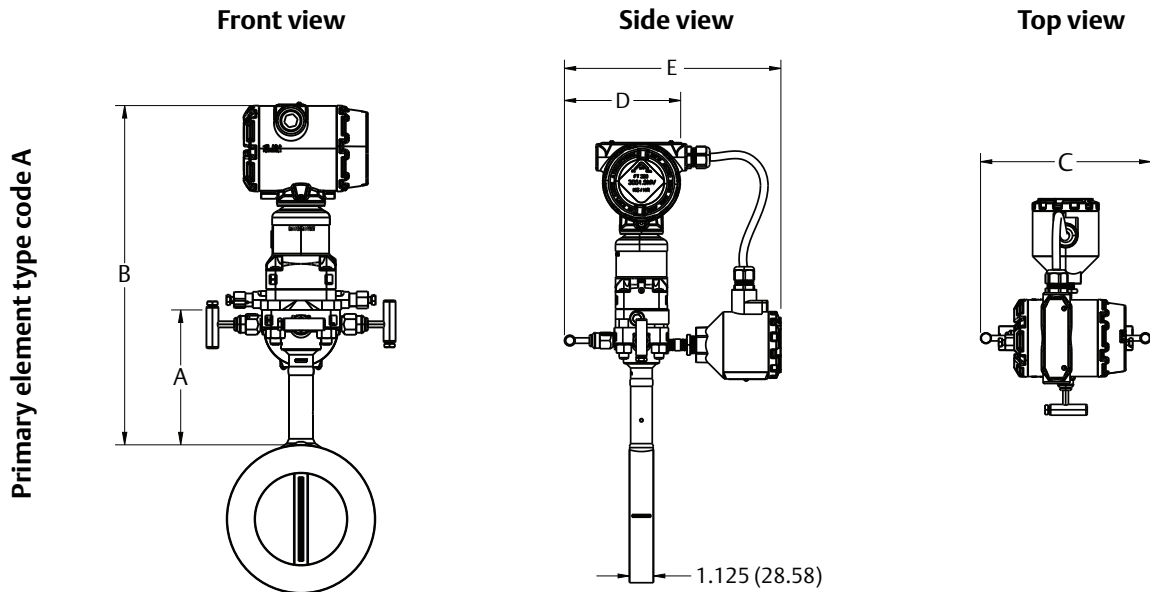


Table 36. 3051SFC Compact Dimensional Data

Primary element type	A	B	Transmitter height	C	D	E	F
A	5.62 (143)	Transmitter Height + A	8.53 (217)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open	10.0 (254)- closed 10.25 (260.3)-open	N/A

Dimensions are in inches (millimeters).

A.16.2 3051CF dimensional drawings

Figure 9. Rosemount 3051CFA Pak-Lok Annubar Flowmeter⁽¹⁾

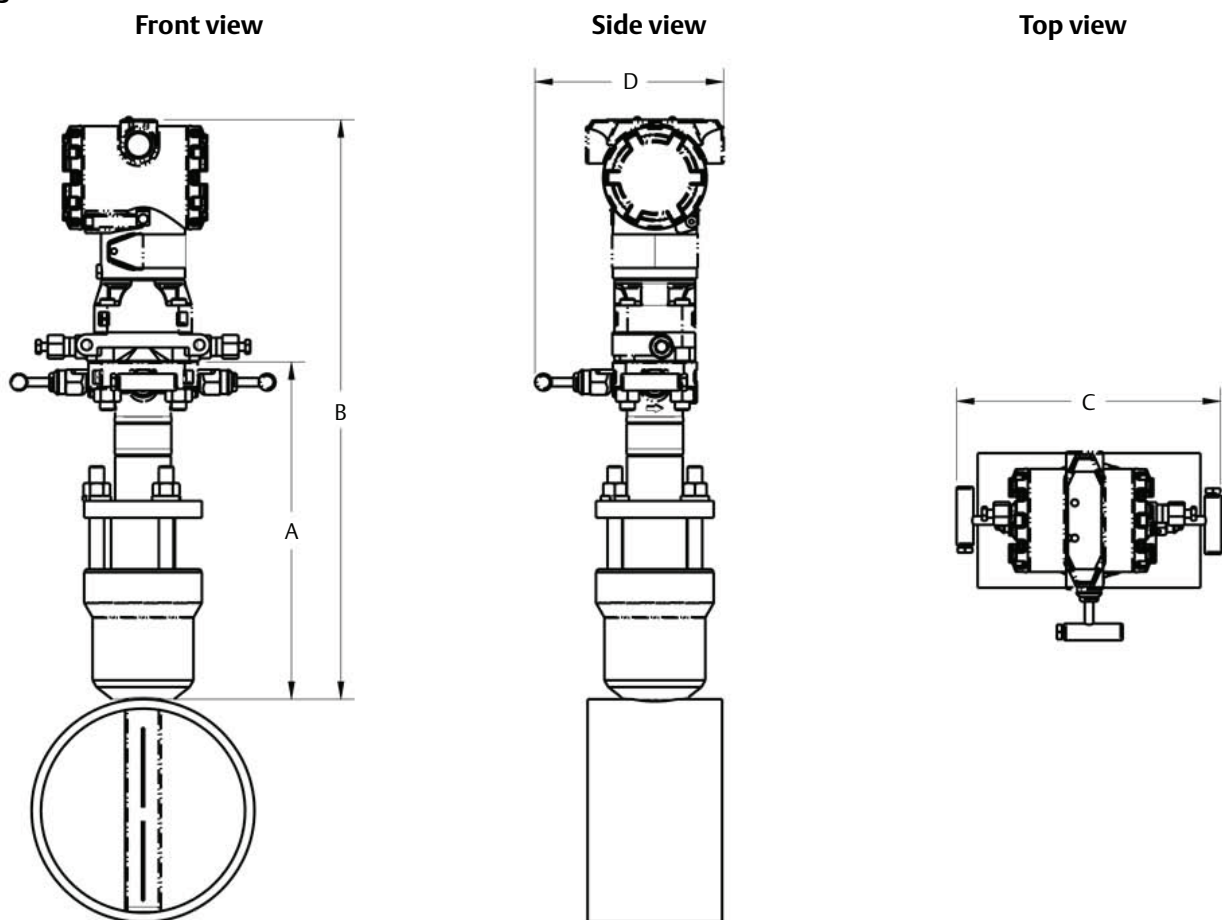


Table 37. 3051CFA Pak-Lok Annubar Flowmeter Dimensional Data

Sensor size	A (Max)	B (Max)	C (Max)	D (Max)
1	8.50 (215.9)	14.60 (370.8)	9.00 (228.6)	6.00 (152.4)
2	11.0 (279.4)	16.35 (415.3)	9.00 (228.6)	6.00 (152.4)
3	12.00 (304.8)	19.10 (485.1)	9.00 (228.6)	6.00 (152.4)

Dimensions are in inches (millimeters).

1. The Pak-Lok Annubar model is available up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

Figure 10. Rosemount 3051CFA Flange-Lok Annubar Flowmeter⁽¹⁾

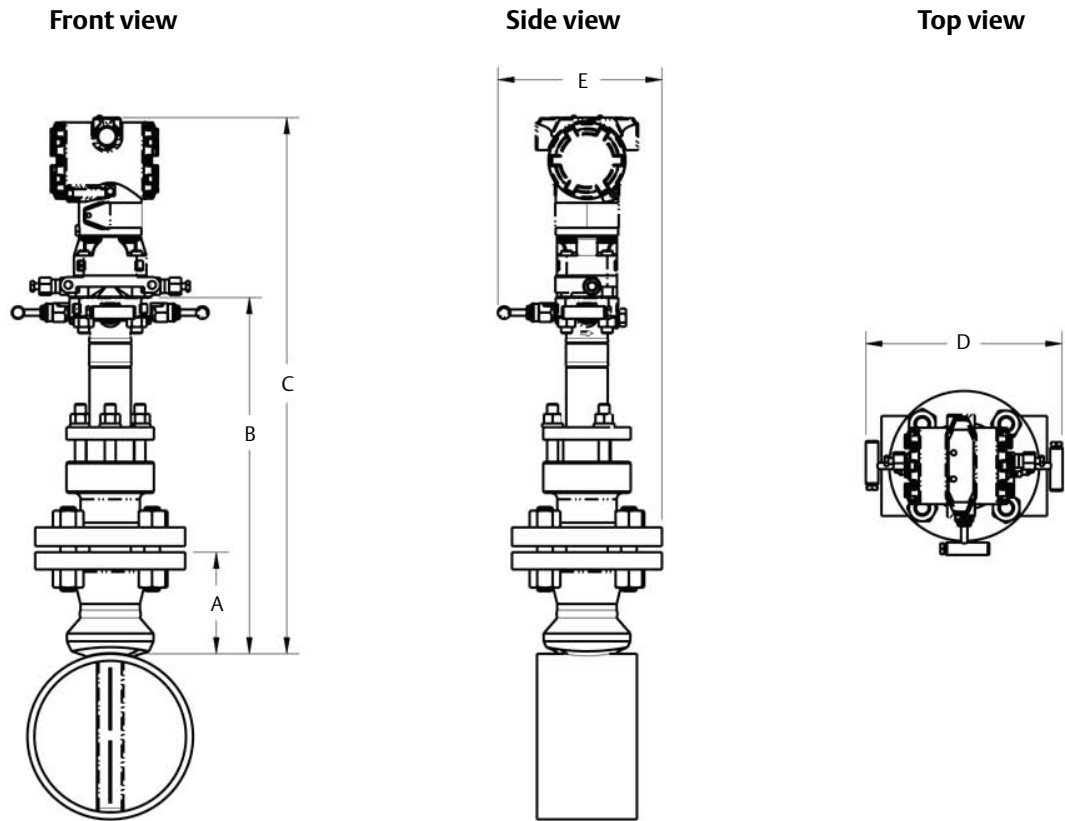


Table 38. 3051CFA Flange-Lok Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C (Max)	D (Max)	E (Max)
1	1½ – 150#	3.88 (98.6)	12.25 (311.2)	19.35 (491.5)	9.00 (228.6)	6.30 (160.0)
1	1½ – 300#	4.13 (104.9)	12.25 (311.2)	19.35 (491.5)	9.00 (228.6)	6.86 (174.2)
1	1½ – 600#	4.44 (112.8)	12.25 (311.2)	19.35 (491.5)	9.00 (228.6)	6.86 (174.2)
1	DN40/PN16	3.09 (78.5)	12.25 (311.2)	19.35 (491.5)	9.00 (228.6)	6.86 (174.2)
1	DN40/PN40	3.21 (81.5)	12.25 (311.2)	19.35 (491.5)	9.00 (228.6)	6.86 (174.2)
1	DN40/ PN100	3.88 (98.6)	12.25 (311.2)	19.35 (491.5)	9.00 (228.6)	6.86 (174.2)
2	2 – 150#	4.13 (104.9)	14.25 (362.0)	21.35 (542.3)	9.00 (228.6)	6.80 (172.7)
2	2 – 300#	4.38 (111.3)	14.25 (362.0)	21.35 (542.3)	9.00 (228.6)	7.05 (179.1)
2	2 – 600#	4.75 (120.7)	14.25 (362.0)	21.35 (542.3)	9.00 (228.6)	7.05 (179.1)
2	DN50/PN16	3.40 (86.4)	14.25 (362.0)	21.35 (542.3)	9.00 (228.6)	7.05 (179.1)
2	DN50/PN40	3.52 (89.4)	14.25 (362.0)	21.35 (542.3)	9.00 (228.6)	7.05 (179.1)
2	DN50/ PN100	4.30 (109.2)	14.25 (362.0)	21.35 (542.3)	9.00 (228.6)	7.05 (179.1)
3	3 – 150#	4.63 (117.6)	17.50 (444.5)	24.60 (624.8)	9.00 (228.6)	7.55 (191.8)

1. The Flange-Lok Annubar model can be direct mounted up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

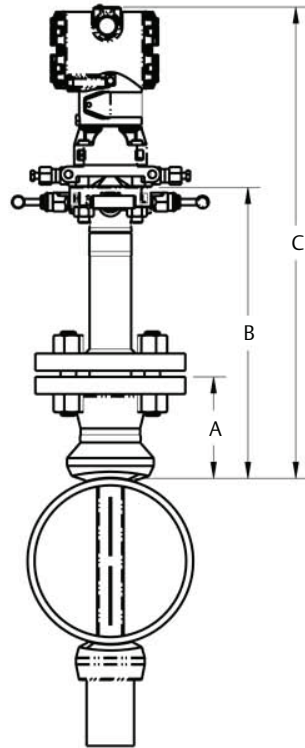
Table 38. 3051 CFA Flange-Lok Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C (Max)	D (Max)	E (Max)
3	3 – 300#	5.00 (127.0)	17.50 (444.5)	24.60 (624.8)	9.00 (228.6)	7.93 (201.3)
3	3 – 600#	5.38 (136.7)	17.50 (444.5)	24.60 (624.8)	9.00 (228.6)	7.93 (201.3)
3	DN80/PN16	3.85 (97.8)	17.50 (444.5)	24.60 (624.8)	9.00 (228.6)	7.93 (201.3)
3	DN80/PN40	4.16 (105.7)	17.50 (444.5)	24.60 (624.8)	9.00 (228.6)	7.93 (201.3)
3	DN80/ PN100	4.95 (125.7)	17.50 (444.5)	24.60 (624.8)	9.00 (228.6)	7.93 (201.3)

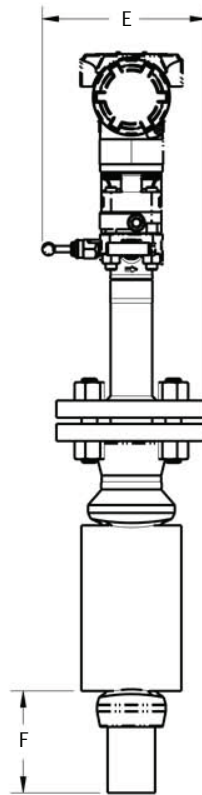
Dimensions are in inches (millimeters).

Figure 11. Rosemount 3051CFA Flanged Annubar Flowmeter

Front view



Side view



Top view

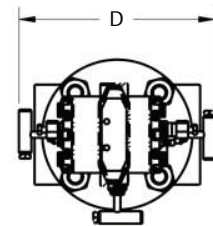


Table 39. 3051CFA Flanged Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ± 0.25 (6.4)	D (Max)	E (Max)	F (Max)
1	1½ – 150#	3.88 (98.6)	11.00 (279.4)	18.10 (459.7)	9.00 (228.6)	6.30 (160.0)	3.50 (88.9)
1	1½ – 300#	4.13 (104.9)	11.00 (279.4)	18.10 (459.7)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	1½ – 600#	4.44 (112.8)	11.00 (279.4)	18.10 (459.7)	9.00(228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/PN16	3.09 (78.5)	11.00 (279.4)	18.10 (459.7)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/PN40	3.21 (81.5)	11.00 (279.4)	18.10 (459.7)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/ PN100	3.88 (98.6)	11.00 (279.4)	18.10 (459.7)	9.00(228.6)	6.86 (174.2)	3.50 (88.9)
1	1½ – 900#	4.94 (125.5)	9.31 (236.5)	N/A	N/A	N/A	3.50 (88.9)
1	1½ – 1500#	4.94 (125.5)	9.31 (236.5)	N/A	N/A	N/A	3.50 (88.9)
1	1½ – 2500#	6.76 (171.7)	11.63 (295.4)	N/A	N/A	N/A	4.00 (101.6)
2	2 – 150#	4.13 (104.9)	12.00 (304.8)	19.10 (458.1)	9.00 (228.6)	6.80 (172.7)	5.00 (127.0)
2	2 – 300#	4.38 (111.3)	12.00 (304.8)	19.10 (458.1)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	2 – 600#	4.75 (120.7)	12.00 (304.8)	19.10 (458.1)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	DN50/PN16	3.40 (86.4)	12.00 (304.8)	19.10 (458.1)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	DN50/PN40	3.52 (89.4)	12.00 (304.8)	19.10 (458.1)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)

Table 39. 3051CFA Flanged Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ± 0.25 (6.4)	D (Max)	E (Max)	F (Max)
2	DN50/ PN100	4.30 (109.3)	12.00 (304.8)	19.10 (458.1)	9.00 (228.6)	7.05 (179.1)	5.00 (127.0)
2	2 – 900#	5.88 (149.4)	10.50 (266.7)	N/A	N/A	N/A	5.00 (127.0)
2	2 – 1500#	5.88 (149.4)	10.50 (266.7)	N/A	N/A	N/A	5.00 (127.0)
2	3 – 2500#	9.88 (251.0)	15.63 (397.0)	N/A	N/A	N/A	4.50 (114.3)
3	3 – 150#	4.63 (117.6)	13.50 (342.9)	20.60 (523.2)	9.00 (228.6)	7.55 (191.8)	4.00 (101.6)
3	3 – 300#	5.00 (127.0)	13.50 (342.9)	20.60 (523.2)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	3 – 600#	5.38 (136.7)	13.50 (342.9)	20.60 (523.2)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	DN80/PN16	3.85 (97.8)	13.50 (342.9)	20.60 (523.2)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	DN80/PN40	4.16 (105.7)	13.50 (342.9)	20.60 (523.2)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	DN80/ PN100	4.95 (125.7)	13.50 (342.9)	20.60 (523.2)	9.00 (228.6)	7.93 (201.3)	4.00 (101.6)
3	4 – 900#	8.19 (208.0)	13.06 (331.8)	N/A	N/A	N/A	7.00 (177.8)
3	4 – 1500#	8.56 (217.4)	13.81 (350.8)	N/A	N/A	N/A	7.00 (177.8)
3	4 – 2500#	11.19 (284.2)	17.31 (439.7)	N/A	N/A	N/A	7.00 (177.8)

Dimensions are in inches (millimeters).

Figure 12. Rosemount 3051CFA Flanged Flo-Tap Annubar Flowmeter⁽¹⁾

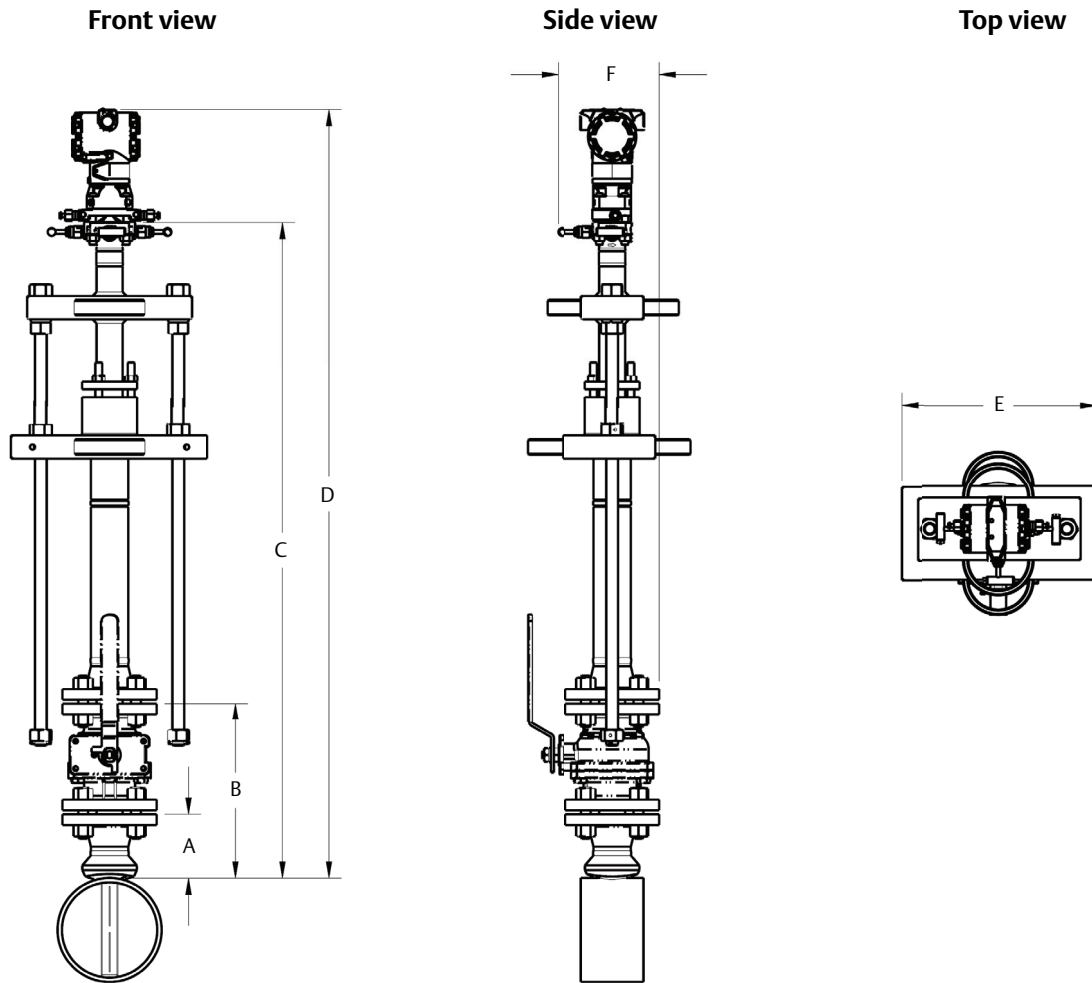


Table 40. 3051CFA Flanged Flo-Tap Annubar Flowmeter Dimensional Data⁽¹⁾⁽²⁾

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ¹ (Max) (Gear drive)	C ¹ (Max) (Manual)	D (Max)	E (Max)	F (Max)
1	1½ – 150#	3.88 (98.6)	10.50 (266.7)	N/A	17.77 (451.4)	C + 7.10 (180.3)	10.50 (266.7)	6.30 (160.0)
1	1½ – 300#	4.13 (104.9)	11.75 (298.5)	N/A	17.77 (451.4)	C + 7.10 (180.3)	10.50 (266.7)	6.86 (174.2)
1	1½ – 600#	4.44 (112.8)	14.06 (357.2)	N/A	17.77 (451.4)	C + 7.10 (180.3)	10.50 (266.7)	6.86 (174.2)
1	DN40/PN16 ⁽³⁾	3.09 (78.5)	Customer Supplied	N/A	17.77 (451.4)	C + 7.10 (180.3)	10.50 (266.7)	6.86 (174.2)
1	DN40/PN40	3.21 (81.5)	Customer Supplied	N/A	17.77 (451.4)	C + 7.10 (180.3)	10.50 (266.7)	6.86 (174.2)
1	DN40/PN100	3.88 (98.6)	Customer Supplied	N/A	17.77 (451.4)	C + 7.10 (180.3)	10.50 (266.7)	6.86 (174.2)

1. The Flanged Flo-Tap Annubar Flowmeter is available with both the manual and gear drive options.

Table 40. 3051 CFA Flanged Flo-Tap Annubar Flowmeter Dimensional Data⁽¹⁾⁽²⁾

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ¹ (Max) (Gear drive)	C ¹ (Max) (Manual)	D (Max)	E (Max)	F (Max)
2	2 – 150#	4.13 (104.9)	11.25 (285.8)	24.44 (620.8)	21.20 (538.5)	C +7.10 (180.3)	12.56 (319.0)	6.80 (172.7)
2	2 – 300#	4.38 (111.3)	13.00 (330.2)	24.44 (620.8)	21.20 (538.5)	C +7.10 (180.3)	12.56 (319.0)	7.05 (179.1)
2	2 – 600#	4.75 (120.7)	16.38 (416.0)	24.44 (620.8)	21.20 (538.5)	C +7.10 (180.3)	12.56 (319.0)	7.05 (179.1)
2	DN50/PN16	3.40 (86.4)	Customer Supplied	24.44 (620.8)	21.20 (538.5)	C +7.10 (180.3)	12.56 (319.0)	7.05 (179.1)
2	DN50/PN40	3.52 (89.4)	Customer Supplied	24.44 (620.8)	21.20 (538.5)	C +7.10 (180.3)	12.56 (319.0)	7.05 (179.1)
2	DN50/PN100	4.30 (109.2)	Customer Supplied	24.44 (620.8)	21.20 (538.5)	C +7.10 (180.3)	12.56 (319.0)	7.05 (179.1)
3	3 – 150#	4.63 (117.6)	12.75 (323.9)	26.37 (669.8)	23.14 (587.8)	C +7.10 (180.3)	14.13 (358.9)	7.55 (191.8)
3	3 – 300#	5.00 (127.0)	16.25 (412.8)	26.37 (669.8)	23.14 (587.8)	C +7.10 (180.3)	14.13 (358.9)	7.93 (201.3)
3	3 – 600#	5.38 (136.7)	19.50 (495.3)	26.37 (669.8)	23.14 (587.8)	C +7.10 (180.3)	14.13 (358.9)	7.93 (201.3)
3	DN80/PN16	3.85 (97.8)	Customer Supplied	26.37 (669.8)	23.14 (587.8)	C +7.10 (180.3)	14.13 (358.9)	7.93 (201.3)
3	DN80/PN40	4.16 (105.7)	Customer Supplied	26.37 (669.8)	23.14 (587.8)	C +7.10 (180.3)	14.13 (358.9)	7.93 (201.3)
3	DN80/PN100	4.95 (125.7)	Customer Supplied	26.37 (669.8)	23.14 (587.8)	C +7.10 (180.3)	14.13 (358.9)	7.93 (201.3)

Dimensions are in inches (millimeters).

1. Inserted, C Dimension = Pipe I.D. + Wall Thickness + B + C¹
2. Retracted, C Dimension = 2 × (Pipe I.D. + Wall Thickness + B) + C¹
3. DIN Valves are not offered.

Figure 13. Rosemount 3051CFA Threaded Flo-Tap Annubar Flowmeter⁽¹⁾

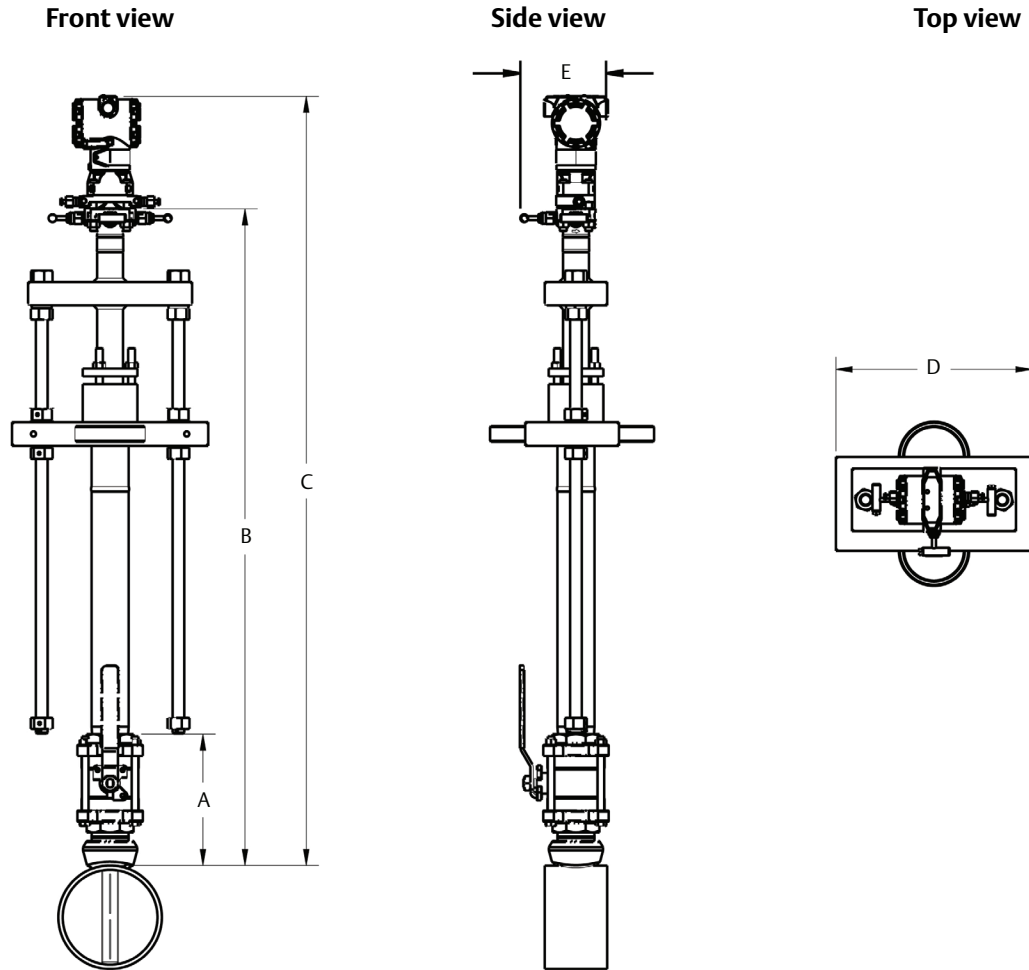


Table 41. 3051CFA Threaded Flo-Tap Annubar Flowmeter Dimensional Data⁽¹⁾⁽²⁾

Sensor size	A ± 0.50 (12.7)	B ¹ (Max) (Gear drive)	B ¹ (Max) (Manual)	C (Max)	D (Max)	E (Max)
1	7.51 (190.9)	N/A	16.96 (430.8)	B + 7.10 (180.3)	10.50 (266.7)	6.00 (152.4)
2 ⁽³⁾	8.17 (207.5)	23.62 (599.9)	20.39 (517.9)	B + 7.10 (180.3)	12.56 (319.0)	6.00 (152.4)

Dimensions are in inches (millimeters).

1. Inserted, B Dimension = Pipe I.D. + Wall Thickness + A + B¹
2. Retracted, B Dimension = 2 3 (Pipe I.D. + Wall Thickness + A) + B¹
3. Sensor Size 3 is not available in a Threaded Flo-Tap.

1. The Threaded Flo-Tap Annubar Flowmeter is available with both the manual and gear drive options.

Figure 14. Rosemount 3051CFC Compact Flowmeter

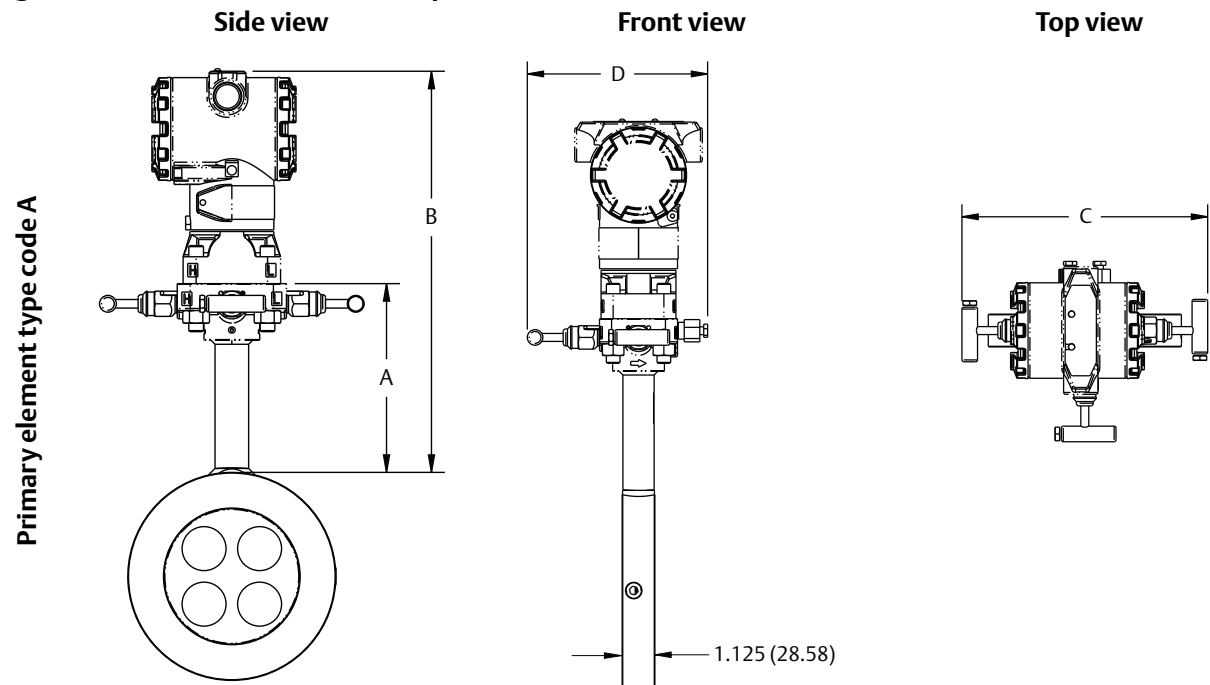


Table 42. 3051CFC Compact Dimensional Data

Primary element type	A	B	Transmitter height	C	D
A	5.62 (143)	Transmitter Height + A	7.38 (188)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open

Dimensions are in inches (millimeters).

A.16.3 2051CF dimensional drawings

Figure 15. Rosemount 2051CFA Pak-Lok Annubar Flowmeter⁽¹⁾

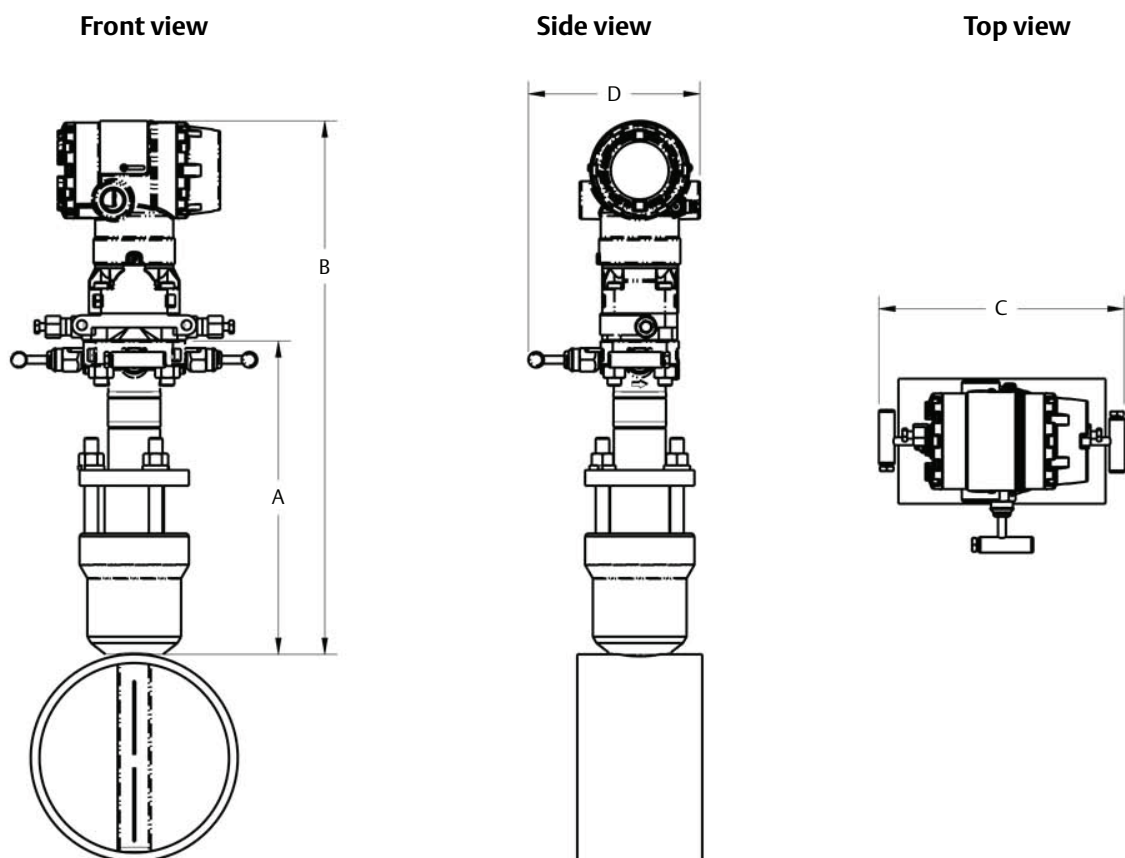


Table 43. 2051CFA Pak-Lok Annubar Flowmeter Dimensional Data

Sensor size	A (Max)	B (Max)	C (Max)	D (Max)
1	8.50 (215.9)	14.55 (369.6)	9.00 (228.6)	6.00 (152.4)
2	11.00 (279.4)	16.30 (414.0)	9.00 (228.6)	6.00 (152.4)
3	12.00 (304.8)	19.05 (483.9)	9.00 (228.6)	6.00 (152.4)

Dimensions are in inches (millimeters).

1. The Pak-Lok Annubar model is available up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

Figure 16. Rosemount 2051CFA Flanged with Opposite Side Support Annubar Flowmeter

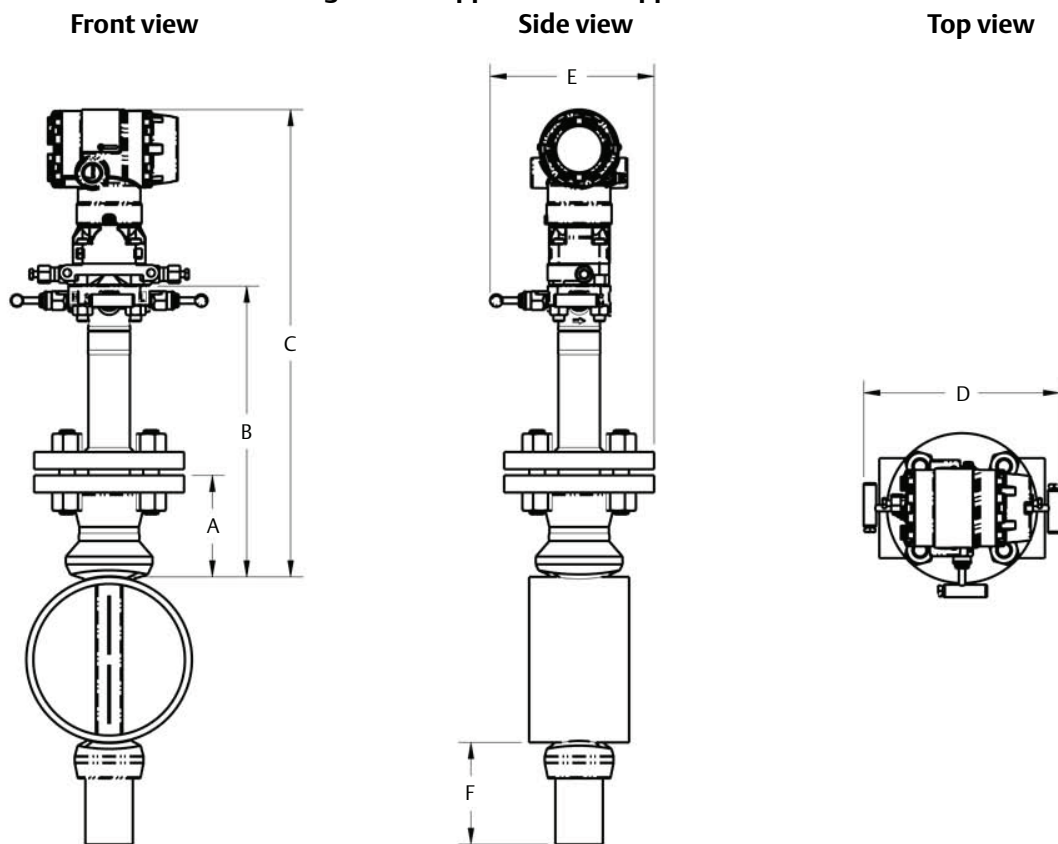


Table 44. Flanged Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ± 0.25 (6.4)	D (Max)	E (Max)	F (Max)
1	1½ – 150#	3.88 (98.6)	11.00 (279.4)	18.03 (458.0)	9.00 (228.6)	6.30 (160.0)	3.50 (88.9)
1	1½ – 300#	4.13 (104.9)	11.00 (279.4)	18.03 (458.0)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	1½ – 600#	4.44 (112.8)	11.00 (279.4)	18.03 (458.0)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/PN16	3.09 (78.5)	11.00 (279.4)	18.03 (458.0)	9.00 (228.6)	6.30 (160.0)	3.50 (88.9)
1	DN40/PN40	3.21 (81.5)	11.00 (279.4)	18.03 (458.0)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	DN40/ PN100	3.88 (98.6)	11.00 (279.4)	18.03 (458.0)	9.00 (228.6)	6.86 (174.2)	3.50 (88.9)
1	1½ – 900#	4.94 (125.5)	9.31 (236.5)	N/A	N/A	N/A	3.50 (88.9)
1	1½ – 1500#	4.94 (125.5)	9.31 (236.5)	N/A	N/A	N/A	3.50 (88.9)
1	1½ – 2500#	6.76 (171.7)	11.63 (295.4)	N/A	N/A	N/A	4.00 (101.6)
2	2 – 150#	4.13 (104.9)	12.00 (304.8)	19.03 (483.4)	9.00 (228.6)	6.30 (160.0)	5.00 (127.0)

Table 44. Flanged Annubar Flowmeter Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ± 0.25 (6.4)	D (Max)	E (Max)	F (Max)
2	2 – 300#	4.38 (111.3)	12.00 (304.8)	19.03 (483.4)	9.00 (228.6)	6.86 (174.2)	5.00 (127.0)
2	2 – 600#	4.75 (120.7)	12.00 (304.8)	19.03 (483.4)	9.00 (228.6)	6.86 (174.2)	5.00 (127.0)
2	DN50/PN16	3.40 (86.4)	12.00 (304.8)	19.03 (483.4)	9.00 (228.6)	6.30 (160.0)	5.00 (127.0)
2	DN50/PN40	3.52 (89.4)	12.00 (304.8)	19.03 (483.4)	9.00 (228.6)	6.86 (174.2)	5.00 (127.0)
2	DN50/ PN100	4.30 (109.2)	12.00 (304.8)	19.03 (483.4)	9.00 (228.6)	6.86 (174.2)	5.00 (127.0)
2	2 – 900#	5.88 (149.4)	10.50 (266.7)	N/A	N/A	N/A	5.00 (127.0)
2	2 – 1500#	5.88 (149.4)	10.50 (266.7)	N/A	N/A	N/A	5.00 (127.0)
2	2 – 2500#	9.88 (251.0)	15.63 (397.0)	N/A	N/A	N/A	4.50 (114.3)
3	3 – 150#	4.63 (117.6)	13.50 (342.9)	20.53 (521.5)	9.00 (228.6)	6.30 (160.0)	4.00 (101.6)
3	3 – 300#	5.00 (127.0)	13.50 (342.9)	20.53 (521.5)	9.00 (228.6)	6.86 (174.2)	4.00 (101.6)
3	3 – 600#	5.38 (136.7)	13.50 (342.9)	20.53 (521.5)	9.00 (228.6)	6.86 (174.2)	4.00 (101.6)
3	DN80/PN16	3.85 (97.8)	13.50 (342.9)	20.53 (521.5)	9.00 (228.6)	6.30 (160.0)	4.00 (101.6)
3	DN80/PN40	4.16 (105.7)	13.50 (342.9)	20.53 (521.5)	9.00 (228.6)	6.86 (174.2)	4.00 (101.6)
3	DN80/ PN100	4.95 (125.7)	13.50 (342.9)	20.53 (521.5)	9.00 (228.6)	6.86 (174.2)	4.00 (101.6)
3	3 – 900#	8.19 (208.0)	13.06 (331.7)	N/A	N/A	N/A	7.00 (177.8)
3	3 – 1500#	8.56 (217.4)	13.81 (350.8)	N/A	N/A	N/A	7.00 (177.8)
3	3 – 2500#	11.19 (284.2)	17.31 (439.7)	N/A	N/A	N/A	7.00 (177.8)

Dimensions are in inches (millimeters).

Figure 17. Rosemount 2051CFC Compact Flowmeter

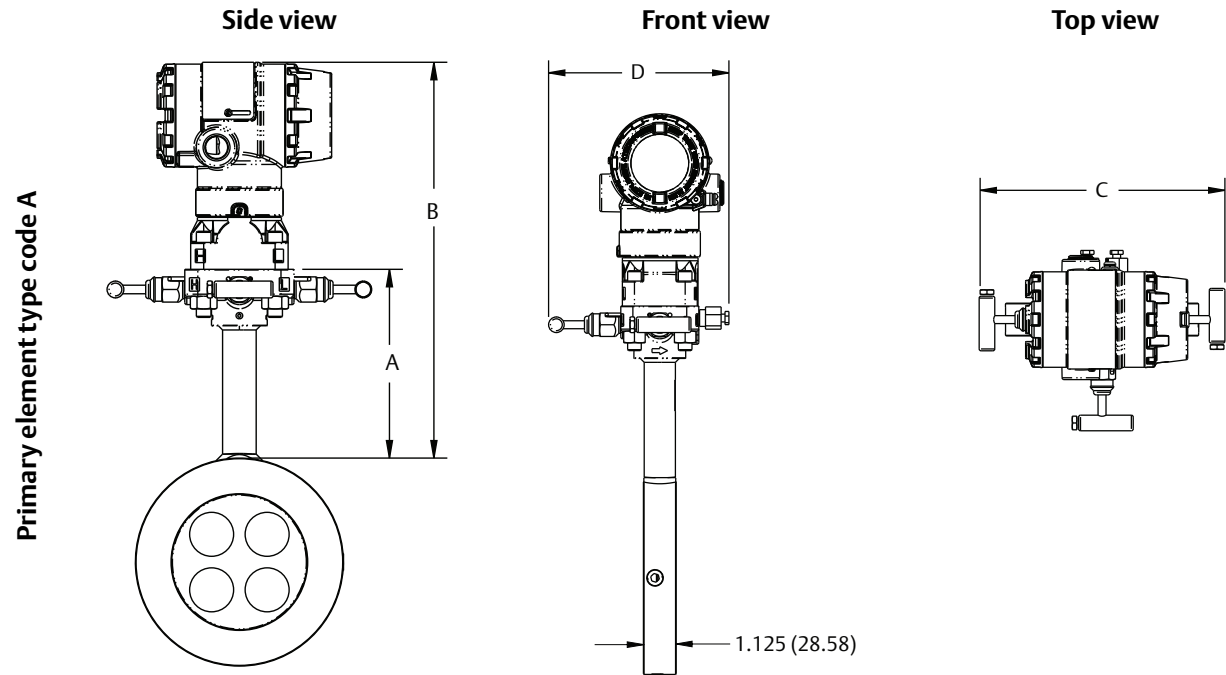


Table 45. 2051CFC Compact Dimensional Data

Primary element type	A	B	Transmitter height	C	D
A	5.62 (143)	Transmitter Height + A	7.03 (179)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open

Dimensions are in inches (millimeters).

A.16.4 485 dimensional drawings

Figure 18. Pak-Lok 485 Annubar Primary Element⁽¹⁾

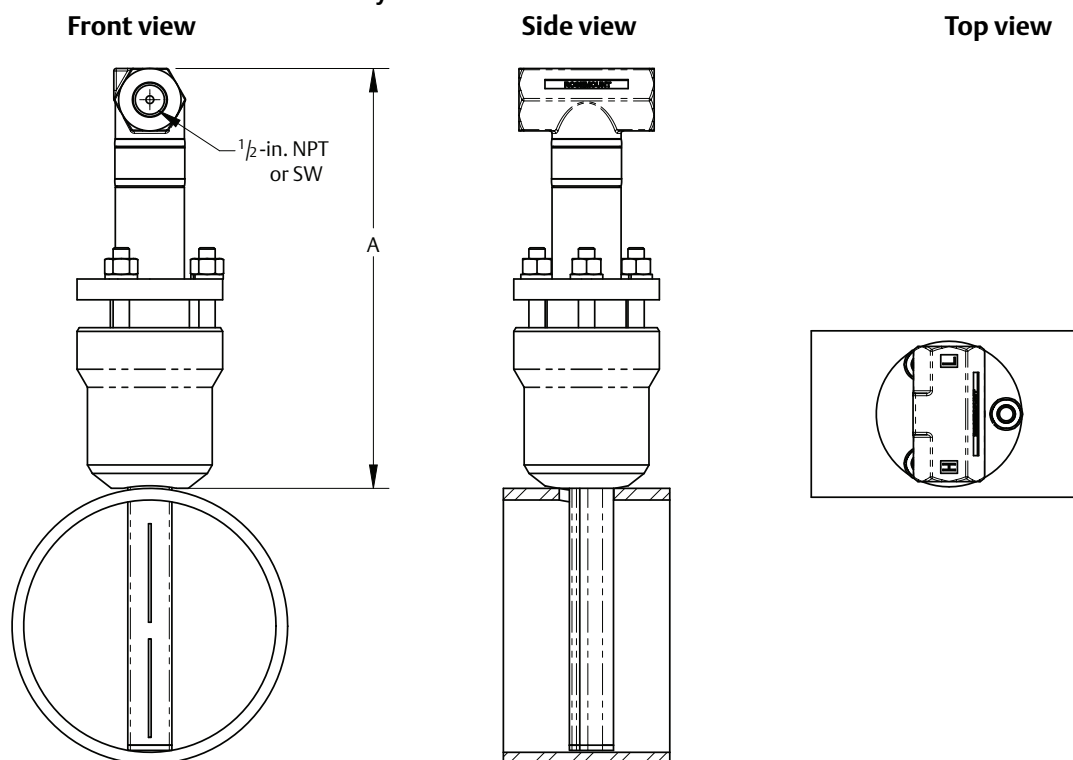


Table 46. Pak-Lok 485 Annubar Primary Element Dimensional Data

Sensor size	A (Max)
1	8.50 (215.9)
2	11.00 (279.4)
3	12.00 (304.8)

Dimensions are in inches (millimeters).

1. The Pak-Lok Annubar model is available up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

Figure 19. Flange-Lok 485 Annubar Primary Element⁽¹⁾

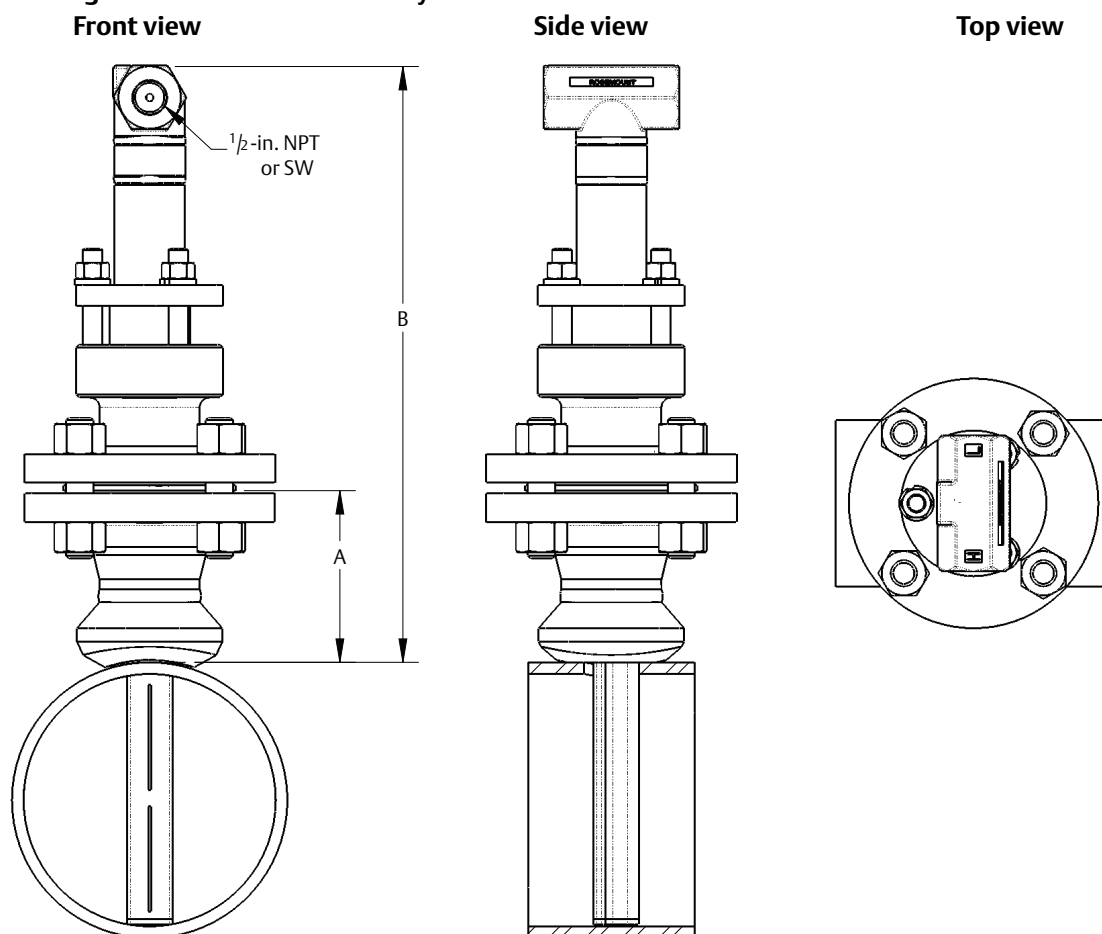


Table 47. Flange-Lok 485 Annubar Primary Element Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)
1	1½ – 150#	3.88 (98.6)	12.25 (311.2)
1	1½ – 300#	4.13 (104.9)	12.25 (311.2)
1	1½ – 600#	4.44 (112.8)	12.25 (311.2)
1	DN40/PN16	3.09 (78.5)	12.25 (311.2)
1	DN40/PN40	3.21 (81.5)	12.25 (311.2)
1	DN40/PN100	3.88 (98.6)	12.25 (311.2)
2	2 – 150#	4.13 (104.9)	14.25 (362.0)
2	2 – 300#	4.38 (111.3)	14.25 (362.0)
2	2 – 600#	4.75 (120.7)	14.25 (362.0)
2	DN50/PN16	3.40 (86.4)	14.25 (362.0)
2	DN50/PN40	3.52 (89.4)	14.25 (362.0)
2	DN50/ PN100	4.30 (109.2)	14.25 (362.0)

1. The Flange-Lok Annubar model can be direct mounted up to 600# ANSI (1440 psig at 100 °F [99 bar at 38 °C]).

Table 47. Flange-Lok 485 Annubar Primary Element Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)
3	3 – 150#	4.63 (117.6)	17.50 (444.5)
3	3 – 300#	5.00 (127.0)	17.50 (444.5)
3	3 – 600#	5.38 (136.7)	17.50 (444.5)
3	DN80/PN16	3.85 (97.8)	17.50 (444.5)
3	DN80/PN40	4.16 (105.7)	17.50 (444.5)
3	DN80/ PN100	4.95 (125.7)	17.50 (444.5)

Dimensions are in inches (millimeters).

Figure 20. Flanged 485 Annubar Primary Element

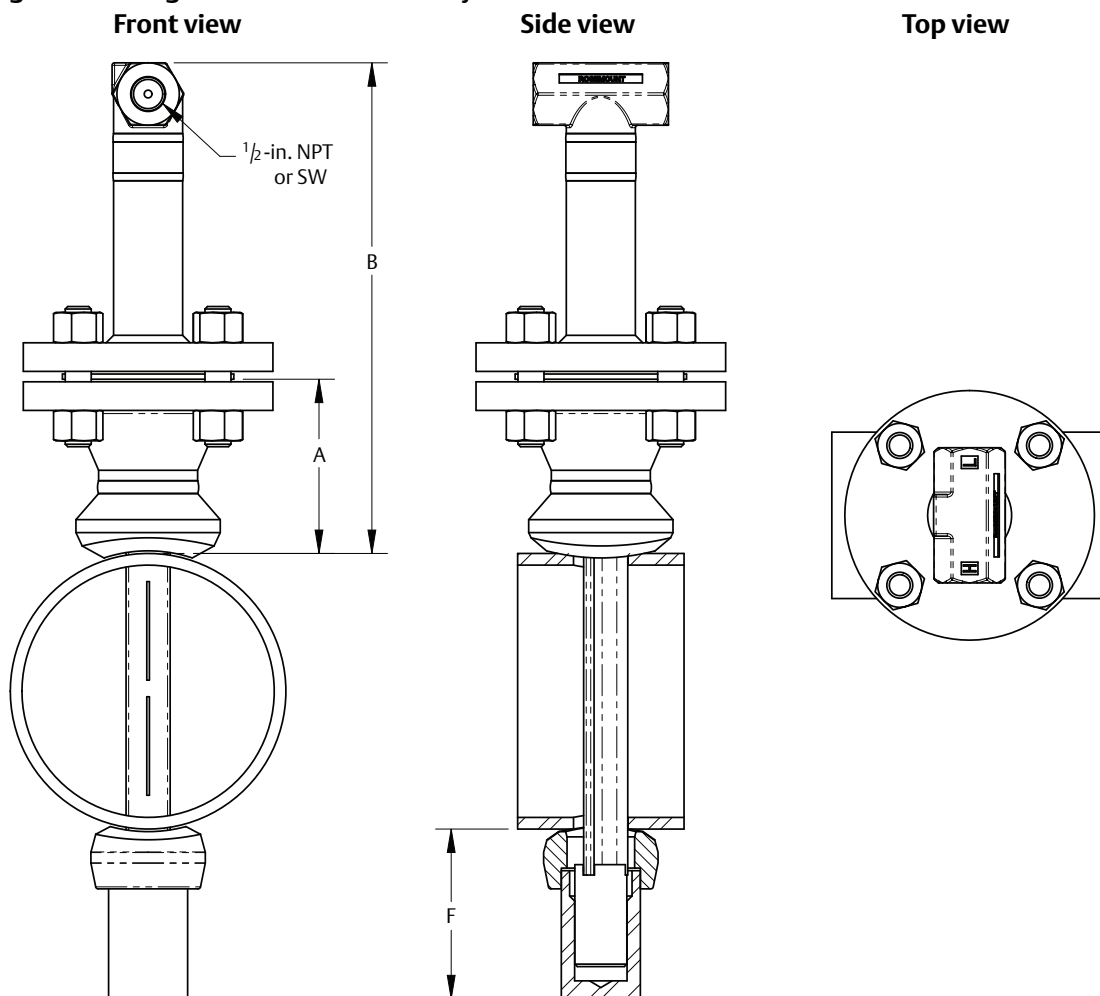


Table 48. Flanged Annubar Primary Element Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	F (Max)
1	1½ – 150#	3.88 (98.6)	11.00 (279.4)	3.50 (88.9)
1	1½ – 300#	4.13 (104.9)	11.00 (279.4)	3.50 (88.9)
1	1½ – 600#	4.44 (112.8)	11.00 (279.4)	3.50 (88.9)
1	DN40/PN16	3.09 (78.5)	11.00 (279.4)	3.50 (88.9)
1	DN40/PN40	3.21 (81.5)	11.00 (279.4)	3.50 (88.9)
1	DN40/ PN100	3.88 (98.6)	11.00 (279.4)	3.50 (88.9)
1	1½ – 900#	4.94 (125.5)	9.31 (236.5)	3.50 (88.9)
1	1½ – 1500#	4.94 (125.5)	9.31 (236.5)	3.50 (88.9)
1	1½ – 2500#	6.76 (171.7)	11.63 (295.4)	4.00 (101.6)
2	2 – 150#	4.13 (104.9)	12.00 (304.8)	5.00 (127.0)
2	2 – 300#	4.38 (111.3)	12.00 (304.8)	5.00 (127.0)
2	2 – 600#	4.75 (120.7)	12.00 (304.8)	5.00 (127.0)

Table 48. Flanged Annubar Primary Element Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	F (Max)
2	DN50/PN16	3.40 (86.4)	12.00 (304.8)	5.00 (127.0)
2	DN50/PN40	3.52 (89.4)	12.00 (304.8)	5.00 (127.0)
2	DN50/ PN100	4.30 (109.2)	12.00 (304.8)	5.00 (127.0)
2	2 – 900#	5.88 (149.4)	10.50 (266.7)	5.00 (127.0)
2	2 – 1500#	5.88 (149.4)	10.50 (266.7)	5.00 (127.0)
2	3 – 2500#	9.88 (251.0)	15.63 (397.0)	4.50 (114.3)
3	3 – 150#	4.63 (117.6)	13.50 (342.9)	4.00 (101.6)
3	3 – 300#	5.00 (127.0)	13.50 (342.9)	4.00 (101.6)
3	3 – 600#	5.38 (136.7)	13.50 (342.9)	4.00 (101.6)
3	DN80/PN16	3.85 (97.8)	13.50 (342.9)	4.00 (101.6)
3	DN80/PN40	4.16 (105.7)	13.50 (342.9)	4.00 (101.6)
3	DN80/ PN100	4.95 (125.7)	13.50 (342.9)	4.00 (101.6)
3	4 – 900#	8.19 (208.0)	13.06 (331.7)	7.00 (177.8)
3	4 – 1500#	8.56 (217.4)	13.81 (350.8)	7.00 (177.8)
3	4 – 2500#	11.19 (284.2)	17.31 (439.7)	7.00 (177.8)

Dimensions are in inches (millimeters).

Figure 21. Flanged Flo-Tap 485 Annubar Primary Element

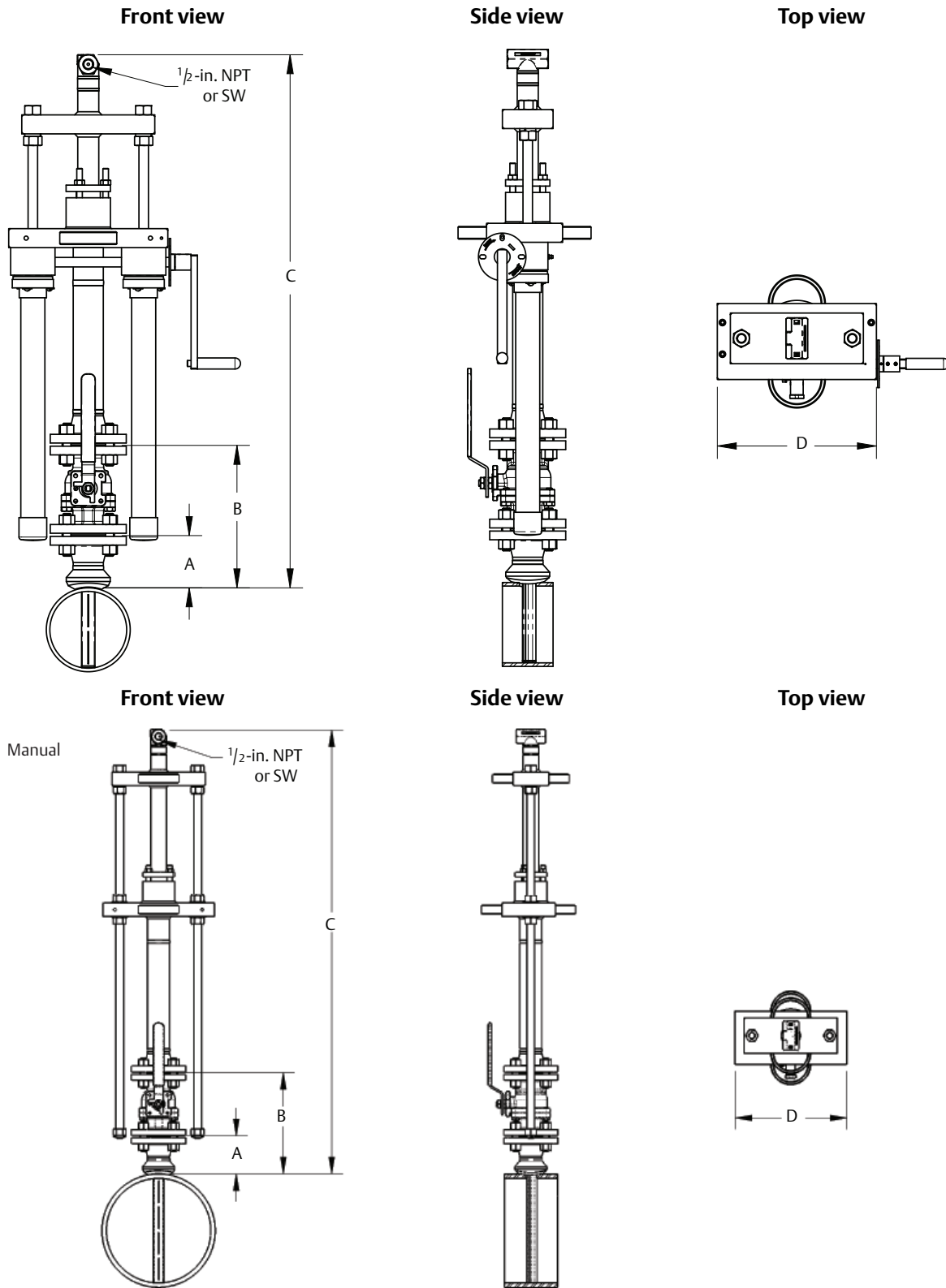


Table 49. Flanged Flo-Tap 485 Annubar Primary Element Dimensional Data⁽¹⁾

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ¹ (Max) (Gear Drive)	C ¹ (Max) (Manual)	D (Max)
1	1½ – 150#	3.88 (98.6)	10.50 (266.7)	N/A	17.77 (451.4)	10.50 (266.7)
1	1½ – 300#	4.13 (104.9)	11.75 (298.5)	N/A	17.77 (451.4)	10.50 (266.7)
1	1½ – 600#	4.44 (112.8)	14.06 (357.2)	N/A	17.77 (451.4)	10.50 (266.7)
1	DN40/PN16	3.09 (78.5)	See Footnote 1	N/A	17.77 (451.4)	10.50 (266.7)
1	DN40/PN40	3.21 (81.5)	See Footnote 1	N/A	17.77 (451.4)	10.50 (266.7)
1	DN40/PN100	3.88 (98.6)	See Footnote 1	N/A	17.77 (451.4)	10.50 (266.7)
2	2 – 150#	4.13 (104.9)	11.25 (285.8)	24.44 (620.8)	21.20 (538.5)	12.56 (319.0)
2	2 – 300#	4.38 (111.3)	13.00 (330.2)	24.44 (620.8)	21.20 (538.5)	12.56 (319.0)
2	2 – 600#	4.75 (120.7)	16.38 (416.0)	24.44 (620.8)	21.20 (538.5)	12.56 (319.0)
2	DN50/PN16	3.40 (86.4)	See Footnote 1	24.44 (620.8)	21.20 (538.5)	12.56 (319.0)
2	DN50/PN40	3.52 (89.4)	See Footnote 1	24.44 (620.8)	21.20 (538.5)	12.56 (319.0)
2	DN50/PN100	4.30 (109.2)	See Footnote 1	24.44 (620.8)	21.20 (538.5)	12.56 (319.0)
3	3 – 150#	4.63 (117.6)	12.75 (323.9)	26.37 (669.8)	23.14 (587.8)	14.13 (358.9)
3	3 – 300#	5.00 (127.0)	16.25 (412.8)	26.37 (669.8)	23.14 (587.8)	14.13 (358.9)
3	3 – 600#	5.38 (136.7)	19.50 (495.4)	26.37 (669.8)	23.14 (587.8)	14.13 (358.9)
3	DN80/PN16	3.85 (97.8)	See Footnote 1	26.37 (669.8)	23.14 (587.8)	14.13 (358.9)
3	DN80/PN40	4.16 (105.7)	See Footnote 1	26.37 (669.8)	23.14 (587.8)	14.13 (358.9)
3	DN80/PN100	4.95 (125.7)	See Footnote 1	26.37 (669.8)	23.14 (587.8)	14.13 (358.9)

Use the appropriate formula to determine C value:

Inserted formula: Pipe I.D. + Wall Thickness + Value B + C¹ (use the Manual Drive or Gear drive values for C¹)

Retracted formula: [2 × (Pipe I.D. + Wall Thickness + Value B)] + C¹ (use the Manual Drive or Gear drive values for C¹)

Dimensions are in inches (millimeters).

1. DIN Valves are not offered.

Figure 22. Threaded Flo-Tap 485 Annubar Primary Element

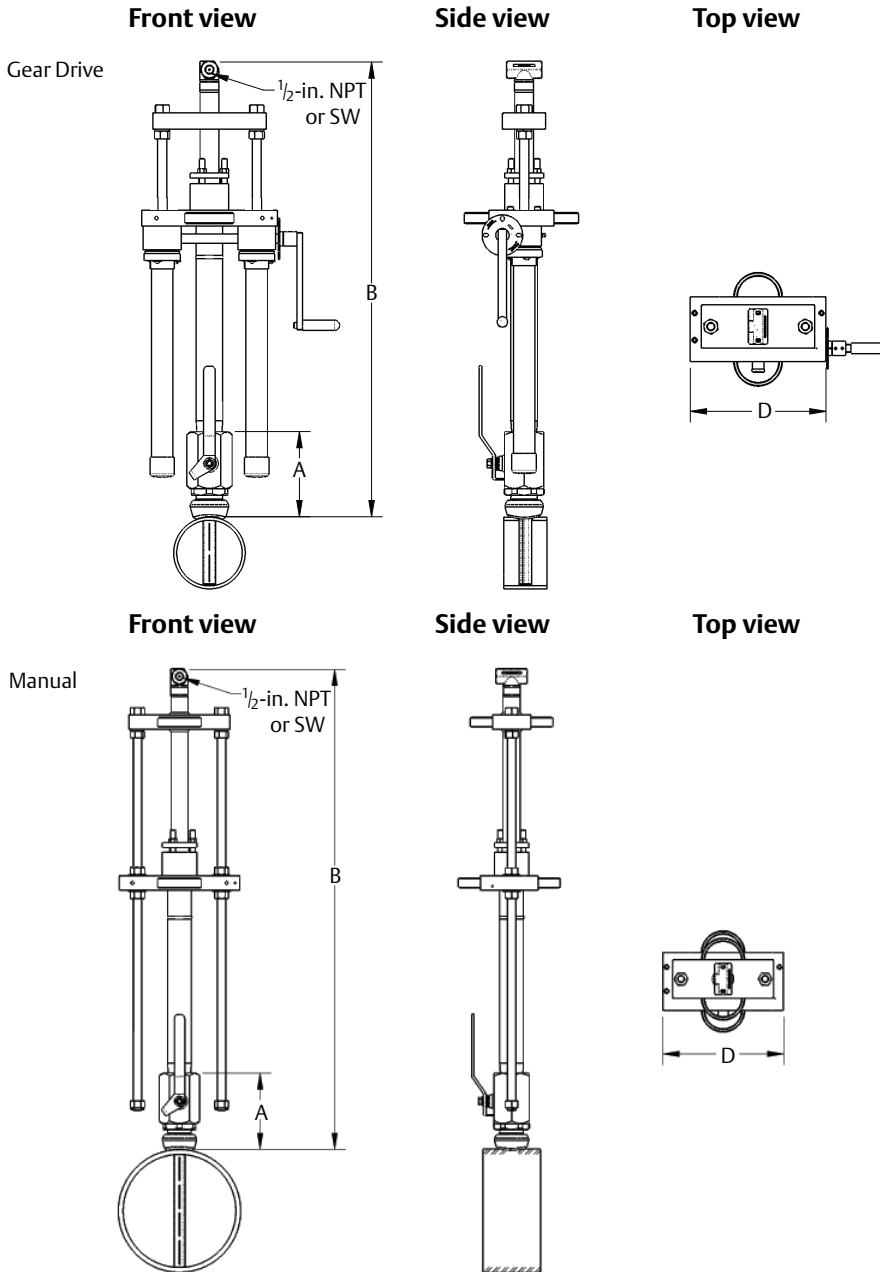


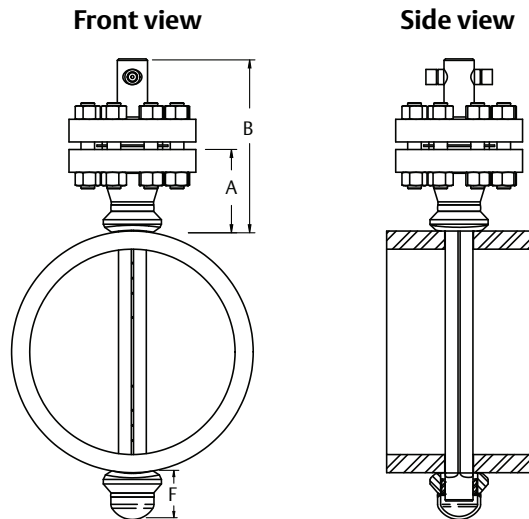
Table 50. Threaded Flo-Tap 485 Annubar Primary Element Dimensional Data⁽¹⁾⁽²⁾

Sensor size	A ± 0.50 (12.7)	B ¹ (Max) (Gear Drive)	B ¹ (Max) (Manual)	D (Max)
1	7.51 (190.9)	N/A	16.96 (430.8)	10.50 (266.7)
2	8.17 (207.5)	23.62 (599.9)	20.39 (517.9)	12.56 (319.0)
3 ⁽³⁾	N/A	N/A	N/A	N/A

1. Inserted, B Dimension = Pipe I.D. + Wall Thickness + A + B¹
2. Retracted, B Dimension = 2 × (Pipe I.D. + Wall Thickness + A) + B¹
3. Sensor Size 3 is not available in a Threaded Flo-Tap.

A.16.5 585 dimensional drawings

Figure 23. Rosemount 585 Flanged with Opposite Side Support Annubar Primary Element



Note: Dimensions are shown with a remote-mount connection. Using direct-mount will add 0.15-in. for sensor size 11 and 22 or 3.15-in. for sensor size 44 to Dimension B.

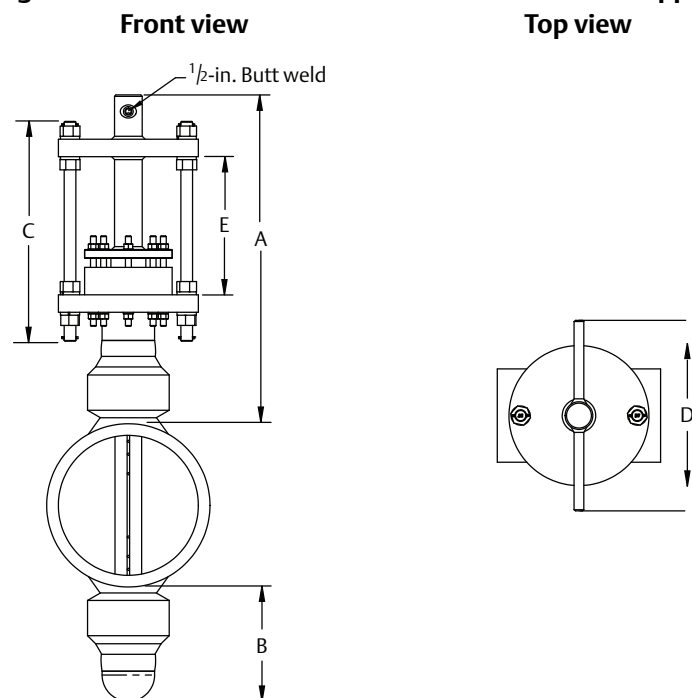
Table 51. 585 Flanged with Opposite Side Support Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	F (Max)
11	1½-in. – 150#	3.88 (98.6)	9.70 (246.4)	3.10 (78.7)
11	1½-in. – 300#	4.13 (104.9)	10.07 (255.8)	3.10 (78.7)
11	1½-in. – 600#	4.44 (112.8)	10.70 (271.8)	3.10 (78.7)
11	DIN40/PN16	3.21 (81.5)	9.05 (229.9)	3.10 (78.7)
11	DIN40/PN40	3.21 (81.5)	9.05 (229.9)	3.10 (78.7)
11	DIN40/ PN100	3.88 (98.6)	10.03 (254.8)	3.10 (78.7)
11	1½-in. – 900#	4.94 (125.5)	11.57 (293.9)	3.60 (91.4)
11	1½-in. – 1500#	4.94 (125.5)	11.57 (293.9)	3.60 (91.4)
11	1½-in. – 2500#	6.75 (171.5)	13.88 (352.6)	3.60 (91.4)
22	2-in. – 150#	4.13 (104.9)	10.01 (254.3)	4.50 (114.3)
22	2-in. – 300#	4.38 (111.3)	10.38 (263.7)	4.50 (114.3)
22	2-in. – 600#	4.75 (120.7)	11.13 (282.7)	4.50 (114.3)
22	DIN50/PN16	3.40 (86.4)	9.24 (234.7)	4.50 (114.3)
22	DIN50/PN40	3.52 (89.4)	9.44 (239.8)	4.50 (114.3)
22	DIN50/ PN100	4.30 (109.2)	10.53 (267.5)	4.50 (114.3)
22	2-in. – 900#	5.88 (149.4)	12.76 (324.1)	4.50 (114.3)
22	2-in. – 1500#	5.88 (149.4)	12.76 (324.1)	4.50 (114.3)
22	3-in. – 2500#	9.88 (250.1)	17.88 (454.2)	4.50 (114.3)
44	3-in. – 150#	4.63 (117.6)	10.69 (271.5)	3.90 (99.1)
44	3-in. – 300#	5.00 (127.0)	11.26 (286.6)	3.90 (99.1)

Table 51. 585 Flanged with Opposite Side Support Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	F (Max)
44	3-in. – 600#	5.38 (136.7)	12.00 (304.8)	3.90 (99.1)
44	DIN80/PN16	3.85 (97.8)	9.77 (248.2)	3.90 (99.1)
44	DIN80/PN40	4.16 (105.7)	10.23 (259.8)	3.90 (99.1)
44	DIN80/ PN100	4.95 (125.7)	11.34 (288.8)	3.90 (99.1)
44	4-in. – 900#	8.19 (208.8)	15.32 (389.1)	6.40 (162.6)
44	4-in. – 1500#	8.56 (217.4)	16.07 (408.2)	6.40 (162.6)
44	4-in. – 2500#	11.19 (284.2)	19.57 (497.1)	6.40 (162.6)

Dimensions are in inches (millimeters).

Figure 24. Rosemount 585 Main Steam Annubar with Opposite Side Support Annubar Primary Element**Table 52. 585 Main Steam Annubar with Opposite Side Support Dimensional Data**

Sensor size	A (Max)	B	C	D	E
44	29.67 (753.6)	10.0 (254)	19.0 (483)	16.33 (414.0)	11.0 (279)

Dimensions are in inches (millimeters).

Note

Locking rods are always located 90° from the instrument connections. For horizontal installations, the instrument connections will be parallel to the pipe. For vertical installations, the instrument connections will be perpendicular to the pipe.

Figure 25. Rosemount 585 Flanged Flo-Tap Annubar Primary Element

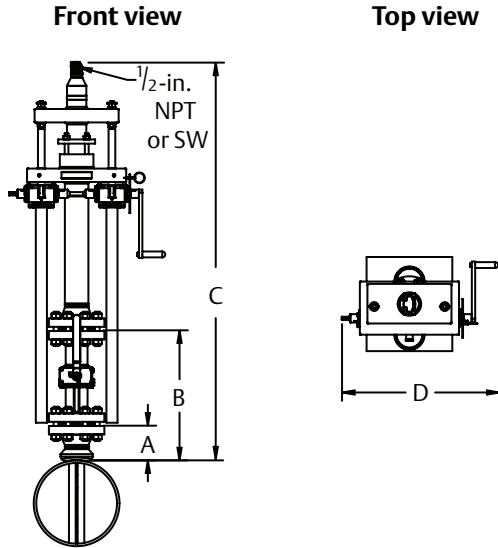


Table 53. 585 Flanged Flo-Tap Annubar Primary Element Dimensional Data

Sensor size	Flange size and rating	A ± 0.125 (3.2)	B ± 0.25 (6.4)	C ¹ (Max) (Gear drive)	D (Max)
44	3 – 150#	4.63 (117,6)	12.75 (323,9)	25.58 (649.7)	23.3 (591,8)
44	3 – 300#	5.00 (127,0)	16.25 (412,8)	25.58 (649.7)	23.3 (591,8)
44	3 – 600#	5.38 (136,7)	19.50 (495,4)	25.58 (649.7)	23.3 (591,8)

Use the appropriate formula to determine C value:

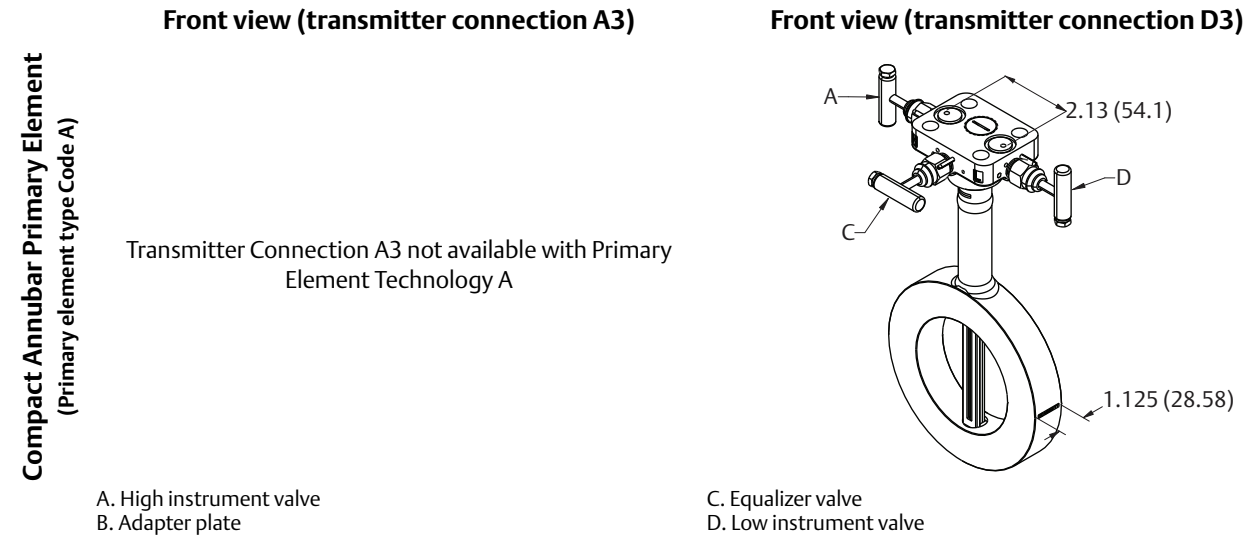
Inserted formula: Pipe I.D. + Wall Thickness + Value B + C¹ (use the Gear drive values for C¹)

Retracted formula: [2 × (Pipe I.D. + Wall Thickness + Value B)] + C¹ (use the Gear drive values for C¹)

Dimensions are in inches (millimeters).

A.16.6 405 Dimensional drawings

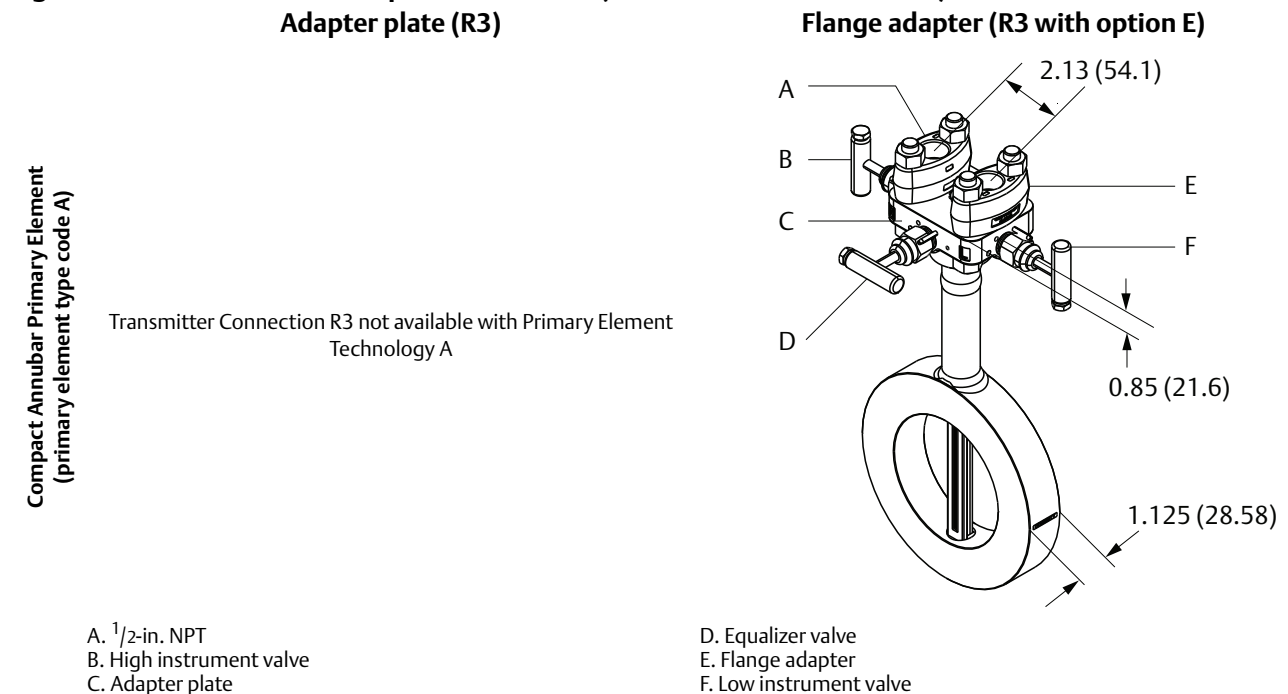
Figure 26. Rosemount 405 Compact Orifice Plate (Direct Mount)



Note

Transmitter connection code A3 is to be used with a traditional style transmitter. This is a stainless steel adapter plate for allowing the direct mount of traditional style transmitters.

Figure 27. Rosemount 405 Compact Orifice Plate (Remote Mount Transmitter)



Appendix B Product Certifications

Hazardous Locations Installations	page 213
Rosemount® 3051SFA and 3051SFC_A	page 213
Rosemount 3051CFA and 3051CFC_A	page 218
Rosemount 2051CFA and 2051CFC_A	page 224
Installation Drawings	page 229

B.1 Hazardous Locations Installations

The flowmeter is designed with explosion-proof housings and circuitry suitable for intrinsically safe and non-incendive operation. Each flowmeter is clearly marked with a tag indicating the approvals. To maintain certified ratings for installed transmitters, install in accordance with all applicable installation codes and approval drawings. Verify that 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.

B.2 Rosemount® 3051SFA and 3051SFC_A

Rev 1.2

B.2.1 European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at www.rosemount.com.

B.2.2 Ordinary Location Certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA). As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

B.2.3 Installing Equipment in North America

The US National Electrical Code (NEC) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

USA

- E5** FM Explosionproof (XP) and Dust-Ignitionproof (DIP)
Certificate: 3008216
Standards: FM Class 3600 - 2011, FM Class 3615 - 2006, FM Class 3616 - 2011, FM Class 3810 - 2005, ANSI/NEMA 250 - 2003
Markings: XP CL I, DIV 1, GP B, C, D; DIP CL II, DIV 1, GP E, F, G; CL III; T5(-50 °C ≤ T_a ≤ +85 °C); Factory Sealed; Type 4X
- I5** FM Intrinsic Safety (IS) and Nonincendive (NI)
Certificate: 3031960
Standards: FM Class 3600 - 2011, FM Class 3610 - 2007, FM Class 3611 - 2004, FM Class 3616 - 2006, FM Class 3810 - 2005, NEMA 250 - 1991
Markings: IS CL I, DIV 1, GP A, B, C, D; CL II, DIV 1, GP E, F, G; Class III; Class 1, Zone 0 AEx ia IIC T4; NI CL 1, DIV 2, GP A, B, C, D; T4(-50 °C ≤ T_a ≤ +70 °C); when connected per Rosemount drawing 03151-1206; Type 4X

Note

Transmitters marked with NI CL 1, DIV 2 can be installed in Division 2 locations using general Division 2 wiring methods or Nonincendive Field Wiring (NIFW). See Drawing 03151-1206.

IE FM FISCO

Certificate: 3031960

Standards: FM Class 3600 - 2011, FM Class 3610 - 2010, FM Class 3611 - 2004, FM Class 3616 - 2006, FM Class 3810 - 2005, NEMA 250 - 1991

Markings: IS CL I, DIV 1, GP A, B, C, D;
T4(-50 °C ≤ T_a ≤ +70 °C); when connected per Rosemount drawing 03151-1006; Type 4X**Canada****E6 CSA Explosionproof, Dust-Ignitionproof, and Division 2**
Certificate: 1143113

Standards: CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 25-1966, CSA Std C22.2 No. 30-M1986, CAN/CSA C22.2 No. 94-M91, CSA Std C22.2 No. 142-M1987, CSA Std C22.2 No. 213-M1987, ANSI/ISA 12.27.01-2003, CSA Std C22.2 No. 60529:05

Markings: Explosionproof Class I, Division 1, Groups B, C, D; Dust-Ignitionproof Class II, Division 1, Groups E, F, G; Class III; suitable for Class I, Division 2, Groups A, B, C, D; Type 4X

I6 CSA Intrinsically Safe

Certificate: 1143113

Standards: CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 30-M1986, CAN/CSA C22.2 No. 94-M91, CSA Std C22.2 No. 142-M1987, CSA Std C22.2 No. 157-92, ANSI/ISA 12.27.01-2003, CSA Std C22.2 No. 60529:05

Markings: Intrinsically Safe Class I, Division 1; Groups A, B, C, D; suitable for Class 1, Zone 0, IIC, T3C; when connected per Rosemount drawing 03151-1207; Type 4X

IF CSA FISCO

Certificate: 1143113

Standards: CAN/CSA C22.2 No. 0-10, CSA Std C22.2 No. 30-M1986, CAN/CSA C22.2 No. 94-M91, CSA Std C22.2 No. 142-M1987, CSA Std C22.2 No. 157-92, ANSI/ISA 12.27.01-2003, CSA Std C22.2 No. 60529:05

Markings: FISCO Intrinsically Safe Class I, Division 1; Groups A, B, C, D; suitable for Class I, Zone 0; T3C; when installed per Rosemount drawing 03151-1207; Type 4X

Europe**E1 ATEX Flameproof**

Certificate: KEMA 00ATEX2143X

Standards: EN 60079-0:2012, EN 60079-1: 2007, EN 60079-26:2007 (3051SFx models with RTD are certified to EN 60079-0:2006)

Markings:  II 1/2 G Ex d IIC T6...T4 Ga/Gb, T6(-60 °C ≤ T_a ≤ +70 °C), T5/T4(-60 °C ≤ T_a ≤ +80 °C)

Temperature class	Process temperature
T6	-60 °C to +70 °C
T5	-60 °C to +80 °C
T4	-60 °C to +120 °C

Special Conditions for Safe Use (X):

1. The device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

I1 ATEX Intrinsic Safety

Certificate: Baseefa08ATEX0064X

Standards: EN 60079-0: 2012, EN 60079-11: 2012

Markings:  II 1 G Ex ia IIC T4 Ga, T4(-60 °C ≤ T_a ≤ +70 °C)

Parameters	HART	FOUNDATION Fieldbus	SuperModule only	RTD (for 3051SFx)
Voltage U _i	30 V	30 V	7.14 V	30 V
Current I _i	300 mA	300 mA	300 mA	2.31 mA
Power P _i	1 W	1.3 W	887 mW	17.32 mW
Capacitance C _i	14.8 nF	0	0.11 uF	0
Inductance L _i	0	0	0	0

Special Conditions for Safe Use (X):

1. If the equipment is fitted with the optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in a Zone 0 environment.

IA ATEX FISCO

Certificate: Baseefa08ATEX0064X
Standards: EN 60079-0: 2012, EN 60079-11: 2012
Markings:  II 1 G Ex ia IIC T4 Ga,
T4(-60 °C ≤ T_a ≤ +70 °C)

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	0
Inductance L _i	0

ND ATEX Dust

Certificate: BAS01ATEX1374X
Standards: EN 60079-0: 2012, EN 60079-31: 2009
Markings:  II 1 D Ex ta IIIC T105 °C T₅₀₀ 95 °C Da,
(-20 °C ≤ T_a ≤ +85 °C), V_{max} = 42.4 V

Special Conditions for Safe Use (X):

1. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
2. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
3. Cable entries and blanking plugs must be suitable for the ambient temperature range of the apparatus and capable of withstanding a 7 J impact test.
4. The SuperModule(s) must be securely screwed in place to maintain the ingress protection of the enclosure(s).

N1 ATEX Type n

Certificate: Baseefa08ATEX0065X
Standards: EN 60079-0: 2012, EN 60079-15: 2010
Markings:  II 3 G Ex nA IIC T4 Gc,
(-40 °C ≤ T_a ≤ +70 °C), V_{max} = 45 V

Special Condition for Safe Use (X):

1. If fitted with a 90V transient suppressor, the equipment is not capable of withstanding the 500V electrical strength test as defined in Clause 6.5.1 of EN 60079-15:2010. This must be taken into account during installation.

International

E7 IECEx Flameproof and Dust

Certificate: IECEx KEM 08.0010X (Flameproof)
Standards: IEC 60079-0:2011, IEC 60079-1: 2007,
IEC 60079-26:2006 (3051SFx models with
RTD are certified to IEC 60079-0:2004)
Markings: Ex d IIC T6...T4 Ga/Gb,
T6(-60 °C ≤ T_a ≤ +70 °C),
T5/T4(-60 °C ≤ T_a ≤ +80 °C)

Temperature class	Process temperature
T6	-60 °C to +70 °C
T5	-60 °C to +80 °C
T4	-60 °C to +120 °C

Special Conditions for Safe Use (X):

1. The device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.

Certificate: IECEx BAS 09.0014X (Dust)
Standards: IEC 60079-0:2011, IEC 60079-31:2008
Markings: Ex ta IIIC T105 °C T₅₀₀ 95 °C Da,
(-20 °C ≤ T_a ≤ +85 °C), V_{max} = 42.4V

Special Conditions for Safe Use (X):

1. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
2. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
3. Cable entries and blanking plugs must be suitable for the ambient temperature range of the apparatus and capable of withstanding a 7 J impact test.
4. The 3051S- SuperModule must be securely screwed in place to maintain the ingress protection of the enclosure.

I7 IECEx Intrinsic Safety

Certificate: IECEx BAS 08.0025X
Standards: IEC 60079-0: 2011, IEC 60079-11: 2011
Markings: Ex ia IIC T4 Ga, T4(-60 °C ≤ T_a ≤ +70 °C)

Parameters	HART	FOUNDATION Fieldbus	SuperModule only	RTD (for 3051SFx)
Voltage U _i	30 V	30 V	7.14 V	30 V
Current I _i	300 mA	300 mA	300 mA	2.31 mA
Power P _i	1 W	1.3 W	887 mW	17.32 mW
Capacitance C _i	14.8 nF	0	0.11 uF	0
Inductance L _i	0	0	0	0

Special Conditions for Safe Use (X):

1. If the equipment is fitted with the optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in a Zone 0 environment.

IG IECEx FISCO

Certificate: IECEx BAS 08.0025X

Standards: IEC 60079-0: 2011, IEC 60079-11: 2011

Markings: Ex ia IIC T4 Ga, T4(-60 °C ≤ T_a ≤ +70 °C)

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	0
Inductance L _i	0

N7 IECEx Type n

Certificate: IECEx BAS 08.0026X

Standards: IEC 60079-0: 2011, IEC 60079-15: 2010

Markings: Ex nA IIC T5 Gc, (-40 °C ≤ T_a ≤ +70 °C)**Special Condition for Safe Use (X):**

1. If fitted with a 90 V transient suppressor, the equipment is not capable of withstanding the 500 V electrical strength test as defined in Clause 6.5.1 of IEC 60079-15:2010. This must be taken into account during installation.

Brazil**E2 INMETRO Flameproof**

Certificate: CEPEL 03.0140X [Mfg USA, Singapore, Germany], CEPEL 07.1413X [Mfg Brazil]

Standards: ABNT NBR IEC 60079-0:2008, ABNT NBR IEC 60079-1:2009, ABNT NBR IEC 60529:2009

Markings: Ex d IIC T* Ga/Gb, T6(-40 °C ≤ T_a ≤ +65 °C), T5(-40 °C ≤ T_a ≤ +80 °C), IP66***Special Conditions for Safe Use (X):**

1. For ambient temperature above 60 °C, cable wiring must have minimum isolation temperature of 90 °C, to be in accordance to equipment operation temperature.
2. The device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.

I2 INMETRO Intrinsic Safety

Certificate: NCC 12.1158X [Mfg Brazil, USA, Germany]

Standards: ABNT NBR IEC 60079-0:2013,

ABNT NBR IEC 60079-11:2009,

ABNT NBR IEC 60079-26:2008

Markings: Ex ia IIC T4 Ga, T4(-60 °C ≤ T_a ≤ +70 °C), IP66***Special Conditions for Safe Use (X):**

1. If the equipment is fitted with the optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. For processes with temperatures above 135 °C, the user must assess whether the SuperModule temperature class is suitable for such applications, because in this situation there is a risk of the SuperModule temperature being above T4.

Parameters	HART	FOUNDATION Fieldbus	SuperModule only	RTD (for 3051SFx)
Voltage U _i	30 V	30 V	7.14 V	30 V
Current I _i	300 mA	300 mA	300 mA	2.31 mA
Power P _i	1 W	1.3 W	887 mW	17.32 mW
Capacitance C _i	14.8 nF	0	0.11 uF	0
Inductance L _i	0	0	0	0

China**E3 China Flameproof and Dust Ignition-proof**

Certificate: 3051SMV: GYJ14.1039X

[Mfg USA, China, Singapore]

3051SFx: GYJ11.1711X

[Mfg USA, China, Singapore]

Standards: 3051SMV: GB3836.1-2010, GB3836.2-2010, GB3836.20-2010

3051SFx: GB3836.1-2010, GB3836.2-2010, GB3836.20-2010, GB12476.1-2000

Markings: 3051SMV: Ex d IIC T6/T5 Ga/Gb

3051SFx: Ex d IIC T6/T5 Ga/Gb;

DIP A20 TA105 °C; IP66

Special Conditions for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use: For information on the dimensions of the flameproof joints the manufacturer shall be contacted.
2. The relationship between T code and ambient temperature range are as follows:

T code	Ambient temperature range
T6	-50 °C ~ +65 °C
T5	-50 °C ~ +80 °C

3. The earth connection facility in the enclosure should be connected reliably.
4. During installation, use and maintenance of the product in explosive atmosphere, observe the warning "Do not open cover when circuit is alive". During installation, use, and maintenance in explosive dust atmosphere, observe the warning "Do not open when an explosive dust atmosphere is present".
5. During installation there should be no mixture harmful to the housing.
6. During installation, use and maintenance in explosive dust atmosphere, product enclosure should be cleaned to avoid dust accumulation, but compressed air should not be used.
7. During installation in a hazardous location, cable glands and blanking plugs certified by state appointed inspection bodies with Ex d IIC Gb or Ex d IIC Gb DIP A20 [Flowmeters] IP66 type of protection should be used. Redundant cable entries should be blocked with blanking plugs.
8. End users are not permitted to change any components, but to contact the manufacturer to avoid damage to the product.
9. Maintenance should be done when no explosive gas and dust atmosphere is present.
10. During installation, use and maintenance of this product, observe following standards:
GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres"
GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)"
GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)"
GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering"

- I3** China Intrinsic Safety
Certificate: 3051SMV: GYJ14.1040X
[Mfg USA, China, Singapore]
3051SFx: GYJ11.1707X
[Mfg USA, China, Singapore]
Standards: 3051SMV: GB3836.1-2010,
GB3836.4-2010,
GB3836.20-2010
3051SFx: GB3836.1/4-2010,
GB3836.20-2010,
GB12476.1-2000
Markings: 3051SMV: Ex ia IIC T4 Ga
3051SFx: Ex ia IIC T4 Ga, DIP A20 TA105 °C;
IP66

Special Conditions for Safe Use (X):

1. The enclosure may contain light metal, attention should be taken to avoid ignition hazard due to impact or friction.
2. The apparatus is not capable of withstanding the 500V electrical strength test defined in Clause 6.3.12 of GB3836.4-2010.
3. Ambient temperature range: -60 °C ~ +70 °C
4. Intrinsically safe electric parameters:

Maximum input voltage: U _i (V)	Maximum input current: I _i (mA)	Maximum input power: P _i (W)	Maximum internal parameters:	
			C _i (nF)	L _i (μH)
30	300	1.0	14.8	0

	Maximum output voltage: U _i (V)	Maximum output current: I _i (mA)	Maximum output power: P _i (W)	Maximum external parameters:	
				C _i (nF)	L _i (μH)
RTD	30	2.31	17.32	0	0
SuperModule	7.14	300	887	110	0

5. The cables between this product and associated apparatus should be shielded cables. The shield should be grounded reliably in non-hazardous area.
6. The product should be used with Ex certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.
7. End users are not permitted to change any components, contact the manufacturer to avoid damage to the product.
8. During installation in hazardous location, cable glands, conduit, and blanking plugs certified by state-appointed inspection bodies with DIP A20 IP66 type of protection should be used. Redundant cable entries should be blocked with blanking plugs.
9. During installation, use, and maintenance in explosive dust atmosphere, observe the warning "Do not open when an explosive dust atmosphere is present".
10. Maintenance should be done when no explosive dust atmosphere is present.
11. When installation, use and maintenance of this product, observe following standards:
GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres"
GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres Part 15: Electrical installations in hazardous area (other than mines)"
GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres Part 16: Inspection and maintenance of electrical installation (other than mines)"

GB50257-1996 “Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering”

EAC – Belarus, Kazakhstan, Russia

EM Technical Regulation Customs Union (EAC) Flameproof
Certificate: RU C-US.GB05.B.00835
Markings: Ga/Gb Ex d IIC T6...T4 X

IM Technical Regulation Customs Union (EAC) Intrinsic Safety
Certificate: RU C-US.GB05.B.00835
Markings: 0Ex ia IIC T4 Ga X

Japan

E4 Japan Flameproof
Certificate: TC19070, TC19071, TC19072, TC19073
Markings: Ex d IIC T6

Republic of Korea

EP Republic of Korea Flameproof
Certificate: 12-KB4BO-0180X [Mfg USA],
11-KB4BO-0068X [Mfg Singapore]
Markings: Ex d IIC T5 or T6

IP Republic of Korea Intrinsic Safety
Certificate: 10-KB4BO-0021X [Mfg USA, SMMC]
Markings: Ex ia IIC T4

Combinations

K1 Combination of E1, I1, N1, and ND

K2 Combination of E2 and I2

K5 Combination of E5 and I5

K6 Combination of E6 and I6

K7 Combination of E7, I7, and N7

KA Combination of E1, I1, E6, and I6

KB Combination of E5, I5, E6, and I6

KC Combination of E1, I1, E5, and I5

KD Combination of E1, I1, E5, I5, E6, and I6

KM Combination of EM and IM

KP Combination of EP and IP

Additional Certifications

SBS American Bureau of Shipping (ABS) Type Approval
Certificate: 00-HS145383
Intended Use: Measure gauge or absolute pressure of liquid, gas or vapor applications on ABS classed vessels, marine, and offshore installations.

SBV Bureau Veritas (BV) Type Approval
Certificate: 31910 BV
Requirements: Bureau Veritas Rules for the Classification of Steel Ships
Application: Class Notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS

SDN Det Norske Veritas (DNV) Type Approval
Certificate: A-13243
Intended Use: Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft, and Det Norske Veritas' Offshore Standards

Application:

Location classes	
Type	3051S
Temperature	D
Humidity	B
Vibration	A
EMC	A
Enclosure	D/IP66/IP68

SLL Lloyds Register (LR) Type Approval
Certificate: 11/60002
Application: Environmental categories ENV1, ENV2, ENV3, and ENV5

D3 Custody Transfer – Measurement Canada Accuracy Approval
Certificate: AG-0501, AV-2380C

B.3 Rosemount 3051CFA and 3051CFC_A

Rev 1.1

B.3.1 European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at www.rosemount.com.

B.3.2 Ordinary Location Certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

North America

E5 USA Explosionproof (XP) and Dust-Ignitionproof (DIP)
Certificate: OT2H0.AE
Standards: FM Class 3600 – 2011,
FM Class 3615 – 2006,
FM Class 3810 – 2005,
ANSI/NEMA 250 – 2003
Markings: XP CL I, DIV 1, GP B, C, D; DIP CL II, DIV 1, GP E, F, G; CL III; T5(-50 °C ≤ T_a ≤ +85 °C); Factory Sealed; Type 4X

- I5** USA Intrinsic Safety (IS) and Nonincendive (NI)
Certificate: 1Q4A4.AX
Standards: FM Class 3600 – 2011,
FM Class 3610 – 2010,
FM Class 3611 – 2004, FM Class 3810 – 2005
Markings: IS CL I, DIV 1, GP A, B, C, D; CL II, DIV 1, GP E,
F, G; Class III; DIV 1 when connected per
Rosemount drawing 03031-1019; NI CL 1,
DIV 2, GP A, B, C, D; T4(-50 °C ≤ T_a ≤ +70 °C)
[HART], T5(-50 °C ≤ T_a ≤ +40 °C) [HART];
T4(-50 °C ≤ T_a ≤ +60 °C)
[Fieldbus/PROFIBUS]; Type 4x

Special Conditions for Safe Use (X):

1. The Model 3051 transmitter housing contains aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.
2. The Model 3051 transmitter with the transient terminal block (Option code T1) will not pass the 500Vrms dielectric strength test and this must be taken into account during installation

- IE** USA FISCO
Certificate: 1Q4A4.AX
Standards: FM Class 3600 – 2011,
FM Class 3610 – 2010,
FM Class 3611 – 2004, FM Class 3810 – 2005
Markings: IS CL I, DIV 1, GP A, B, C, D when connected
per Rosemount drawing 03031-1019
(-50 °C ≤ T_a ≤ +60 °C); Type 4x

Special Conditions for Safe Use (X):

1. The Model 3051 transmitter housing contains aluminum and is considered a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact and friction.
2. The Model 3051 transmitter with the transient terminal block (Option code T1) will not pass the 500Vrms dielectric strength test and this must be taken into account during installation

- C6** Canada Explosionproof, Dust-Ignitionproof, Intrinsic Safety and Nonincendive
Certificate: 1053834
Standards: ANSI/ISA 12.27.01-2003,
CSA Std. C22.2 No. 30 -M1986,
CSA Std. C22.2 No.142-M1987,
CSA Std. C22.2. No.157-92,
CSA Std. C22.2 No. 213 - M1987

Markings: Explosionproof for Class I, Division 1, Groups B, C and D; Suitable for Class I, Zone 1, Group IIB+H2, T5; Dust-Ignitionproof Class II, Division 1, Groups E, F, G; Class III Division 1; Intrinsically Safe Class I, Division 1 Groups A, B, C, D when connected in accordance with Rosemount drawing 03031-1024, Temperature Code T3C; Suitable for Class I, Zone 0; Class I Division 2 Groups A, B, C and D, T5; Suitable for Class I Zone 2, Group IIC; Type 4X; Factory Sealed; Single Seal (See drawing 03031-1053)

- E6** Canada Explosionproof, Dust-Ignitionproof and Division 2
Certificate: 1053834

Standards: ANSI/ISA 12.27.01-2003,
CSA Std. C22.2 No. 30 -M1986,
CSA Std. C22.2 No.142-M1987,
CSA Std. C22.2 No. 213 - M1987

Markings: Explosionproof Class I, Division 1, Groups B, C and D; Suitable for Class I, Zone 1, Group IIB+H2, T5; Dust-Ignitionproof for Class II and Class III, Division 1, Groups E, F and G; Class I, Division 2, Groups A, B, C and D; Suitable for Class I Zone 2, Group IIC; Type 4X; Factory Sealed; Single Seal (See drawing 03031-1053)

Europe

- E8** ATEX Flameproof and Dust
Certificate: KEMA00ATEX2013X; Baseefa11ATEX0275X
Standards: EN60079-0:2012 + A11:2013,
EN60079-1:2007, EN60079-26:2007,
EN60079-31:2009
Markings:  II 1/2 G Ex d IIC T6/T5 Ga/Gb,
T6(-50 °C ≤ T_a ≤ +65 °C),
T5(-50 °C ≤ T_a ≤ +80 °C);
 II 1 D Ex ta IIIC T95 °C T₅₀₀ 105 °C Da
(-20 °C ≤ T_a ≤ +85 °C)

Table 1. Process Temperature

Temperature class	Process temperature
T6	-50 °C to +65 °C
T5	-50 °C to +80 °C

Special Conditions for Safe Use (X):

1. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.
3. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

- I1** ATEX Intrinsic Safety and Dust
 Certificate: BAS97ATEX1089X; Baseefa11ATEX0275X
 Standards: EN60079-0:2012, EN60079-11:2012, EN60079-31:2009
 Markings: HART:  II 1 G Ex ia IIC T5/T4 Ga,
 T5(-60 °C ≤ T_a ≤ +40 °C),
 T4(-60 °C ≤ T_a ≤ +70 °C)
 Fieldbus/PROFIBUS:  II 1 G Ex ia IIC Ga
 T4(-60 °C ≤ T_a ≤ +60 °C)
 DUST:  II 1 D Ex ta IIIC T95 °C T₅₀₀ 105 °C
 Da (-20 °C ≤ T_a ≤ +85 °C)

Table 2. Input Parameters

Parameters	HART	Fieldbus/PROFIBUS
Voltage U _i	30 V	30 V
Current I _i	200 mA	300 mA
Power P _i	0.9 W	1.3 W
Capacitance C _i	0.012 μF	0 μF
Inductance L _i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. The apparatus is not capable of withstanding the 500 V insulation test required by clause 6.3.12 of EN60079-11:2012. This must be taken into account when installing the apparatus.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact or abrasion if located in Zone 0.
3. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

- IA** ATEX FISCO
 Certificate: BAS97ATEX1089X
 Standards: EN60079-0:2012, EN60079-11:2009
 Markings:  II 1 G Ex ia IIC T4 Ga (-60 °C ≤ T_a ≤ +60 °C)

Table 3. Input Parameters

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	< 5 nF
Inductance L _i	< 10 μF

Special Conditions for Safe Use (X):

1. The apparatus is not capable of withstanding the 500 V insulation test required by clause 6.3.12 of EN60079-11:2012. This must be taken into account when installing the apparatus.

2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact or abrasion if located in Zone 0.

- N1** ATEX Type n and Dust
 Certificate: BAS00ATEX3105X; Baseefa11ATEX0275X
 Standards: EN60079-0:2012, EN60079-15:2010, EN60079-31:2009
 Markings:  II 3 G Ex nA IIC T5 Gc
 (-40 °C ≤ T_a ≤ +70 °C);
 II 1 D Ex ta IIIC T95 °C T₅₀₀ 105 °C Da
 (-20 °C ≤ T_a ≤ +85 °C)

Special Conditions for Safe Use (X):

1. This apparatus is not capable of withstanding the 500V insulation test that is required by clause 6.8.1 of EN60079-15. This must be taken into account when installing the apparatus.
2. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

International

- E7** IECEx Flameproof and Dust
 Certificate: IECEx KEM 09.0034X; IECEx BAS 10.0034X
 Standards: IEC60079-0:2011, IEC60079-1:2007-04, IEC60079-26:2006, IEC60079-31:2008
 Markings: Ex d IIC T6/T5 Ga/Gb,
 T6(-50 °C ≤ T_a ≤ +65 °C),
 T5(-50 °C ≤ T_a ≤ +80 °C);
 Ex ta IIIC T95 °C T₅₀₀ 105 °C Da
 (-20 °C ≤ T_a ≤ +85 °C)

Table 4. Process Temperature

Temperature class	Process temperature
T6	-50 °C to +65 °C
T5	-50 °C to +80 °C

Special Conditions for Safe Use (X):

1. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. For information on the dimensions of the flameproof joints the manufacturer shall be contacted.
3. Some variants of the equipment have reduced markings on the nameplate. Refer to the Certificate for full equipment marking.

- I7** IECEx Intrinsic Safety
Certificate: IECEx BAS 09.0076X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: HART: Ex ia IIC T5/T4 Ga,
T5(-60 °C ≤ T_a ≤ +40 °C),
T4(-60 °C ≤ T_a ≤ +70 °C)
Fieldbus/PROFIBUS: Ex ia IIC
T4(-60 °C ≤ T_a ≤ +60 °C)

Table 5. Input Parameters

Parameters	HART	Fieldbus/PROFIBUS
Voltage U _i	30 V	30 V
Current I _i	200 mA	300 mA
Power P _i	0.9 W	1.3 W
Capacitance C _i	0.012 μF	0 μF
Inductance L _i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. If the apparatus is fitted with an optional 90V transient suppressor, it is not capable of withstanding the 500V insulation test required by clause 6.3.12 of IEC60079-11. This must be taken into account when installing the apparatus.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.

IECEx Mining (Special A0259)
Certificate: IECEx TSA 14.0001X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: Ex ia I Ma (-60 °C ≤ T_a ≤ +70 °C)

Table 6. Input Parameters

Parameters	HART	Fieldbus/PROFIBUS	FISCO
Voltage U _i	30 V	30 V	17.5 V
Current I _i	200 mA	300 mA	380 mA
Power P _i	0.9 W	1.3 W	5.32 W
Capacitance C _i	0.012 μF	0 μF	< 5 nF
Inductance L _i	0 mH	0 mH	< 10 μF

Special Conditions for Safe Use (X):

1. If the apparatus is fitted with an optional 90V transient suppressor, it is not capable of withstanding the 500V insulation test required by IEC60079-11. This must be taken into account when installing the apparatus.
2. It is a condition of safe use that the above input parameters shall be taken into account during installation.

3. It is a condition of manufacture that only the apparatus fitted with housing, covers and sensor module housing made out of stainless steel are used in Group I applications.

- N7** IECEx Type n
Certificate: IECEx BAS 09.0077X
Standards: IEC60079-0:2011, IEC60079-15:2010
Markings: Ex nA IIC T5 Gc (-40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

1. The apparatus is not capable of withstanding the 500V insulation test required by IEC60079-15. This must be taken into account when installing the apparatus.

Brazil

- E2** INMETRO Flameproof
Certificate: UL-BR 13.0643X
Standards: ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC60079-1:2009 + Errata 1:2011, ABNT NBR IEC60079-26:2008 + Errata 1:2008
Markings: Ex d IIC T6/T5 Ga/Gb,
T6(-50 °C ≤ T_a ≤ +65 °C),
T5(-50 °C ≤ T_a ≤ +80 °C)

Special Conditions for Safe Use (X):

1. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. In case of repair, contact the manufacturer for information on the dimensions of the flameproof joints.
3. The capacitance of the wrap around label, being 1.6nF, exceeds the limit in Table 9 of ABNT NBR IEC 60079-0. The user shall determine suitability for the specific application.

- I2** INMETRO Intrinsic Safety
Certificate: UL-BR 13.0584X
Standards: ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC60079-11:2009
Markings: HART: Ex ia IIC T5/T4 Ga,
T5(-60 °C ≤ T_a ≤ +40 °C),
T4(-60 °C ≤ T_a ≤ +70 °C)
Fieldbus/PROFIBUS: Ex ia IIC T4 Ga
(-60 °C ≤ T_a ≤ +60 °C)

Table 7. Input Parameters

Parameters	HART	Fieldbus/PROFIBUS
Voltage U _i	30 V	30 V
Current I _i	200 mA	300 mA
Power P _i	0.9 W	1.3 W
Capacitance C _i	0.012 μF	0 μF
Inductance L _i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90V transient suppressor, it is not capable of withstanding the 500V insulation test required by ABNT NBR IEC 60079-11. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.

IB INMETRO FISCO

Certificate: UL-BR 13.0584X

Standards: ABNT NBR IEC60079-0:2008 + Errata

1:2011, ABNT NBR IEC60079-11:2009

Markings: Ex ia IIC T4 Ga (-60 °C ≤ T_a ≤ +60 °C)**Table 8. Input Parameters**

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	< 5 nF
Inductance L _i	< 10 μF

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90V transient suppressor, it is not capable of withstanding the 500V insulation test required by ABNT NBR IEC 60079-11. This must be taken into account when installing the equipment.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.

China**E3 China Flameproof**

Certificate: GYJ14.1041X; GYJ10.1313X [Flowmeters]

Standards: GB3836.1-2000, GB3836.2-2010, GB12476-2000

Markings: Ex d IIC T6/T5, T6(-50 °C ≤ T_a ≤ +65 °C), T5(-50 °C ≤ T_a ≤ +80 °C)**Special Conditions for Safe Use (X):**

1. The relation between ambient temperature range and temperature class is as follows:

T _a	Temperature class
-50 °C ~ +80 °C	T5
-50 °C ~ +65 °C	T6

When used in a combustible dust environment, the maximum ambient temperature is 80 °C.

2. The earth connection facility in the enclosure should be connected reliably.
3. Cable entry certified by notified body with type of protection Ex d IIC in accordance with GB3836.1-2000 and GB3836.2-2000, should be applied when installed in a hazardous location. When used in combustible dust environment, cable entry in accordance with IP66 or higher level should be applied.
4. Obey the warning "Keep tight when the circuit is alive."
5. End users are not permitted to change any internal components.
6. During installation, use and maintenance of this product, observe the following standards: GB3836.13-1997, GB3836.15-2000, GB3836.16-2006, GB50257-1996, GB12476.2-2006, GB15577-2007

I3 China Intrinsic Safety

Certificate: GYJ13.1362X; GYJ101312X [Flowmeters]

Standards: GB3836.1-2010, GB3836.4-2010, GB3836.20-2010, GB12476.1-2000

Markings: Ex ia IIC Ga T4/T5

Special Conditions for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use:
 - a. If the apparatus is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test for 1 minute. This must be taken into account when installing the apparatus.
 - b. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.
2. The relation between T code and ambient temperature range is:

Model	T code	Temperature range
HART	T5	-60 °C ≤ T _a ≤ +40 °C
HART	T4	-60 °C ≤ T _a ≤ +70 °C
Fieldbus/PROFIBUS/FISCO	T4	-60 °C ≤ T _a ≤ +60 °C
Flowmeter with 644 Temp Housing	T4	-40 °C ≤ T _a ≤ +60 °C

3. Intrinsically Safe parameters:

Parameters	HART	Fieldbus/ PROFIBUS	FISCO
Voltage U_i	30 V	30 V	17.5 V
Current I_i	200 mA	300 mA	380 mA
Power P_i	0.9 W	1.3 W	5.32 W
Capacitance C_i	0.012 μ F	0 μ F	< 5 nF
Inductance L_i	0 mH	0 mH	< 10 μ F

Note 1: FISCO parameters apply to both Group IIC and IIB.

Note 2: [For Flowmeters] When 644 temperature transmitter is used, the 644 temperature transmitter should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of both 644 temperature transmitter and associated apparatus. The cables between 644 temperatures transmitter and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.

- Transmitters comply with the requirements for FISCO field devices specified in IEC60079-27:2008. For the connection of an intrinsically safe circuit in accordance with FISCO Model, FISCO parameters are listed in the table above.
- The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.
- The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.
- End users are not permitted to change any intern components but to settle the problem in conjunction with the manufacturer to avoid damage to the product.
- During installation, use and maintenance of this product, observe the following standards: GB3836.13-1997, GB3836.15-2000, GB3836.16-2006, GB50257-1996, GB12476.2-2006, GB15577-2007

N3 China Type n
Certificate: GYJ15.1105X
Standards: GB3836.1-2010, GB3836.8-2003
Markings: Ex nA nL IIC T5 Gc (-40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

- Symbol "X" is used to denote specific conditions of use: The apparatus is not capable of withstanding the 500V test to earth for one minute. The must be taken into consideration during installation.

Japan

E4 Japan Flameproof
Certificate: TC20577, TC20578, TC20583, TC20584 [HART]; TC20579, TC20580, TC20581, TC20582 [Fieldbus]
Markings: Ex d IIC T5

Technical Regulations Customs Union (EAC)

EM EAC Flameproof
Certificate: RU C-US.Gb05.B.00400
Markings: Ga/Gb Ex d IIC T5/T6 X, T5(-60 °C ≤ T_a ≤ +80 °C), T6(-60 °C ≤ T_a ≤ +65 °C)

Special Condition for Safe Use (X):

- See certificate for special conditions

IM EAC Intrinsically Safe
Certificate: RU C-US.Gb05.B.00400
Markings: HART: 0Ex ia IIC T4/T5 Ga X, T4(-60 °C ≤ T_a ≤ +70 °C), T5(-60 °C ≤ T_a ≤ +40 °C)
Fieldbus/PROFIBUS: 0Ex ia IIC T4 Ga X (-60 °C ≤ T_a ≤ +60 °C)

Special Condition for Safe Use (X):

- See certificate for special conditions

Combinations

K2 Combination of E2 and I2
K5 Combination of E5 and I5
K6 Combination of C6, E8, and I1
K7 Combination of E7, I7, and N7
K8 Combination of E8, I1, and N1
KB Combination of E5, I5, and C6
KD Combination of E8, I1, E5, I5, and C6
KM Combination EM and IM

Conduit Plugs and Adapters

IECEx Flameproof and Increased Safety
Certificate: IECEx FMG 13.0032X
Standards: IEC60079-0:2011, IEC60079-1:2007, IEC60079-7:2006-2007
Markings: Ex de IIC Gb

ATEX Flameproof and Increased Safety
Certificate: FM13ATEX0076X
Standards: EN60079-0:2012, EN60079-1:2007, IEC60079-7:2007
Markings: Ex II 2 G Ex de IIC Gb

Table 9. Conduit Plug Thread Sizes

Thread	Identification mark
M20 × 1.5	M20
1/2 - 14 NPT	1/2 NPT
G 1/2A	G 1/2

Table 10. Thread Adapter Thread Sizes

Male thread	Identification mark
M20 × 1.5 - 6H	M20
1/2 - 14 NPT	1/2 NPT - 14 NPT
3/4 - 14 NPT	3/4 - 14 NPT
Female thread	Identification mark
M20 × 1.5 - 6H	M20
1/2 - 14 NPT	1/2 NPT - 14 NPT
PG 13.5	PG 13.5

Special Conditions for Safe Use (X):

1. When the thread adapter or blanking plug is used with an enclosure in type of protection increased safety “e” the entry thread shall be suitably sealed in order to maintain the ingress protection rating (IP) of the enclosure.
2. The blanking plug shall not be used with an adapter.
3. Blanking Plug and Threaded Adapter shall be either NPT or Metric thread forms. G 1/2 and PG 13.5 thread forms are only acceptable for existing (legacy) equipment installations.

Additional Certifications

- SBS** American Bureau of Shipping (ABS) Type Approval
Certificate: 09-HS446883A-PDA
Intended Use: Measure gauge or absolute pressure of liquid, gas or vapor applications on ABS classed vessels, marine, and offshore installations.
- SBV** Bureau Veritas (BV) Type Approval
Certificate: 23155
Requirements: Bureau Veritas Rules for the Classification of Steel Ships
Application: Class notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS; Pressure transmitter type 3051 cannot be installed on diesel engines
- SDN** Det Norske Veritas (DNV) Type Approval
Certificate: A-14185
Intended Use: Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards

Application:

Location classes	
Temperature	D
Humidity	B
Vibration	A
EMC	B
Enclosure	D

- SLL** Lloyds Register (LR) Type Approval
Certificate: 11/60002
Application: Environmental categories ENV1, ENV2, ENV3, and ENV5
- C5** Custody Transfer - Measurement Canada Accuracy Approval
Certificate: AG-0226; AG-0454; AG-0477

B.4 Rosemount 2051CFA and 2051CFC_A

Rev 1.0

B.4.1 European Directive Information

A copy of the EC Declaration of Conformity can be found at the end of the Quick Start Guide. The most recent revision of the EC Declaration of Conformity can be found at www.rosemount.com.

B.4.2 Ordinary Location Certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

North America

- E5** USA Explosionproof (XP) and Dust-Ignitionproof (DIP)
Certificate: 3032938
Standards: FM Class 3600 – 2011,
FM Class 3615 – 2006,
FM Class 3810 – 2005,
ANSI/NEMA 250 – 1991,
ANSI/IEC 60529 2004
Markings: XP CL I, DIV 1, GP B, C, D; DIP CL II, DIV 1, GP E, F, G; CL III; T5 (-50 °C ≤ T_a ≤ +85 °C); Factory Sealed; Type 4X
- I5** USA Intrinsic Safety (IS) and Nonincendive (NI)
Certificate: 3033457
Standards: FM Class 3600 – 1998,
FM Class 3610 – 2007,
FM Class 3611 – 2004, FM Class 3810 – 2005

Markings: IS CL I, DIV 1, GP A, B, C, D; CL II, DIV 1, GP E, F, G; Class III; DIV 1 when connected per Rosemount drawing 02051-1009; Class I, Zone 0; AEx ia IIC T4; NI CL 1, DIV 2, GP A, B, C, D; T4(-50 °C ≤ T_a ≤ +70 °C); Type 4x

IE USA FISCO
Certificate: 3033457
Standards: FM Class 3600 – 1998,
FM Class 3610 – 2007,
FM Class 3611 – 2004, FM Class 3810 – 2005
Markings: IS CL I, DIV 1, GP A, B, C, D when connected per Rosemount drawing 02051-1009
(-50 °C ≤ T_a ≤ +60 °C); Type 4x

E6 Canada Explosion-Proof, Dust Ignition Proof
Certificate: 2041384
Standards: CAN/CSA C22.2 No. 0-10,
CSA Std C22.2 No. 25-1966,
CSA Std C22.2 No. 30-M1986,
CAN/CSA-C22.2 No. 94-M91,
CSA Std C22.2 No.142-M1987,
CAN/CSA-C22.2 No.157-92,
CSA Std C22.2 No. 213-M1987,
CAN/CSA-E60079-0:07,
CAN/CSA-E60079-1:07,
CAN/CSA-E60079-11-02,
CAN/CSA-C22.2 No. 60529:05,
ANSI/ISA-12.27.01–2003
Markings: Explosion-Proof for Class I, Divisions 1, Groups B, C, and D. Dust-Ignition Proof for Class II and Class III, Division 1, Groups E, F, and G. Suitable for Class I, Division 2; Groups A, B, C, and D for indoor and outdoor hazardous locations. Class I Zone 1 Ex d IIC T5. Enclosure type 4X, factory sealed. Single Seal.

I6 Canada Intrinsic Safety
Certificate: 2041384
Standards: CSA Std. C22.2 No. 142 - M1987,
CSA Std. C22.2 No. 213 - M1987,
CSA Std. C22.2 No. 157 - 92,
CSA Std. C22.2 No. 213 - M1987,
ANSI/ISA 12.27.01 – 2003,
CAN/CSA-E60079-0:07,
CAN/CSA-E60079-11:02
Markings: Intrinsically safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawings 02051-1008. Temperature code T3C. Class I Zone 1 Ex ia IIC T3C. Single Seal. Enclosure Type 4X

Europe

E1 ATEX Flameproof
Certificate: KEMA 08ATEX0090X
Standards: EN60079-0:2006, EN60079-1:2007,
EN60079-26:2007
Markings:  II 1/2 G Ex d IIC T6 IP66
(-50 °C ≤ T_a ≤ +65 °C);
 II 1/2 G Ex d IIC T5 IP66
(-50 °C ≤ T_a ≤ +80 °C)

Special Conditions for Safe Use (X):

1. The Ex d blanking elements, cable glands and wiring needs to be suitable for a temperature of 90 °C.
2. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for maintenance shall be followed in detail to assure safety during its expected lifetime.
3. In case of repair, contact the manufacturer for information on the dimensions of the flameproof joints.

I1 ATEX Intrinsic Safety
Certificate: Baseefa08ATEX0129X
Standards: EN60079-0:2012, EN60079-11:2012
Markings:  II 1 G Ex ia IIC T4 Ga (-60 °C ≤ T_a ≤ +70 °C)

Table 11. Input Parameters

Parameters	HART	Fieldbus/PROFIBUS
Voltage U _i	30 V	30 V
Current I _i	200 mA	300 mA
Power P _i	1 W	1.3 W
Capacitance C _i	0.012 μF	0 μF
Inductance L _i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

IA ATEX FISCO

Certificate: Baseefa08ATEX0129X

Standards: EN60079-0:2012, EN60079-11:2012

Markings:  II 1 G Ex ia IIC T4 Ga (-60 °C ≤ T_a ≤ +60 °C)**Table 12. Input Parameters**

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	< 5 nF
Inductance L _i	< 10 μF

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

N1 ATEX Type n

Certificate: Baseefa08ATEX0130X

Standards: EN60079-0:2012, EN60079-15:2010

Markings:  II 3 G Ex nA IIC T4 Gc (-40 °C ≤ T_a ≤ +70 °C)**Special Condition for Safe Use (X):**

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V electrical strength test as defined in clause 6.5.1 of by EN 60079-15:2010. This must be taken into account during installation.

ND ATEX Dust

Certificate: Baseefa08ATEX0182X

Standards: EN60079-0:2012, EN60079-31:2009

Markings:  II 1 D Ex ta IIIC T95 °C T₅₀₀ 105 °C Da (-20 °C ≤ T_a ≤ +85 °C)**Special Condition for Safe Use (X):**

1. If the equipment is fitted with an optional 90V transient suppressor, it is incapable of withstanding the 500V isolation from earth test and this must be taken into account during installation.

International**E7** IECEx Flameproof

Certificate: IECExKEM08.0024X

Standards: IEC60079-0:2004, IEC60079-1:2007-04, IEC60079-26:2006

Markings: Ex d IIC T6/T5 IP66, T6(-50 °C ≤ T_a ≤ +65 °C), T5(-50 °C ≤ T_a ≤ +80 °C)**Table 13. Process Temperature**

Temperature class	Process temperature
T6	-50 °C to +65 °C
T5	-50 °C to +80 °C

Special Conditions for Safe Use (X):

1. The device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for maintenance shall be followed in detail to assure safety during its expected lifetime.
2. The Ex d blanking elements, cable glands, and wiring shall be suitable for a temperature of 90 °C.
3. In case of repair, contact the manufacturer for information on the dimensions of the flameproof joints.

I7 IECEx Intrinsic Safety

Certificate: IECExBAS08.0045X

Standards: IEC60079-0:2011, IEC60079-11:2011

Markings: Ex ia IIC T4 Ga (-60 °C ≤ T_a ≤ +70 °C)**Table 14. Input Parameters**

Parameters	HART	Fieldbus/PROFIBUS
Voltage U _i	30 V	30 V
Current I _i	200 mA	300 mA
Power P _i	1 W	1.3 W
Capacitance C _i	0.012 μF	0 μF
Inductance L _i	0 mH	0 mH

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

- IG** IECEx FISCO
Certificate: IECExBAS08.0045X
Standards: IEC60079-0:2011, IEC60079-11:2011
Markings: Ex ia IIC T4 Ga (-60 °C ≤ T_a ≤ +60 °C)

Table 15. Input Parameters

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	< 5 nF
Inductance L _i	< 10 μF

Special Conditions for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is incapable of withstanding the 500 V isolation from earth test and this must be taken into account during installation.
2. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however care should be taken to protect it from impact and abrasion when located in Zone 0.

- N7** IECEx Type n
Certificate: IECExBAS08.0046X
Standards: IEC60079-0:2011, IEC60079-15:2010
Markings: Ex nA IIC T4 Gc (-40 °C ≤ T_a ≤ +70 °C)

Special Condition for Safe Use (X):

1. If fitted with a 90 V transient suppressor, the equipment is not capable of withstanding the 500 V electrical strength test as defined in clause 6.5.1 of IEC60079-15:2010. This must be taken into account during installation.

Brazil

- E2** INMETRO Flameproof
Certificate: CEPEL 09.1767X, CEPEL 11.2065X, UL-BR 14.0375X
Standards: ABNT NBR IEC60079-0:2008, ABNT NBR IEC60079-1:2009, ABNT NBR IEC60079-26:2008, ABNT NBR IEC60529:2009, ABNT NBR IEC60079-0:2008 + Errata 1:2011, ABNT NBR IEC 60079-1:2009 + Errata 1:2011, ABNT NBR IEC 60079-26:2008 + Errata 1:2009
Markings: Ex d IIC T6/T5 Ga/Gb IP66, T6(-50 °C ≤ T_a ≤ +65 °C), T5(-50 °C ≤ T_a ≤ +80 °C)

Special Conditions for Safe Use (X):

1. The device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.
2. The Ex d blanking elements, cable glands, and wiring shall be suitable for a temperature of 90 °C.
3. In case of repair, contact the manufacturer for information on the dimensions of the flameproof joints.

- I2** INMETRO Intrinsic Safety
Certificate: CEPEL 09.1768X, CEPEL 11.2066X
Standards: ABNT NBR IEC60079-0:2008, ABNT NBR IEC60079-11:2009, ABNT NBR IEC60079-26: 2008, ABNT NBR IEC60529:2009
Markings: Ex ia IIC T4 Ga IP66W (-60 °C ≤ T_a ≤ +70 °C)

Table 16. Input Parameters

Parameters	HART	Fieldbus/PROFIBUS
Voltage U _i	30 V	30 V
Current I _i	200 mA	300 mA
Power P _i	1 W	1.3 W
Capacitance C _i	0.012 μF	0 μF
Inductance L _i	0 mH	0 mH

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test required by ABNT NBR IRC 60079-11:2008. This must be taken into account when installing the equipment.

- IB** INMETRO FISCO
Certificate: CEPEL 09.1768X, CEPEL 11.2066X
Standards: ABNT NBR IEC60079-0:2008, ABNT NBR IEC60079-11:2009, ABNT NBR IEC60079-26: 2008, ABNT NBR IEC60529:2009
Markings: Ex ia IIC T4 Ga IP66W (-60 °C ≤ T_a ≤ +60 °C)

Table 17. Input Parameters

Parameters	FISCO
Voltage U _i	17.5 V
Current I _i	380 mA
Power P _i	5.32 W
Capacitance C _i	< 5 nF
Inductance L _i	< 10 μF

Special Condition for Safe Use (X):

1. If the equipment is fitted with an optional 90 V transient suppressor, it is not capable of withstanding the 500 V insulation test required by ABNT NBR IRC 60079-11:2008. This must be taken into account when installing the equipment.

China**E3 China Flameproof**

Certificate: GYJ13.1386X; GYJ101321X [Flowmeters]

Standards: GB3836.1-2000, GB3836.2-2000

Markings: Ex d IIC T6/T5, T6(-50 °C ≤ T_a ≤ +65 °C),
T5(-50 °C ≤ T_a ≤ +80 °C)

Special Conditions of Use (X):

1. Symbol "X" is used to denote specific conditions of use:
 - The Ex d blanking elements, cable glands, and wiring shall be suitable for a temperature of 90°C
 - This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environment conditions to which the diaphragm will be subjected.
2. The relation between T code and ambient temperature range is:

T _a	Temperature class
-50 °C ≤ T _a ≤ +80 °C	T5
-50 °C ≤ T _a ≤ +65 °C	T6

3. The earth connection facility in the enclosure should be connected reliably.
4. During installation, use and maintenance of the product, observe the warning "Don't open the cover when the circuit is alive."
5. During installation, there should be no mixture harmful to flameproof housing
6. Cable entry and conduit, certified by NEPSI with type of protection Ex d IIC and appropriate thread form, should be applied when installed in a hazardous location. Blanking elements should be used on the redundant cable entries.
7. End users are not permitted to change any internal components, but to settle the problem in conjunction with the manufacturer to avoid damage to the product.
8. Maintenance should be done in a non-hazardous location.
9. During installation, use and maintenance of this product, observe the following standards: GB3836.13-1997, GB3836.15-2000, GB3836.16-2006, GB50257-1996

I3 China Intrinsic Safety

Certificate: GYJ12.1295X; GYJ101320X [Flowmeters]

Standards: GB3836.1-2010, GB3836.4-2010,
GB3836.20-2010

Markings: Ex ia IIC T4 Ga

Special Conditions for Safe Use (X):

1. Symbol "X" is used to denote specific conditions of use:
 - a. If the apparatus is fitted with an optional 90V transient suppressor, it is not capable of withstanding the 500V insulation test for 1 minute. This must be taken into account when installing the apparatus.
 - b. The enclosure may be made of aluminum alloy and given a protective polyurethane paint finish; however, care should be taken to protect it from impact or abrasion if located in Zone 0.
2. The relation between T code and ambient temperature range is:

Model	T code	Temperature range
HART, Fieldbus, PROFIBUS, and Low Power	T4	-60 °C ≤ T _a ≤ +70 °C
FISCO	T4	-60 °C ≤ T _a ≤ +60 °C
Flowmeter with 644 Temp Housing	T4	-40 °C ≤ T _a ≤ +60 °C

3. Intrinsically Safe parameters:

Parameters	HART	Fieldbus/ PROFIBUS	FISCO
Voltage U _i	30 V	30 V	17.5 V
Current I _i	200 mA	300 mA	380 mA
Power P _i	1 W	1.3 W	5.32 W
Capacitance C _i	0.012 μF	0 μF	0 nF
Inductance L _i	0 mH	0 mH	0 μF

Note 1: FISCO parameters comply with the

requirements for FISCO field devices in GB3836.19-2010

Note 2: [For Flowmeters] When 644 temperature transmitter is used, the 644 temperature transmitter should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of both 644 temperature transmitter and associated apparatus. The cables between 644 temperatures transmitter and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.

4. The product should be used with Ex-certified associated apparatus to establish explosion protection system that can be used in explosive gas atmospheres. Wiring and terminals should comply with the instruction manual of the product and associated apparatus.

5. The cables between this product and associated apparatus should be shielded cables (the cables must have insulated shield). The shielded cable has to be grounded reliably in a non-hazardous area.
6. End users are not permitted to change any internal components, and needs to settle the problem in conjunction with the manufacturer to avoid damage to the product.
7. During installation, use and maintenance of this product, observe the following standards:
GB3836.13-1997, GB3836.15-2000, GB3836.16-2006, GB50257-1996

Japan

- E4** Japan Flameproof
Certificate: TC20598, TC20599, TC20602, TC20603 [HART]; TC20600, TC20601, TC20604, TC20605 [Fieldbus]
Markings: Ex d IIC T5

Combinations

- K1** Combination of E1, I1, N1, and ND
K2 Combination of E2 and I2
K5 Combination of E5 and I5
K6 Combination of E6 and I6
K7 Combination of E7, I7, and N7
KB Combination of K5 and K6
KD Combination of K1, K5, and K6

Additional Certifications

- SBS** American Bureau of Shipping (ABS) Type Approval
Certificate: 09-HS446883B-3-PDA
Intended Use: Marine & Offshore Applications –
Measurement of either Gauge or Absolute Pressure for Liquid, Gas, and Vapor.
ABS Rules: 2013 Steel Vessels Rules 1-1-4/7.7, 1-1-Appendix 3, 4-8-3/1.7, 4-8-3/13.1
- SBV** Bureau Veritas (BV) Type Approval
Certificate: 23157/A2 BV
BV Rules: Bureau Veritas Rules for the Classification of Steel Ships
Application: Class notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS; Pressure transmitter type 2051 cannot be installed on diesel engines
- SDN** Det Norske Veritas (DNV) Type Approval
Certificate: A-13245
Intended Use: Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft Det Norske Veritas' Offshore Standards

Application:

Location classes	
Type	2051
Temperature	D
Humidity	B
Vibration	A
EMC	B
Enclosure	D

- SLL** Lloyds Register (LR) Type Approval
Certificate: 11/60002
Application: Environmental categories ENV1, ENV2, ENV3 and ENV5

B.5 Installation Drawings

B.5.1 Rosemount 3051SFA ProBar Flowmeter

Rosemount Drawing 03031-1019, 13 Sheets:
Factory Mutual (FM) Installation Drawing.

Rosemount Drawing 03031-1024, 9 Sheets:
Canadian Standards Association (CSA) Installation Drawing.

B.5.2 Rosemount 3051SFC_A Flowmeter

Rosemount Drawing 00405-1001, 7 sheets:
Factory Mutual (FM) Installation Drawing.

Important

Once a device labeled with multiple approval types is installed, it should not be reinstalled using any of the other labeled approval types. To ensure this, the approval label should be permanently marked to distinguish the used from the unused approval type(s).

Figure 1. FM Installation Drawing 03031-1019, Rev. AH

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY	REVISIONS				
	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AF	ADD FISCO DETAILS	RTC1021913	N.J.H.	7/9/06
	AG	ADD FISCO ENTITY PARAMETERS TO SHT 12	RTC1022876	N.J.H.	10/27/06
	AH	UPDATE FOR HART 7	RTC1051594	D.R.S.	8/22/11

ENTITY APPROVALS FOR

3051C
3051L
3051H
3051CA
3051T
3051G

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-4
 OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 5-6
 OUTPUT CODE F/W (FIELDBUS) I.S. SEE SHEETS 7-10
 ALL OUTPUT CODES NONINCENDIVE SEE SHEET 12

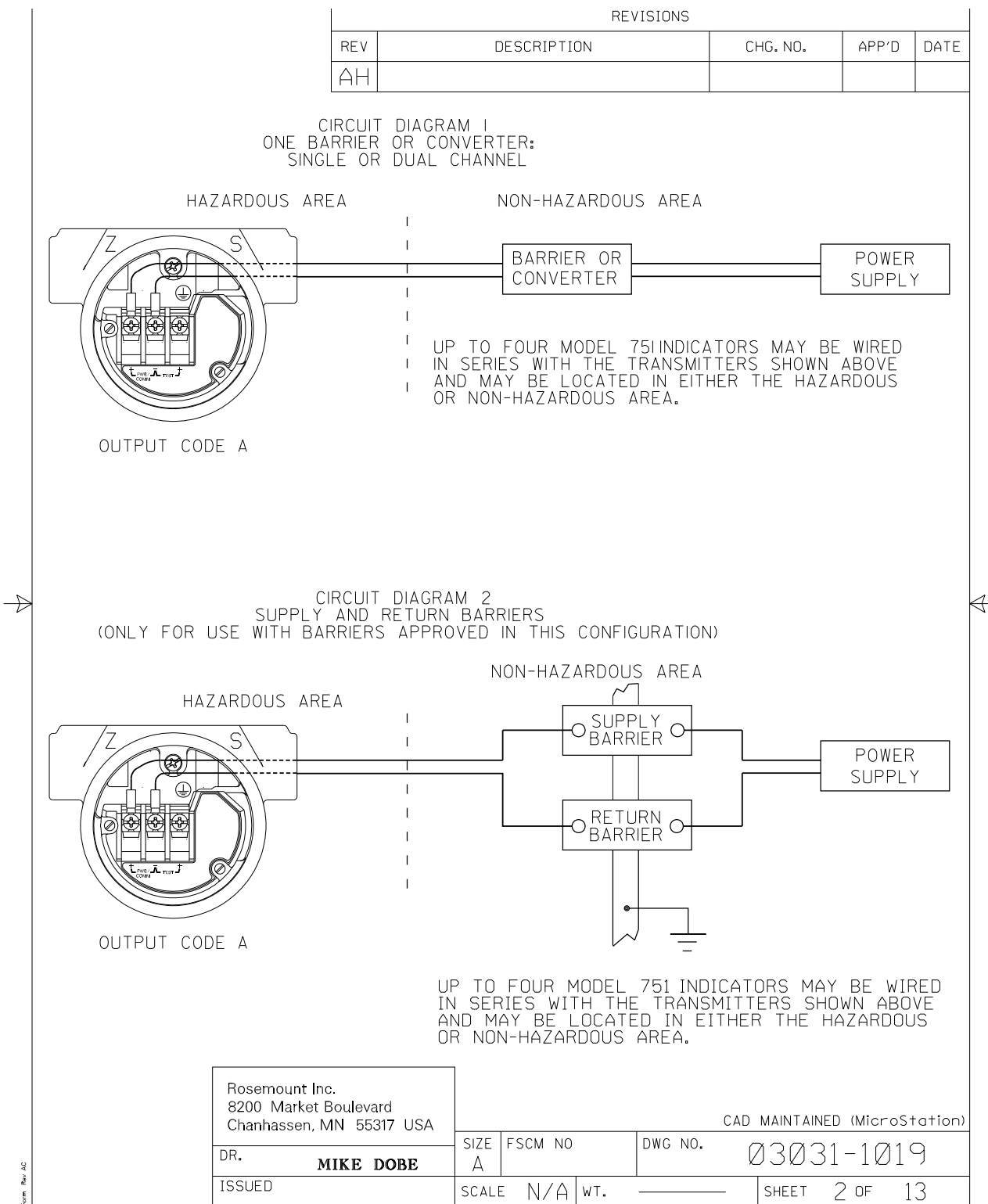
THE ROSEMOUNT TRANSMITTERS LISTED ABOVE ARE F.M. APPROVED AS
 INTRINSICALLY SAFE WHEN USED IN CIRCUIT WITH F.M. APPROVED BARRIERS
 WHICH MEET THE ENTITY PARAMETERS LISTED IN THE CLASS I, II, AND III,
 DIVISION 1 GROUPS INDICATED, TEMP CODE T4. ADDITIONALLY, THE ROSEMOUNT
 751 FIELD SIGNAL INDICATOR IS F.M. APPROVED AS INTRINSICALLY SAFE WHEN
 CONNECTED IN CIRCUIT WITH ROSEMOUNT TRANSMITTERS (FROM ABOVE) AND F.M.
 APPROVED BARRIERS WHICH MEET THE ENTITY PARAMETERS LISTED FOR
 CLASS I, II, AND III, DIVISION 1, GROUPS INDICATED, TEMP CODE T4.

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER
 MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING
 INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (mm). REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125 -TOLERANCE- .X ± .1 [2,5] .XX ± .02 [0,5] .XXX ± .010 [0,25] FRACTIONS ANGLES ± 1/32 ± 2° DO NOT SCALE PRINT	CONTRACT NO.	 ROSEMOUNT® 8200 Market Boulevard • Chanhassen, MN 55317 USA	
	DR. MIKE DOBE 03/21/89		
	CHK'D	INDEX OF I.S. & NONINCENDIVE F.M. FOR 3051C/L/P/H/T AND 3001C/S	
	APP'D. KELLY ORTH 03/22/89	SIZE A FSCM NO DWG NO. 03031-1019	
	APP'D. GOVT.	SCALE N/A WT. SHEET 1 OF 13	

Electronic Master – PRINTED COPIES ARE UNCONTROLLED – Rosemount Proprietary



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REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AH				

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (V_{OC} OR V_t) AND MAX. SHORT CIRCUIT CURRENT (I_{SC} OR I_t) AND MAX. POWER ($V_{OC} \times I_{SC}/4$) OR ($V_t \times I_t/4$), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (V_{MAX}), MAXIMUM SAFE INPUT CURRENT (I_{MAX}), AND MAXIMUM SAFE INPUT POWER (P_{MAX}) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (C_a) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (L_a) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

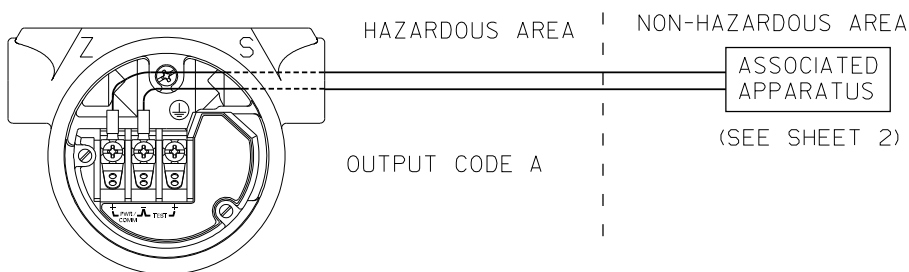
FOR OUTPUT CODE A NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

CLASS I, DIV. 1, GROUPS A AND B

$V_{MAX} = 30V$	V_t OR V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 165mA$	I_t OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_t \times I_t}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_i = .01\mu f$	C_a IS GREATER THAN $.01\mu f$
$L_i = 10\mu H$	L_a IS GREATER THAN $10\mu H$

CLASS I, DIV. 1, GROUPS C AND D

$V_{MAX} = 30V$	V_t OR V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 225mA$	I_t OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_t \times I_t}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_i = .01\mu f$	C_a IS GREATER THAN $.01\mu f$
$L_i = 10\mu H$	L_a IS GREATER THAN $10\mu H$



Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. MIKE DOBE	SIZE A	FSCM NO.	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT.	SHEET 3 OF 13

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MODEL 3051G

FOR OUTPUT CODE A

CLASS I, DIV. 1, GROUPS A AND B

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AH				

FOR OUTPUT CODE M

CLASS I, DIV. 1, GROUPS A AND B

$V_{MAX} = 30V$	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 165mA$	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 165mA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_I = .042\mu f$	C_A IS GREATER THAN $.042\mu f$
$L_I = 10\mu H$	L_A IS GREATER THAN $10\mu H$

*

FOR T1 OPTION:

$L_I = 0.75mH$	L_A IS GREATER THAN $0.75mH$
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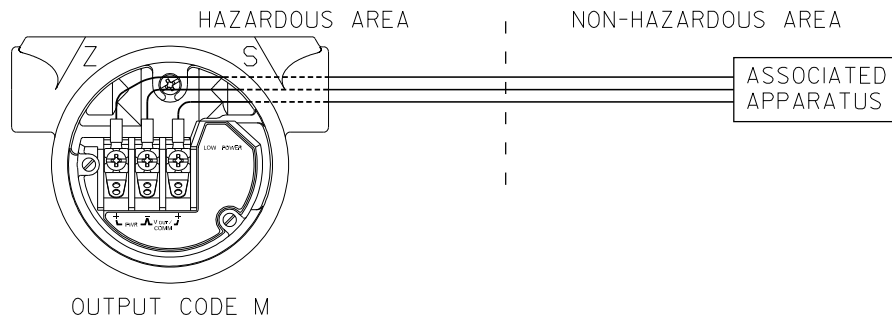
CLASS I, DIV. 1, GROUPS C AND D

$V_{MAX} = 30V$	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 225mA$	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 225mA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_I = .042\mu f$	C_A IS GREATER THAN $.042\mu f$
$L_I = 10\mu H$	L_A IS GREATER THAN $10\mu H$

*

FOR T1 OPTION:

$L_I = 0.75mH$	L_A IS GREATER THAN $0.75mH$
----------------	--------------------------------

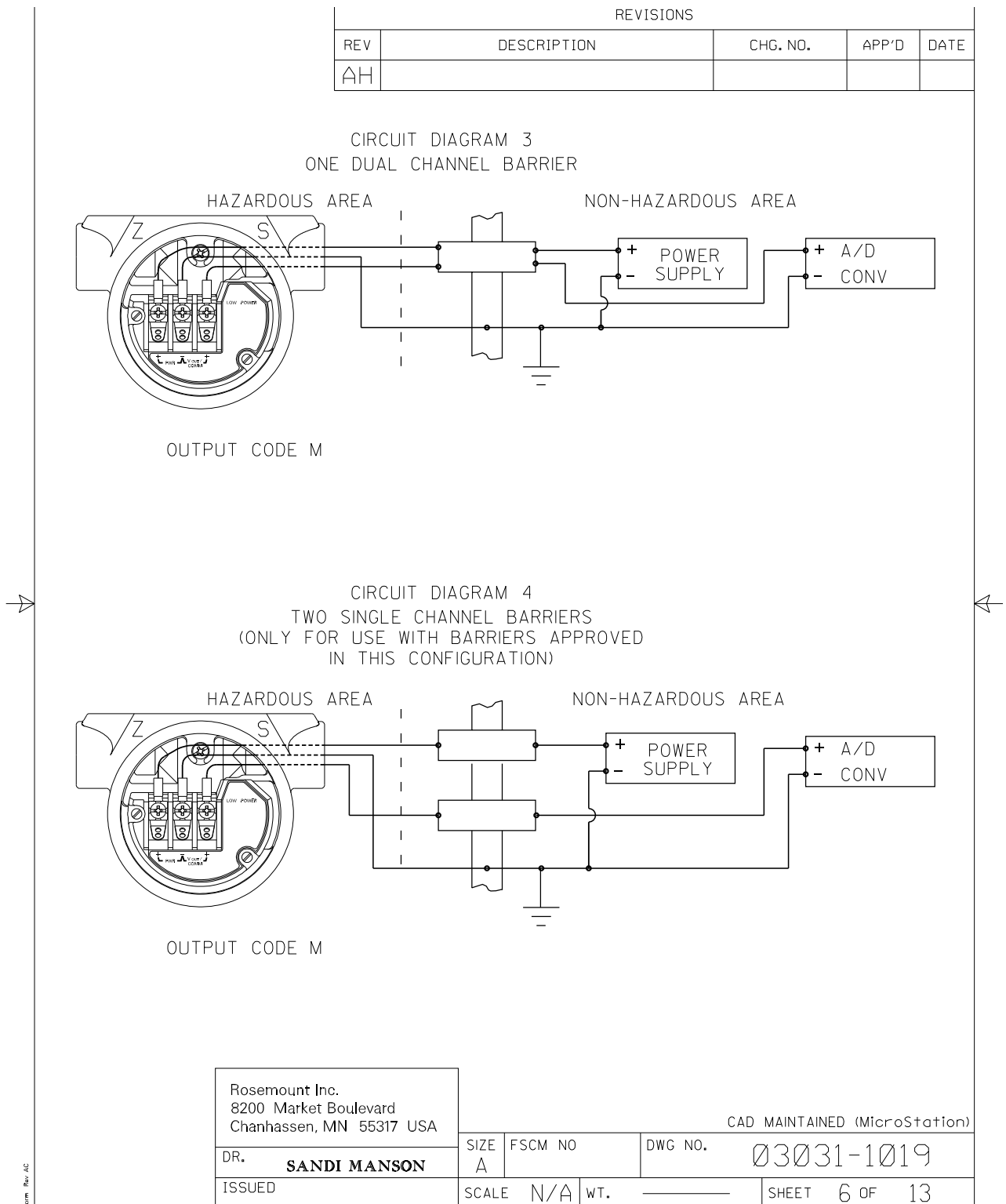


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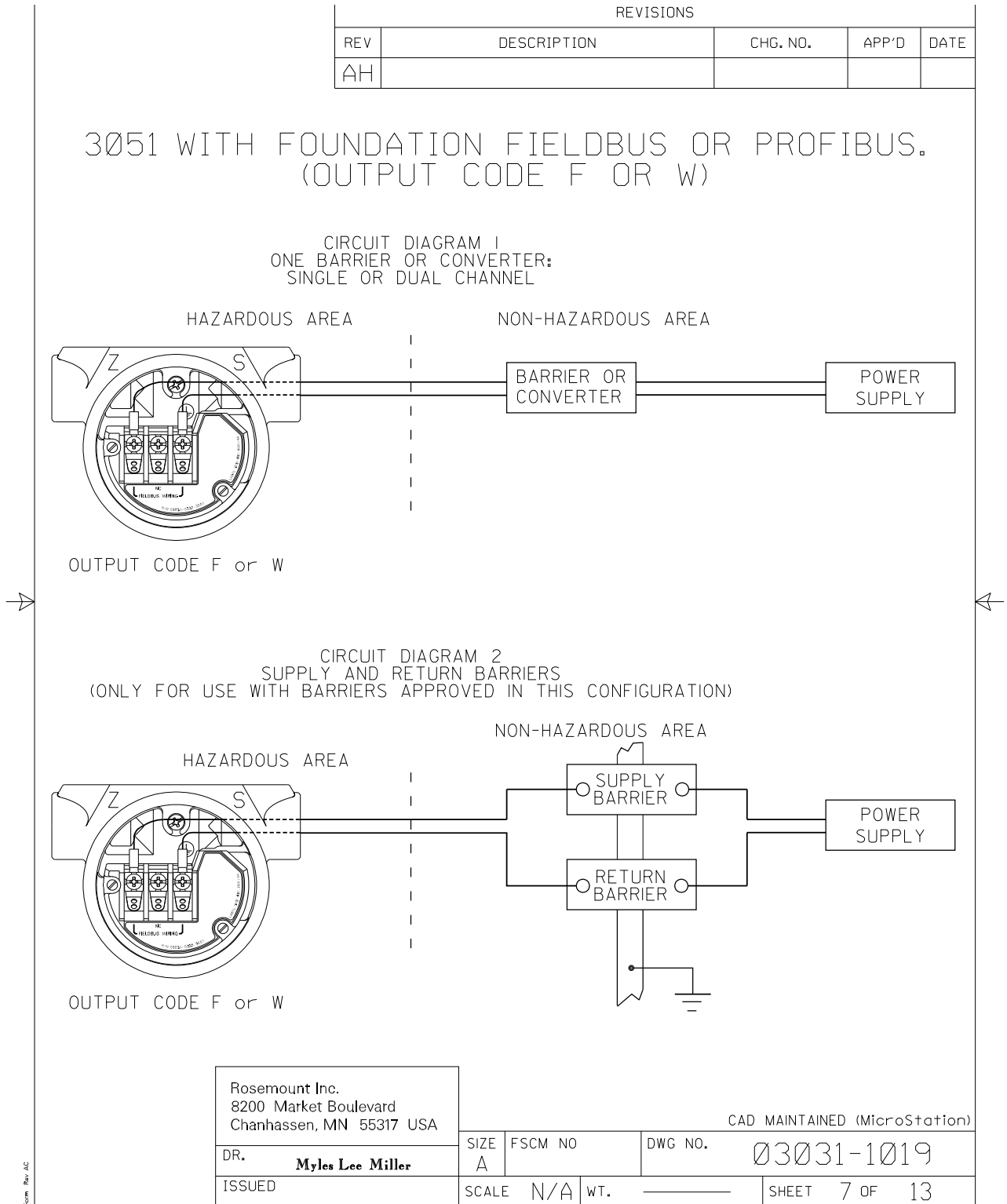
CAD MAINTAINED (MicroStation)

DR. MIKE DOBE	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. —	SHEET 5 OF 13

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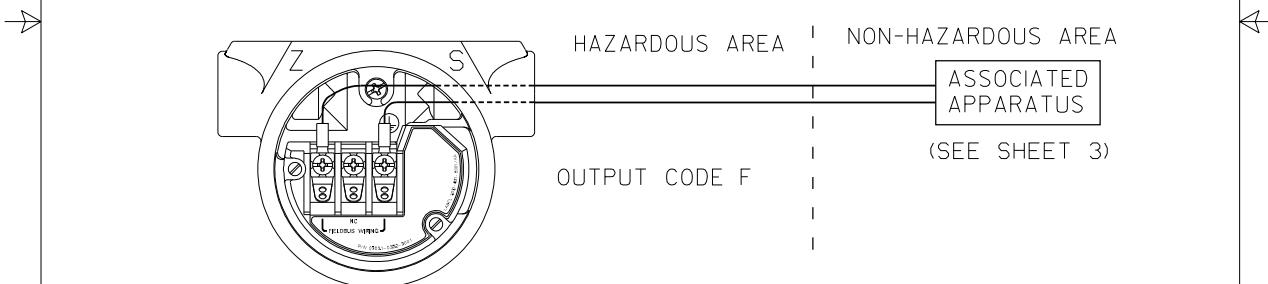
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AH				

FOR OUTPUT CODE F or W

CLASS I, DIV. 1, GROUPS A, B, C AND D

$V_{MAX} = 30V$	V_T OR V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 300mA$	I_T OR I_{SC} IS LESS THAN OR EQUAL TO 300mA
$P_{MAX} = 1.3 \text{ WATT}$	$(\frac{V_T \times I_T}{4})$ OR $(\frac{V_{OC} \times I_{SC}}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
$C_I = 0\mu f$	C_A IS GREATER THAN $0\mu f$
$L_I = 0\mu H$	L_A IS GREATER THAN $0\mu H$



Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA		CAD MAINTAINED (MicroStation)		
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO.	03031-1019
ISSUED	SCALE	N/A	WT.	—
			SHEET	8 OF 13

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AH				

FISCO CONCEPT APPROVALS

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_i or V_{max}), THE CURRENT (I_i or I_{max}), AND THE POWER (P_i or P_{ma}) THAT INTRINSICALLY SAFE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALLY SAFE, INCLUDING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (U_o , V_{oc} , or V_t), THE CURRENT (I_o , I_{sc} , or I_t), AND THE POWER (P_o or P_{max}) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. ALSO, THE MAXIMUM UNPROTECTED CAPACITANCE (C_i) AND THE INDUCTANCE (L_i) OF EACH APPARATUS (BESIDES THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO $5nF$ AND $10\mu H$ RESPECTIVELY.

ONLY ONE ACTIVE DEVICE IN EACH SECTION (USUALLY THE ASSOCIATED APPARATUS) IS ALLOWED TO CONTRIBUTE THE DESIRED ENERGY FOR THE FIELDBUS SYSTEM. THE ASSOCIATED APPARATUS' VOLTAGE U_o (or V_{oc} or V_t) IS LIMITED TO A RANGE OF 14V TO 24 V.D.C. ALL OTHER EQUIPMENT COMBINED IN THE BUS CABLE MUST BE PASSIVE (THEY CANNOT PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF $50\mu A$ FOR EACH CONNECTED DEVICE) SEPARATELY POWERED EQUIPMENT REQUIRES A GALVANIC ISOLATION TO AFFIRM THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT WILL REMAIN PASSIVE. THE PARAMETER OF THE CABLE USED TO INTERCONNECT THE DEVICES MUST BE IN THE FOLLOWING RANGE:

LOOP RESISTANCE R' :	15...150 OHM/km
INDUCTANCE PER UNIT LENGTH L' :	$0.4...1mH/KM$
CAPACITANCE PER UNLIT LENGTH C' :	$80...200nF$

$C' = C' \text{ LINE/LINE} + 0.5C' \text{ LINE/SCREEN}$, IF BOTH LINES ARE FLOATING, OR
 $C' = C' \text{ LINE/LINE} + C' \text{ LINE/SCREEN}$, IF THE SCREEN IS CONNECTED TO ONE LINE
 TRUNK CABLE LENGTH: $\leq 1000 \text{ m}$
 SPUR CABLE LENGTH: $\leq 30 \text{ m}$
 SPLICE LENGTH: $\leq 1 \text{ m}$

AN APPROVED INFALLIBLE LINE TERMINATION TO EACH END OF THE TRUNK CABLE, WITH THE FOLLOWING PARAMETERS IS APPROPRIATE:

$R = 90...100 \text{ OHMS}$	$C = 2.2\mu F$
-----------------------------	----------------

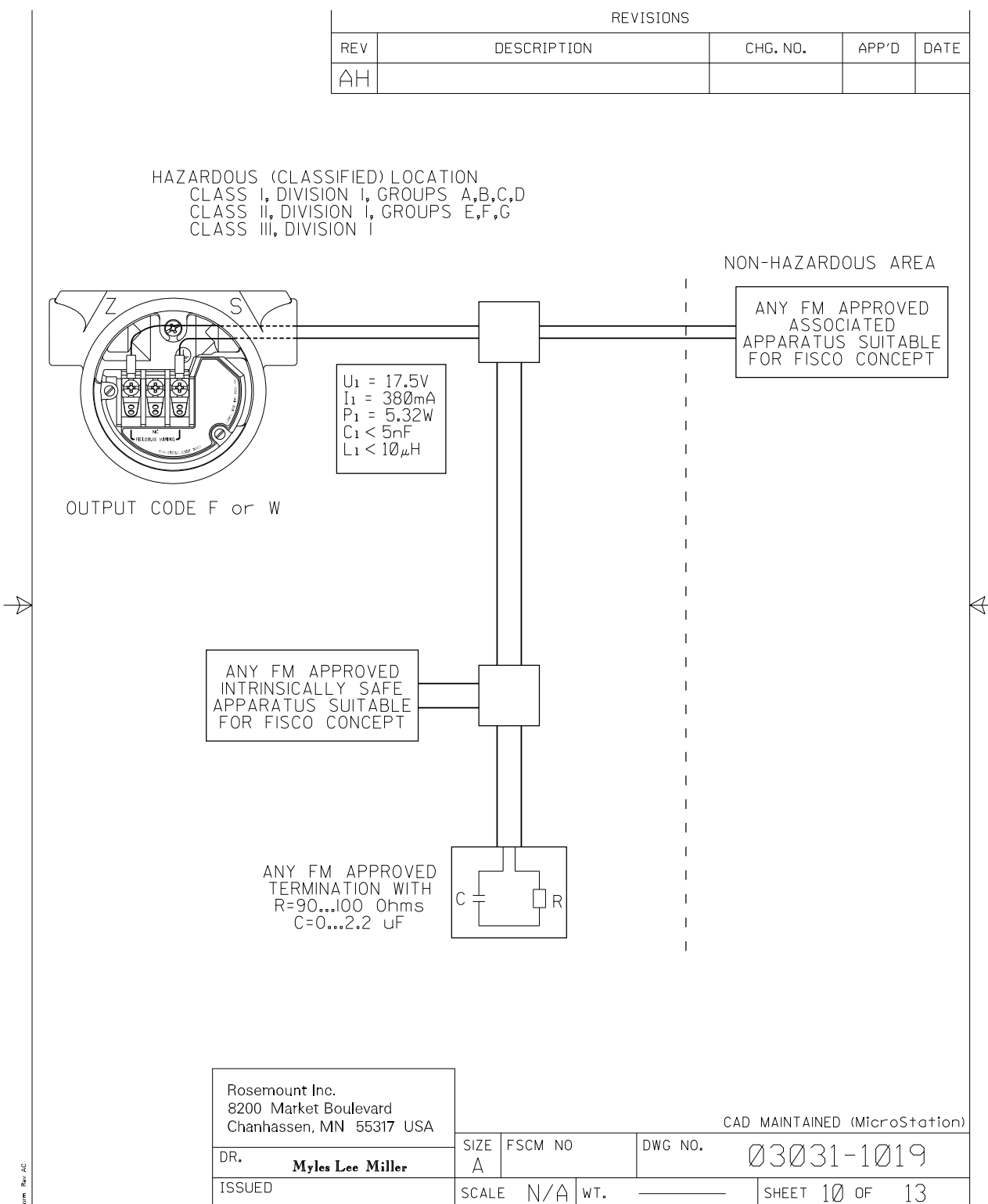
AN ALLOWED TERMINATION MIGHT ALREADY BE LINKED IN THE ASSOCIATED APPARATUS. DUE TO I.S. REASONS, THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED. IF THE RULES ABOVE ARE FOLLOWED, UP TO A TOTAL LENGTH OF 1000 m (THE SUMMATION OF TRUNK AND ALL SPUR CABLES), THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT DAMAGE THE INTRINSIC SAFETY OF THE SYSTEM.

NOTES:
INTRINSICALLY SAFE CLASS I, DIV. 1, GROUPS A, B, C, D

1. THE MAXIMUM NON-HAZARDOUS AREA VOLTAGE MUST NOT EXCEED 250 V.
2. CAUTION: ONLY USE SUPPLY WIRES SUITABLE FOR $5^\circ C$ ABOVE SURROUNDING TEMPERATURE.
3. WARNING: REPLACEMENT OF COMPONENTS MAY DAMAGE INTRINSIC SAFETY.

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DR.	Myles Lee Miller	SIZE A	FSCM NO. DWG NO. 03031-1019
ISSUED		SCALE N/A	WT. SHEET 9 OF 13

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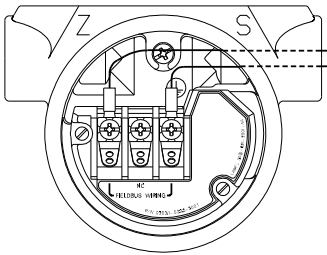


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ROSEMOUNT INC. MODEL 3051 PRESSURE TRANSMITTER FRMC DIV 2 INSTALLATION OPTIONS

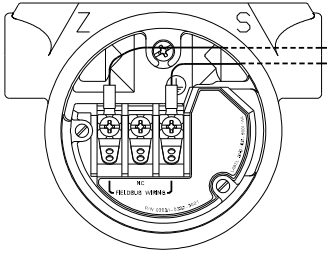
CLASS I, DIV. 2 HAZARDOUS (CLASSIFIED)
LOCATION SUITABLE FOR CLASS II, III, DIV. 2



UNCLASSIFIED
LOCATION

UNSPECIFIED
EQUIPMENT

MECHANICALLY
PROTECTED
WIRE PER NEC



FRMC APPROVED
ASSOCIATED
NONINCENDIVE
APPARATUS [3]

NOTES:
FRMC DIV. 2 INSTALLATION OPTIONS

[3] ASSOCIATED NONINCENDIVE APPARATUS
PARAMETERS LIMITS

$V_{oc} \text{ OR } V_T \leq V_{MAX}$

$C_A \geq C_{CABLE} + C_1$

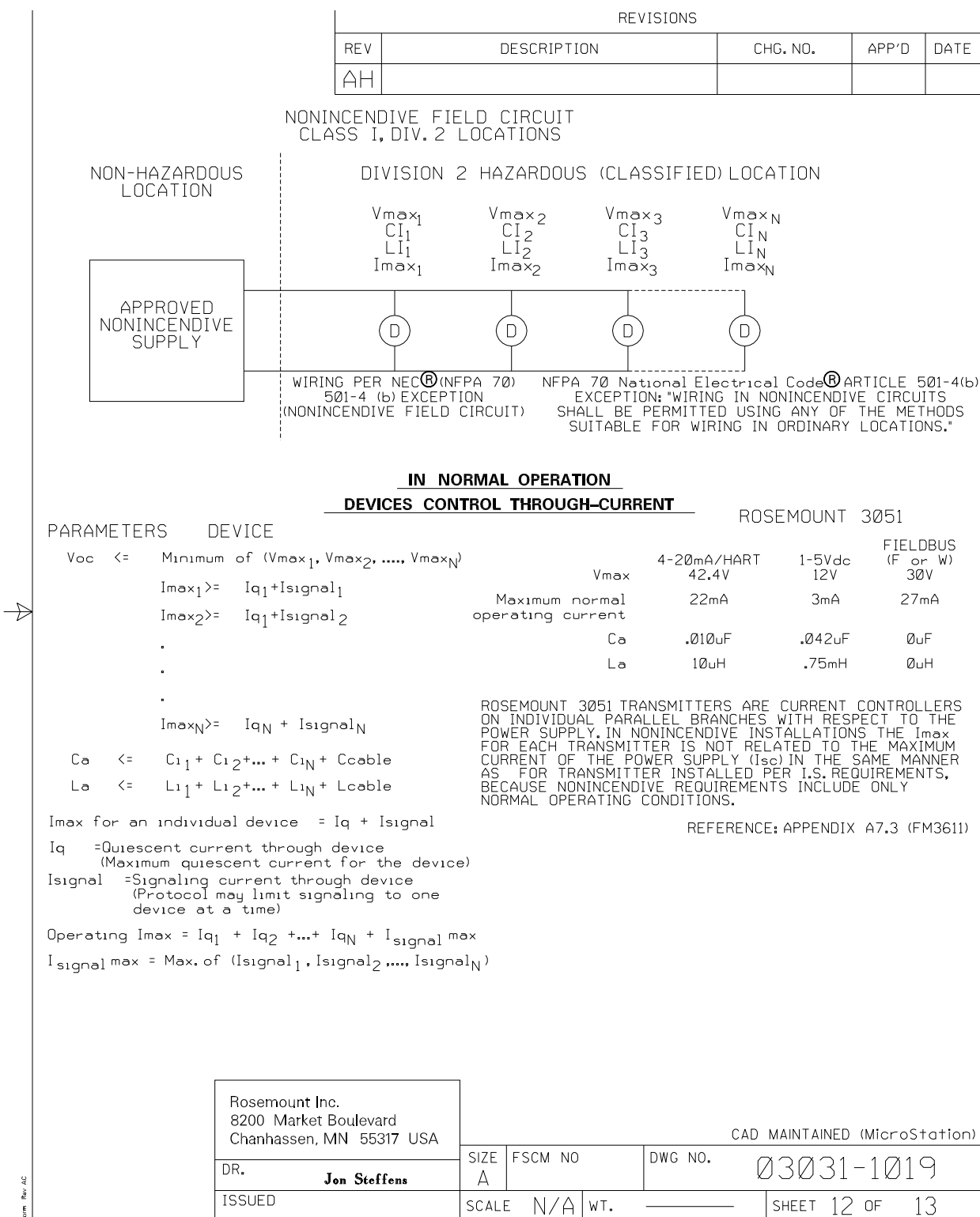
$L_A \geq L_{CABLE} + L_1$

[8] MUST BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE
FOR WIRING IN DIVISION 2 HAZARDOUS (CLASSIFIED) LOCATIONS.

[9] DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED
IN CLASS II AND CLASS III ENVIRONMENTS.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA		CAD MAINTAINED (MicroStation)	
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1019
ISSUED	SCALE N/A	WT. —	SHEET 11 OF 13

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GENERAL NOTES:

1. NO REVISION TO THIS DRAWING WITHOUT PRIOR FACTORY MUTUAL APPROVAL.
2. ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
3. DUST-TIGHT CONDUIT SEAL MUST BE USED WHEN INSTALLED IN CLASS II AND CLASS III ENVIRONMENTS.
4. CONTROL EQUIPMENT CONNECTED TO BARRIER MUST NOT USE OR GENERATE MORE THAN 250 Vrms or Vdc.
5. RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN 1 OHM.
6. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA-RP12.6 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70).
7. THE ASSOCIATED APPARATUS MUST BE FACTORY MUTUAL APPROVED.
8. WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC AND NON-INCENDIVE SAFETY.
9. ASSOCIATED APPARATUS MUST MEET THE FOLLOWING PARAMETERS:
 U_o or V_{oc} or V_t LESS THAN or EQUAL TO U_i (V_{max})
 I_o or I_{sc} or I_t LESS THAN or EQUAL TO I_1 (I_{max})
 P_o or P_{max} LESS THAN or EQUAL TO P_1 (P_{max})
 C_a IS GREATER THAN or EQUAL THE SUM OF ALL C_1 's PLUS C_{cable}
 L_a IS GREATER THAN or EQUAL THE SUM OF ALL L_1 's PLUS L_{cable}
10. WARNING - TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING.
11. THE ASSOCIATED APPARATUS MUST BE A RESISTIVELY LIMITED SINGLE OR MULTIPLE CHANNEL FM APPROVED BARRIER HAVING PARAMETERS LESS THAN THOSE QUOTED, AND FOR WHICH THE OUTPUT AND THE COMBINATIONS OF OUTPUTS IS NON-IGNITION CAPABLE FOR THE CLASS, DIVISION AND GROUP OF USE.
12. FIELD WIRING SHOULD BE RATED TO 70°C MINIMUM.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA	
DR. Myles Lee Miller	SIZE A
ISSUED	SCALE N/A

CAD MAINTAINED (MicroStation)	
FSCM NO	DWG NO. 03031-1019
WT.	SHEET 13 OF 13

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Figure 2. CSA Installation Drawing 03031-1024, Rev. AF



CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY	REVISIONS				
	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	AD	ADD FISCO FIELD BUS	RTC1012624	J.P.W.	4/4/02
	AE	UPDATE FOR HART 7	RTC1052064	D.R.S.	10/5/11
	AF	ADD 3051G	RTC1058799	J.H.	1/9/14

APPROVALS FOR

3051C
3051L
3051H
3051CA
3051T
3051G

OUTPUT CODE A (4-20 mA HART) I.S. SEE SHEETS 2-3
 OUTPUT CODE M (LOW POWER) I.S. SEE SHEETS 3-4
 OUTPUT CODE F/W (FIELD BUS) I.S. SEE SHEETS 5-7
 OUTPUT CODES A,F,M,W I.S. ENTITY PARAMETERS SHEET 8-9

TO ASSURE AN INTRINSICALLY SAFE SYSTEM, THE TRANSMITTER AND BARRIER
 MUST BE WIRED IN ACCORDANCE WITH THE BARRIER MANUFACTURER'S FIELD WIRING
 INSTRUCTIONS AND THE APPLICABLE CIRCUIT DIAGRAM.

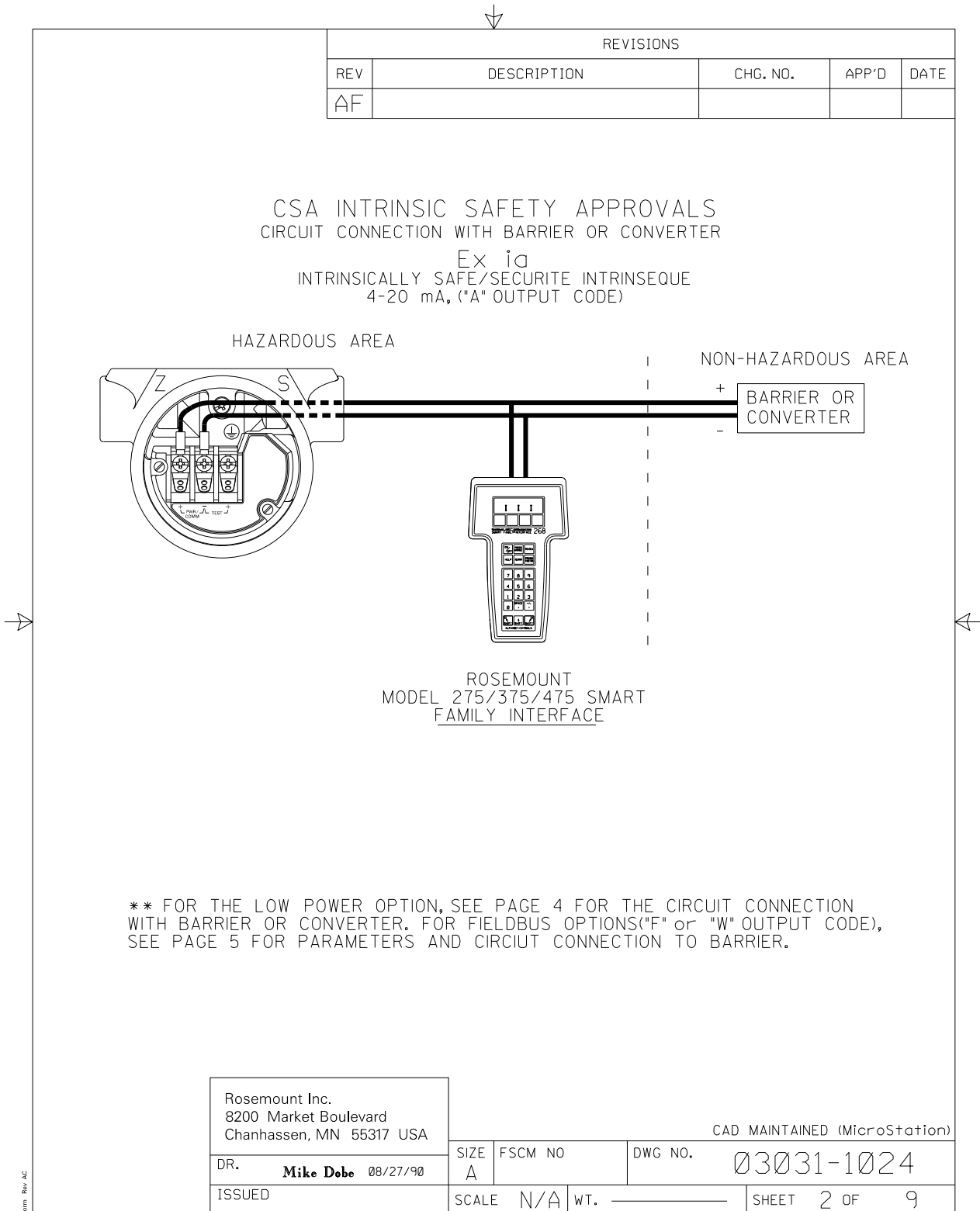
WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS
 MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS
 PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS
 DE CLASSE I, DIVISION 2.

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (mm). REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125 -TOLERANCE- .X ± .1 [2,5] .XX ± .02 [0,5] .XXX ± .010 [0,25] FRACTIONS ANGLES ± 1/32 ± 2° DO NOT SCALE PRINT	CONTRACT NO.	 ROSEMOUNT® 8200 Market Boulevard • Chanhassen, MN 55317 USA	
	DR. Mike Dobe 08/27/90		
	CHK'D	INDEX OF I.S. CSA FOR 3151C/L/H/T/G	
	APP'D. GLEN MONZO 8/31/90	SIZE FSCM NO DWG NO.	
	APP'D. GOVT.	A N/A WT. SHEET 1 OF 9	

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REVISIONS				
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AF				

4-20 mA, ("A" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	30 V OR LESS	GROUPS A, B, C, D
	* 330 OHMS OR MORE	
	* 28 V OR LESS	
	* 300 OHMS OR MORE	
	25 V OR LESS	
FOXBORO CONVERTER 2AI-I2V-CGB, 2AI-I3V-CGB, 2AS-I3I-CGB, 3A2-I2D-CGB, 3A2-I3D-CGB, 3AD-I3I-CGB, 3A4-I2D-CGB, 2AS-I2I-CGB, 3F4-I2DA	200 OHMS OR MORE	GROUPS B, C, D
	* 22 V OR LESS	
	180 OHMS OR MORE	
CSA APPROVED SAFETY BARRIER	30 V OR LESS 150 OHMS OR MORE	GROUPS C, D

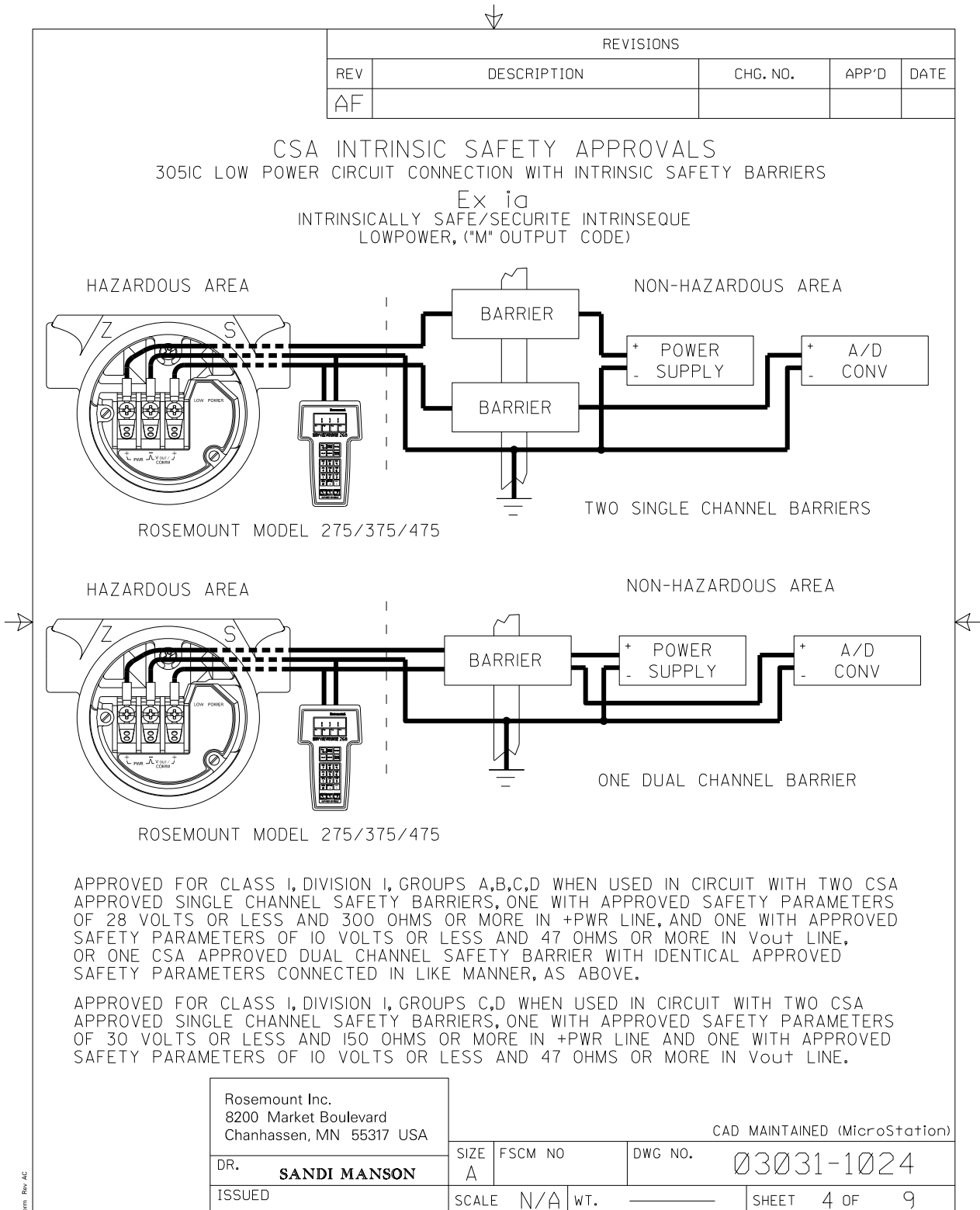
LOW POWER, ("M" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV.I
CSA APPROVED SAFETY BARRIER	Supply $\leq 28V, \geq 300 \Omega$ Return $\leq 10V, \geq 47 \Omega$	GROUPS A, B, C, D
	Supply $\leq 30V, \geq 150 \Omega$ Return $\leq 10V, \geq 47 \Omega$	
		GROUPS C, D

* MAY BE USED WITH ROSEMOUNT MODEL 275/375/475
SMART FAMILY INTERFACE.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA		CAD MAINTAINED (MicroStation)	
DR. Mike Dobe	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. _____	SHEET 3 OF 9

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FIELDBUS, ("F" or "W" OUTPUT CODE)

DEVICE	PARAMETERS	APPROVED FOR CLASS I, DIV. I
CSA APPROVED SAFETY BARRIER	30 V OR LESS 300 OHMS OR MORE 28 V OR LESS 235 OHMS OR MORE 25 V OR LESS 160 OHMS OR MORE 22 V OR LESS 100 OHMS OR MORE	GROUPS A, B, C, D

CSA INTRINSIC SAFETY APPROVALS
CIRCUIT CONNECTION WITH BARRIER OR CONVERTER

Ex ia
INTRINSICALLY SAFE/SECURITE INTRINSEQUE
FIELDBUS, ("F" or "W" OUTPUT CODE)

HAZARDOUS AREA

NON-HAZARDOUS AREA

BARRIER OR
CONVERTER

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS
MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS
PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS
DE CLASSE I, DIVISION 2.

Rosemount Inc.
8200 Market Boulevard
Chanhassen, MN 55317 USA

CAD MAINTAINED (MicroStation)

DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT. ———	SHEET 5 OF 9

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AF				

FISCO CONCEPT APPROVALS

THE FISCO CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIALLY EXAMINED IN SUCH COMBINATION. FOR THIS INTERCONNECTION TO BE VALID THE VOLTAGE (U_i or V_{max}), THE CURRENT (I_i or I_{max}), AND THE POWER (P_i or P_{ma}) THAT INTRINSICALLY SAFE APPARATUS CAN RECEIVE AND REMAIN INTRINSICALLY SAFE, INCLUDING FAULTS, MUST BE EQUAL OR GREATER THAN THE VOLTAGE (U_o , V_{oc} , or V_t), THE CURRENT (I_o , I_{sc} , or I_t), AND THE POWER (P_o or P_{max}) LEVELS WHICH CAN BE DELIVERED BY THE ASSOCIATED APPARATUS, CONSIDERING FAULTS AND APPLICABLE FACTORS. ALSO, THE MAXIMUM UNPROTECTED CAPACITANCE (C_i) AND THE INDUCTANCE (L_i) OF EACH APPARATUS (BESIDES THE TERMINATION) CONNECTED TO THE FIELDBUS MUST BE LESS THAN OR EQUAL TO 5nF AND 10μH RESPECTIVELY. ONLY ONE ACTIVE DEVICE IN EACH SECTION (USUALLY THE ASSOCIATED APPARATUS) IS ALLOWED TO CONTRIBUTE THE DESIRED ENERGY FOR THE FIELDBUS SYSTEM. THE ASSOCIATED APPARATUS' VOLTAGE U_o (or V_{oc} or V_t) IS LIMITED TO A RANGE OF 14V TO 24 V.D.C. ALL OTHER EQUIPMENT COMBINED IN THE BUS CABLE MUST BE PASSIVE (THEY CANNOT PROVIDE ENERGY TO THE SYSTEM, EXCEPT A LEAKAGE CURRENT OF 50 μA FOR EACH CONNECTED DEVICE) SEPARATELY POWERED EQUIPMENT REQUIRES A GALVANIC ISOLATION TO AFFIRM THAT THE INTRINSICALLY SAFE FIELDBUS CIRCUIT WILL REMAIN PASSIVE. THE PARAMETER OF THE CABLE USED TO INTERCONNECT THE DEVICES MUST BE IN THE FOLLOWING RANGE:

LOOP RESISTANCE R': 15...150 OHM/km

INDUCTANCE PER UNIT LENGTH L': 0.4...1mH/KM

CAPACITANCE PER UNLIT LENGTH C': 80...200nF

C' = C' LINE/LINE + 0.5C' LINE/SCREEN, IF BOTH LINES ARE FLOATING, OR

C' = C' LINE/LINE + C' LINE/SCREEN, IF THE SCREEN IS CONNECTED TO ONE LINE

TRUNK CABLE LENGTH: ≤ 1000 m

SPUR CABLE LENGTH: ≤ 30 m

SPLICE LENGTH: ≤ 1 m

AN APPROVED INFALLIBLE LINE TERMINATION TO EACH END OF THE TRUNK CABLE, WITH THE FOLLOWING PARAMETERS IS APPROPRIATE:

R = 90...100 OHMS C = 2.2μF

AN ALLOWED TERMINATION MIGHT ALREADY BE LINKED IN THE ASSOCIATED APPARATUS. DUE TO I.S. REASONS, THE NUMBER OF PASSIVE APPARATUS CONNECTED TO THE BUS SEGMENT IS NOT LIMITED. IF THE RULES ABOVE ARE FOLLOWED, UP TO A TOTAL LENGTH OF 1000 m (THE SUMMATION OF TRUNK AND ALL SPUR CABLES), THE INDUCTANCE AND THE CAPACITANCE OF THE CABLE WILL NOT DAMAGE THE INTRINSIC SAFETY OF THE SYSTEM.

NOTES:

INTRINSICALLY SAFE CLASS I, DIV. 1, GROUPS A, B, C, D

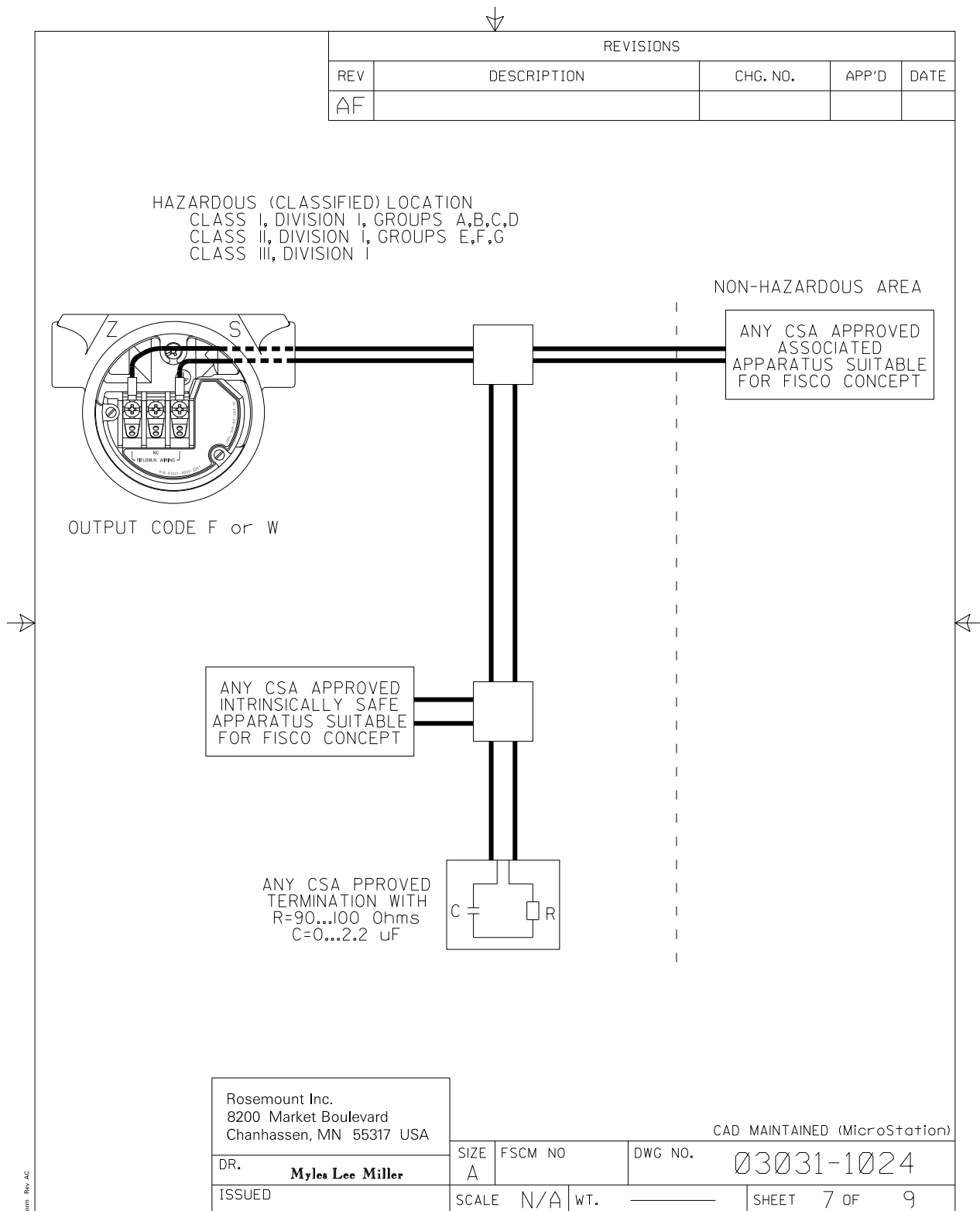
1. THE MAXIMUM NON-HAZARDOUS AREA VOLTAGE MUST NOT EXCEED 250 V.
2. CAUTION: ONLY USE SUPPLY WIRES SUITABLE FOR 5°C ABOVE SURROUNDING TEMPERATURE.
3. WARNING: REPLACEMENT OF COMPONENTS MAY DAMAGE INTRINSIC SAFETY.

Rosemount Inc. 8200 Market Boulevard Chanhausen, MN 55317 USA	
DR. Myles Lee Miller	SIZE A
ISSUED	SCALE N/A

CAD MAINTAINED (MicroStation)

FSCM NO	DWG NO. 03031-1024	
WT.	SHEET 6 OF 9	

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3051 I.S. ENTITY PARAMETERS. (OUTPUT CODE A,F,M or W)

ENTITY CONCEPT APPROVALS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM. THE APPROVED VALUES OF MAX. OPEN CIRCUIT VOLTAGE (V_{oc}) AND MAX. SHORT CIRCUIT CURRENT (I_{sc}) AND MAX. POWER ($V_{oc} \times I_{sc}/4$), FOR THE ASSOCIATED APPARATUS MUST BE LESS THAN OR EQUAL TO THE MAXIMUM SAFE INPUT VOLTAGE (V_{max}), MAXIMUM SAFE INPUT CURRENT (I_{max}), AND MAXIMUM SAFE INPUT POWER (P_{max}) OF THE INTRINSICALLY SAFE APPARATUS. IN ADDITION, THE APPROVED MAX. ALLOWABLE CONNECTED CAPACITANCE (C_a) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE CAPACITANCE AND THE UNPROTECTED INTERNAL CAPACITANCE (C_i) OF THE INTRINSICALLY SAFE APPARATUS, AND THE APPROVED MAX. ALLOWABLE CONNECTED INDUCTANCE (L_a) OF THE ASSOCIATED APPARATUS MUST BE GREATER THAN THE SUM OF THE INTERCONNECTING CABLE INDUCTANCE AND THE UNPROTECTED INTERNAL INDUCTANCE (L_i) OF THE INTRINSICALLY SAFE APPARATUS.

FOR OUTPUT CODE A

CLASS I, DIV. 1, GROUPS A, B, C AND D

$V_{MAX} = 30V$	V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 200mA$	I_{SC} IS LESS THAN OR EQUAL TO 200mA
$P_{MAX} = 1 \text{ WATT}$	$(\frac{V_{oc} \times I_{sc}}{4})$ IS LESS THAN OR EQUAL TO 1 WATT
$C_i = .01\mu f$	C_A IS GREATER THAN $.01\mu f + C \text{ CABLE}$
$L_i = 10\mu H$	L_A IS GREATER THAN $10\mu H + L \text{ CABLE}$

FOR OUTPUT CODE F or W

CLASS I, DIV. 1, GROUPS A, B, C AND D

$V_{MAX} = 30V$	V_{OC} IS LESS THAN OR EQUAL TO 30V
$I_{MAX} = 300mA$	I_{SC} IS LESS THAN OR EQUAL TO 300mA
$P_{MAX} = 1.3 \text{ WATT}$	$(\frac{V_{oc} \times I_{sc}}{4})$ IS LESS THAN OR EQUAL TO 1.3 WATT
$C_i = 0\mu f$	C_A IS GREATER THAN $0\mu f + C \text{ CABLE}$
$L_i = 0\mu H$	L_A IS GREATER THAN $0\mu H + L \text{ CABLE}$

NOTE: ENTITY PARAMETERS LISTED APPLY ONLY TO ASSOCIATED APPARATUS WITH LINEAR OUTPUT.

Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA		CAD MAINTAINED (MicroStation)	
DR. JON STEFFENS	SIZE A	FSCM NO.	DWG NO. 03031-1024
ISSUED	SCALE N/A	WT.	SHEET 8 OF 9

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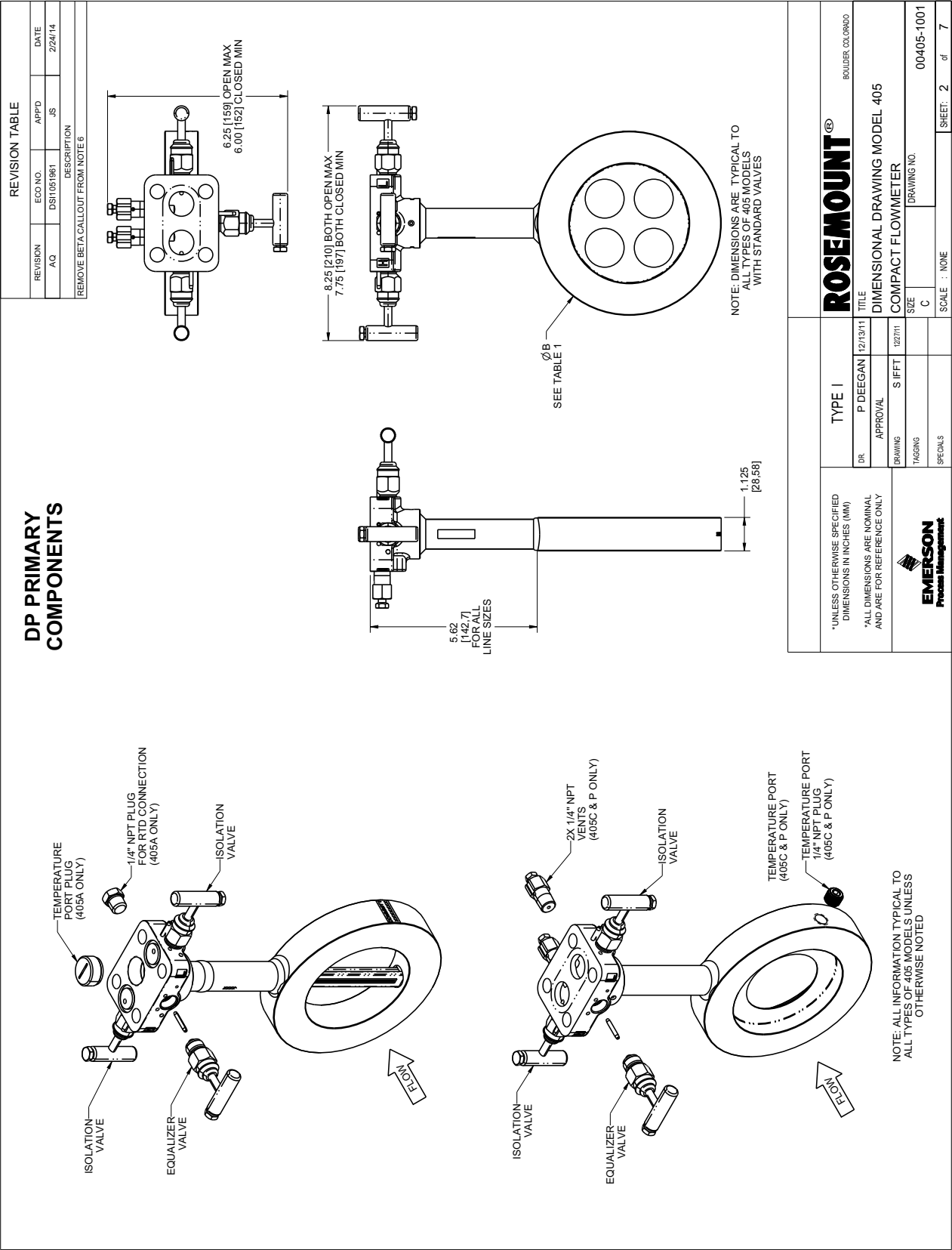
Figure 3. FM Installation Drawing 00405-1001, Rev. AQ

TABLE 1: DIMENSIONAL & FLANGE RATINGS (SEE NOTES 9 & 10)													REVISION TABLE			
FLANGE SIZE ANSI/DIN	ØB	FLANGE RATING										DESCRIPTION				
		150# ANSI	300# ANSI	600# ANSI	DIN PN16	DIN PN40	DIN PN100	JIS 10K	JIS 20K	JIS 40K	REVISION	ECONO.	APPD	DATE		
		THREAD SIZE / (QTY) / STUD LENGTH (NOTE: DIN & JIS LENGTHS GIVEN IN mm)										AQ	DS11051961	JIS	2/24/14	
												REMOVE BETA CALLOUT FROM NOTE 6				
1/2" DN15	1.38 [35]	1/2-13 (4) 4.50	1/2-13 (4) 4.75	1/2-13 (4) 5.25	M12 (4) 118	M12 (4) 130	M12 (4) 145	M12 (4) 120	M12 (4) 120	M16 (4) 140						
1" DN25	2.00 [51]	1/2-13 (4) 4.50	5/8-11 (4) 5.25	5/8-11 (4) 5.75	M12 (4) 120	M12 (4) 135	M16 (4) 165	M16 (4) 130	M16 (4) 140	M16 (4) 140						
1-1/2" DN40	2.88 [73]	1/2-13 (4) 5.00	3/4-10 (4) 5.75	3/4-10 (4) 6.50	M16 (4) 120	M16 (4) 135	M20 (4) 175	M16 (4) 130	M16 (4) 150	M20 (4) 150						
2" DN50	3.62 [92]	5/8-11 (4) 5.50	5/8-11 (8) 5.75	5/8-11 (8) 6.50	M16 (4) 140	M16 (4) 145	M24 (4) 180	M16 (4) 130	M16 (8) 150	M16 (8) 150						
3" DN60	5.00 [127]	5/8-11 (4) 5.75	3/4-10 (8) 6.50	3/4-10 (8) 7.25	M16 (8) 150	M16 (8) 165	M24 (8) 185	M16 (8) 140	M20 (8) 170	M20 (8) 170						
4" DN100	6.19 [157]	5/8-11 (8) 5.75	3/4-10 (8) 6.75	7/8-9 (8) 8.00	M16 (8) 150	M20 (8) 165	M27 (8) 200	M16 (8) 150	M20 (8) 170	M22 (8) 180						
5" DN125	7.31 [186]	3/4-10 (8) 6.50	3/4-10 (8) 7.50	1-8 (8) 9.5	M20 (8) 155	M24 (8) 185	M30 (12) 240	M20 (8) 170	M22 (8) 180	M24 (8) 190						
6" DN150	8.50 [216]	3/4-10 (8) 6.50	3/4-10 (12) 7.50	1-8 (12) 9.50	M20 (8) 155	M24 (8) 185	M30 (12) 240	M20 (8) 170	M22 (12) 180	M30 (12) 210						
8" DN200	10.62 [270]	3/4-10 (8) 6.75	7/8-9 (12) 8.25	1-1/8-7 (12) 10.25	M12 (12) 160	M27 (12) 305	M33 (12) 265	M20 (12) 170	M22 (12) 180	M30 (12) 230						
10" DN250	12.75 [324]	7/8-9 (12) 7.00	1-8 (16) 8.25	1-1/4-8 (16) 10.5	M24 (12) 170	M30 (12) 210	M36 (12) 270	M22 (12) 180	M24 (12) 200	M30 (12) 240						
12" DN300	15.00 [381]	7/8-9 (12) 7.00	1-1/8-8 (16) 9.00	1-1/4-8 (20) 11.00	M24 (12) 180	M30 (16) 240	M39 (16) 280	M22 (16) 180	M24 (16) 200	M36 (16) 260						

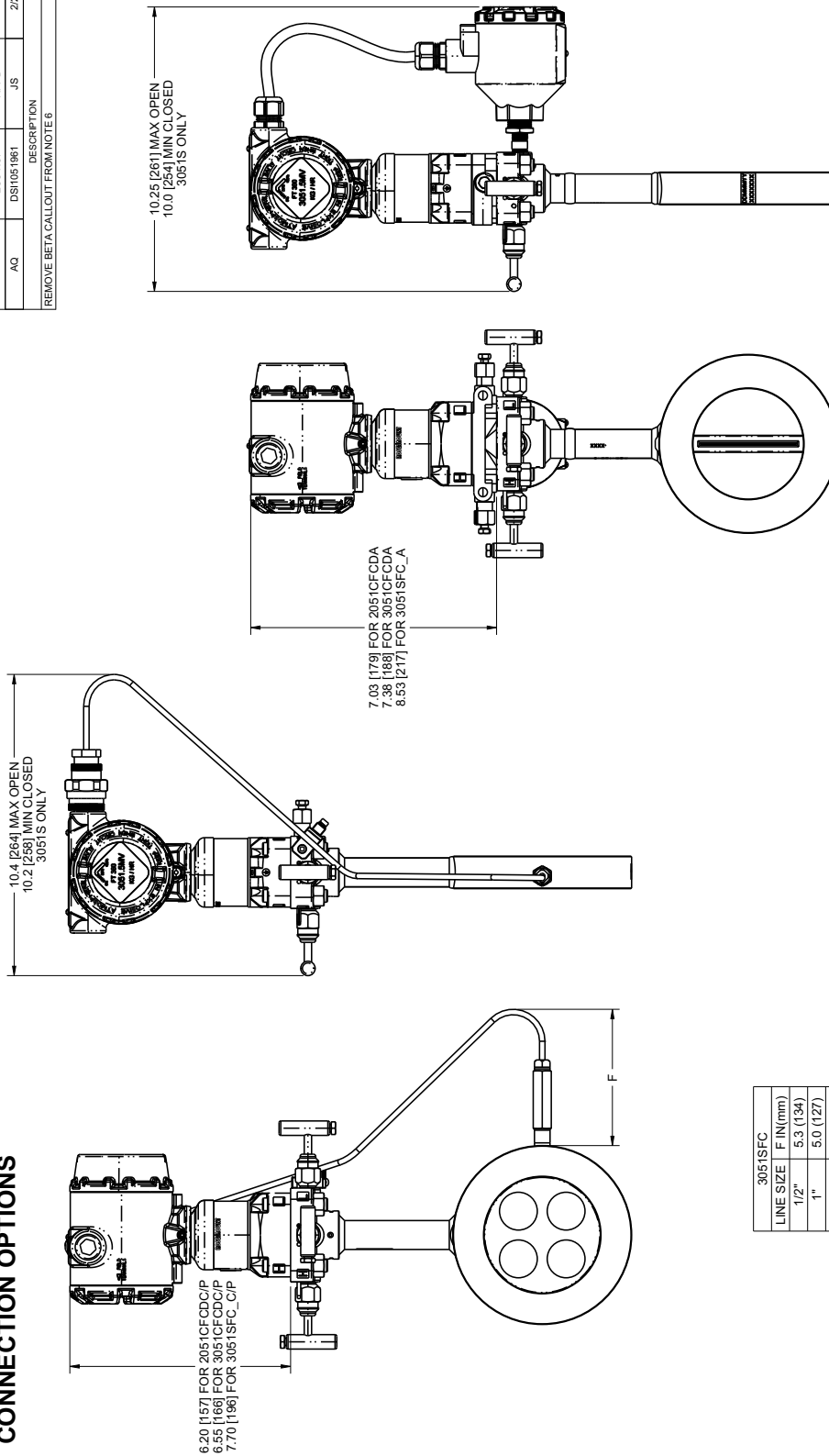
NOTES:

- ROSEMOUNT INC. CERTIFIES THIS DRAWING IS IN ACCORDANCE WITH ENGINEERING SPECIFICATIONS AND ACCURATELY REPRESENTS THE EQUIPMENT FURNISHED.
- SENSOR ORIENTATION SHOWN FOR DETAIL ONLY. FOR ACTUAL RECOMMENDED LOCATION AND ORIENTATION REFER TO INSTALLATION MANUAL 00809-0100-4810.
- FOR MODEL SELECTIONS, REFER TO ROSEMOUNT PRODUCT DATA SHEET 00813-0100-4810.
- 405 TEMPERATURE LIMITS ARE -40°F TO 450°F FOR DIRECT MOUNT 3 VALVE MANIFOLD, -148°F TO 850°F FOR REMOTE MOUNT WITH GRAPHOL VALVE PACKING.
- MATERIALS: 316/316L STAINLESS STEEL.
- ORIFICE BORE HAS SQUARE EDGE. 405C/P ONLY.
- 405 RATED TO 600# ANSI/PN100 316SSST.
- REMOTE MOUNT 3-VALVE MANIFOLD WITH ADAPTER PLATE AND 1/2" NPT FLANGE ADAPTERS. ADAPTERS CAN BE ROTATED TO GIVE CONNECTIONS CENTERS OF 2.00 (51), 2.13 (54) OR 2.25 (57).
- ASSEMBLY OF 405 TO FLANGE PIPE SECTION: ALIGNMENT RING WILL HAVE ETCHED FLANGE SIZE TO BE INDEXED WITH STUDS TO INSURE PROPER ALIGNMENT OF 405 TO PIPE ID.
- STUDS, NUTS AND GASKETS NOT INCLUDED WITH 405. CORRECT STUD SIZE PER TABLE 1 IS CRITICAL FOR PROPER ALIGNMENT. RECOMMENDED GASKET: 1/8" MAX THICKNESS WITH APPROPRIATE MATERIAL FOR APPLICATION CONDITIONS.
- FOR OPTIMUM PERFORMANCE, ORIENTATION AND FLOW DIRECTION IS AS FOLLOWS:
GAS: DIRECT MOUNT OR REMOTE MOUNT OPTIONS ARE ACCEPTABLE IN HORIZONTAL OR DOWNWARD FLOW IN A VERTICAL LINE.
LIQUID: DIRECT MOUNT OR REMOTE MOUNT OPTIONS ARE ACCEPTABLE IN A HORIZONTAL OR UPWARD FLOWING VERTICAL LINE. IT IS NOT RECOMMENDED FOR USE IN A DOWNWARD FLOWING VERTICAL LINE.
STEAM: REMOTE MOUNTING OPTION IS ACCEPTABLE IN A HORIZONTAL OR UPWARD FLOWING VERTICAL LINE. DIRECT MOUNTING OPTION IS RECOMMENDED ONLY IN A HORIZONTAL LINE. IT IS NOT RECOMMENDED FOR USE IN A DOWNWARD FLOWING LINE.
- SPECIAL CLEANING IS NOT AVAILABLE WITH HIGH TEMPERATURE OPTION ON 405C/P OR ANY 405A.

"UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (MM)		TYPE I		ROSEMOUNT®	
"ALL DIMENSIONS ARE NOMINAL AND ARE FOR REFERENCE ONLY		DR	P DEEGAN	TITLE	
		APPROVAL	S IFFT	DIMENSIONAL DRAWING MODEL 405	
		DRAWING	C	COMPACT FLOWMETER	
		TAGGING		DRAWING NO	
		SPT2ALS		00405-1001	



DIRECT MOUNT TYPE CONNECTION OPTIONS

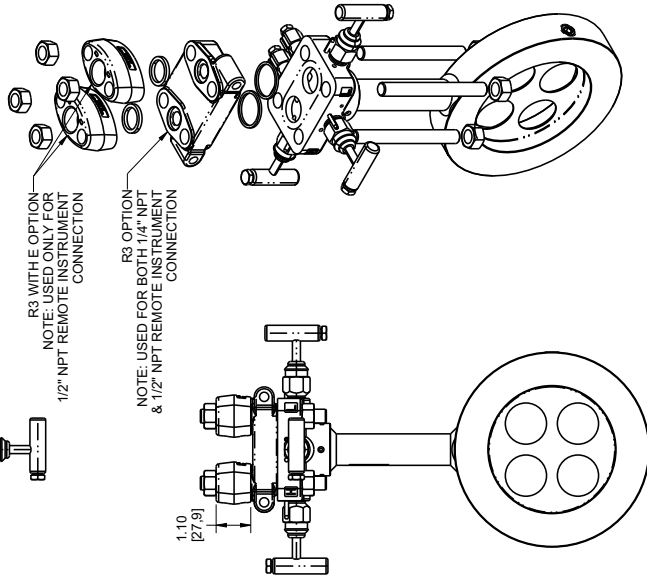
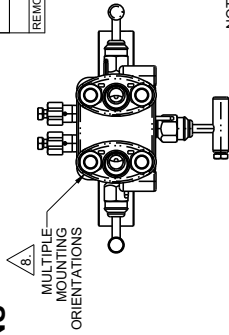
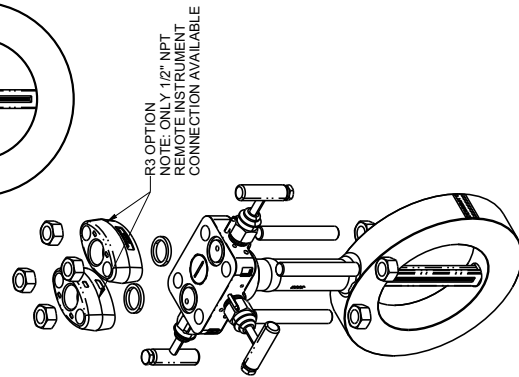
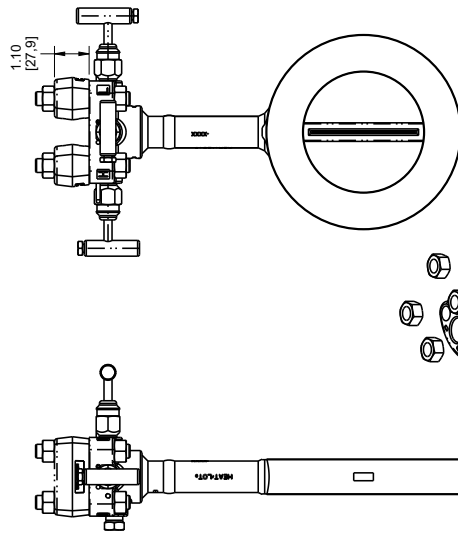
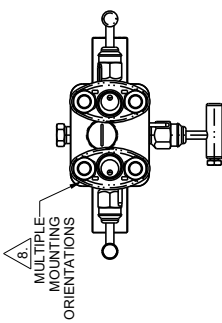


3051SFC	
LINE SIZE	F IN(mm)
1/2"	5.3 (134)
1"	5.0 (127)
1-1/2"	4.5 (115)
2"	5.9 (150)
3"	5.2 (132)
4"	4.6 (116)
5"	7.2 (184)
6"	6.7 (171)
8"	5.8 (148)
10"	6.7 (170)
12"	5.7 (144)

*UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (MM) *ALL DIMENSIONS ARE NOMINAL AND ARE FOR REFERENCE ONLY EMERSON Power Management	TYPE I			ROSEMOUNT[®]		BOULDER, COLORADO	
	DR.	P DEEGAN	12/13/11	TITLE			
	APPROVAL			DIMENSIONAL DRAWING MODEL 405			
	DRAWING		S IFFT	12/27/11			
	TAGGING		SIZE	C	DRAWING NO.		
SPECIALS			SCALE : NONE			SHEET: 3 of 7	



REMOTE MOUNT TYPE CONNECTION OPTIONS



**REMOTE MOUNT
CONNECTION TYPE
(405C/P)**

**REMOTE MOUNT
CONNECTION TYPE
(405A)**

*UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES (MM) *ALL DIMENSIONS ARE NOMINAL AND ARE FOR REFERENCE ONLY	TYPE I		ROSEMOUNT [®]		BOULDER, COLORADO
	DR	P DEEGAN	12/13/11	TITLE	
	APPROVAL			DIMENSIONAL DRAWING MODEL 405	
	DRAWING		S 1FFT	COMPACT FLOWMETER	
	TAGGING		SIZE	DRAWING NO.	00405-1001
	SPECIALS		C		
			SCALE : NONE		SHEET: 5 of 7

REVISION TABLE

REVISION	ECONO.	APPD	DATE
AQ	DS11051961	JS	2/24/14

DESCRIPTION

REMOVE BETA CALLOUT FROM NOTE 6

REMOTE MOUNT MANIFOLD TYPE
CONNECTION OPTIONS

3051S TRANSMITTER
SHOWN

305 3-VALVE
MANIFOLD

ISOLATION VALVE

ISOLATION VALVE

1/4" NPT
MANIFOLD
VENTS

1/4" NPT
MANIFOLD
VENTS

EQUALIZER
VALVE

1/2" NPT
PROCESS
CONNECTIONS

PIPE MOUNTING
CONFIGURATION

3 VALVE / PIPE MOUNT

3051S TRANSMITTER
SHOWN

305 5-VALVE
MANIFOLD

ISOLATION VALVE

ISOLATION VALVE

TEST/VENT
VALVE

TEST/VENT
VALVE

1/4" NPT VENT
CONNECTION

1/4" NPT VENT
CONNECTION

EQUALIZER
VALVE

1/2" NPT
PROCESS
CONNECTIONS

PANEL MOUNTING
CONFIGURATION

5 VALVE / PANEL MOUNT

*UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES (MM)

*ALL DIMENSIONS ARE NOMINAL
AND ARE FOR REFERENCE ONLY

TYPE I

DR. P DEEGAN 12/13/11

APPROVAL

DRAWING S IFFT 12/27/11

TAGGING

SPECIALS

ROSEMOUNT®

Boulder, CO, USA

DIMENSIONAL DRAWING MODEL 405

COMPACT FLOWMETER

DRAWING NO. 00405-1001

SCALE : NONE

SHEET: 6 of 7

FLOW METER
INSTALLATION EXAMPLE

TEMPERATURE FITTING

NOTE: ALIGNMENT RING
INSTALLS BEHIND
TEMPERATURE FITTING

ALIGNMENT
RING

STUDS
QTY VARIES

TEMPERATURE SENSOR
CLAMP (405CF ONLY)

COMPACT
FLOWMETER
(405C SHOWN)

FLOW

REVISION TABLE			
REVISION	ECONO.	APPD	DATE
AO	DS1051961	JS	2/24/14

DESCRIPTION
REMOVE BETA CALLOUT FROM NOTE 6

TYPE I		ROSEMOUNT®		BOLDED COLORADO	
DR	P DEEGAN	12/13/11	TITLE	DIMENSIONAL DRAWING MODEL 405	
APPROVAL	S IFFT	12/20/11	COMPACT FLOWMETER	DRAWING NO.	
DRAWING	TAGGING	SPECIALS	SCALE	7	7
			00405-1001		

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