

Rosemount Compact Orifice Flowmeter Series



ROSEMOUNT®

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EMERSON™
Process Management

Rosemount Compact Orifice 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

⚠ 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 Emerson Process Management 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.

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Section 1 Introduction

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TRANSMITTER INFORMATION

If the 405 primary element was ordered assembled to a Rosemount 3051S transmitter, the new assembly is the Rosemount 3051SFC Compact Orifice Flowmeter. See the Rosemount 3051S Series Pressure Transmitter reference manual (document number 00809-0100-4801) for information regarding transmitter installation, configuration, and operation.

If the 405 primary element was ordered assembled to a Rosemount 3095M transmitter, the new assembly is the Rosemount 3095MFC Compact Orifice Mass Flowmeter. See the Rosemount 3095M Mass Flow Transmitter reference manual (document number 00809-0100-4801) for information regarding transmitter installation, configuration, and operation.

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 model number, serial number, and customer tag number. Report any damage to the carrier.

RETURNING THE PRODUCT

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.

CONSIDERATIONS

Functional

The Rosemount 405 produces the most accurate and repeatable measurement when it is used in single-phase flow or steam flow above the saturation temperature. Location of the 405 in pulsating flow will cause a noisy signal. Vibration can also distort the output signal and compromise the structural limits of the flowmeter.

Mount the 405 in a secure run of pipe as far as possible from pulsation sources such as check valves, reciprocating compressors or pumps, and control valves.

Install the 405 in the correct location within the piping branch to prevent measurement inaccuracies caused by flow disturbances.

Maximum temperature for direct mount applications is 450 °F (232 °C). Maximum temperature for remote mount applications is 850 °F (454 °C).

Vibration Limits

Qualified per IEC61298-3 (1998) for field with high vibration level or pipeline with high vibration level (10-60Hz 0.21mm displacement peak amplitude / 60 - 500Hz 3g).

The weight and length of the transmitter assembly shall not exceed 5.8 lbs and 7.75-in.

Section 2 Installation

Safety Messages	page 2-1
Installation	page 2-1
Location and Orientation	page 2-4

SAFETY MESSAGES

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

⚠️WARNING

Explosions could result in death or serious injury:

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

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

- Make sure only qualified personnel perform the installation.

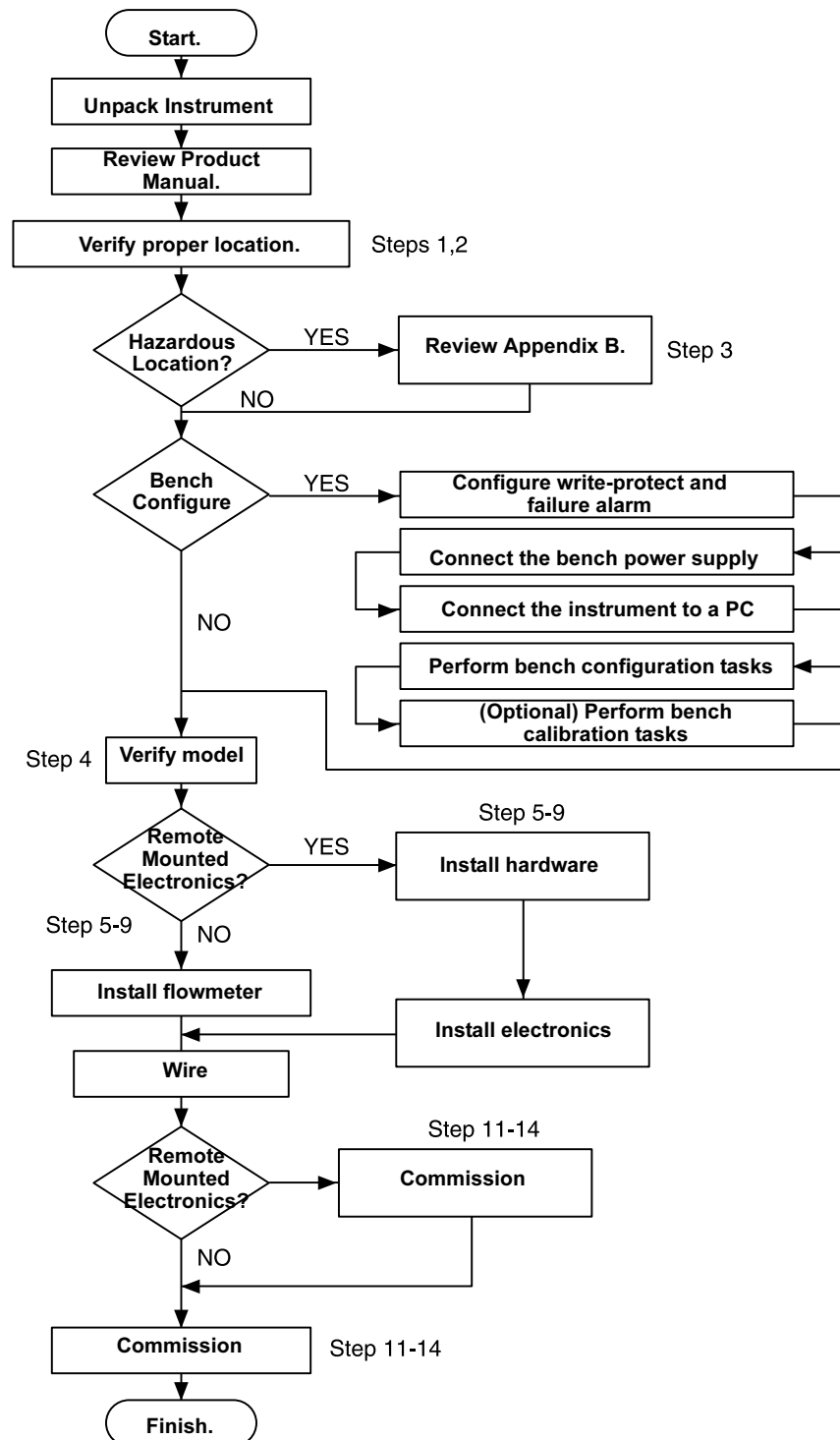
The product may be hot while in service, potentially causing burns. Handle with care.

INSTALLATION

Flowchart

Installation Chart page 2-2 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 2-1. Installation Chart



Handling

The product tag is not designed to withstand the weight of the orifice - do not lift the product by the tag.

Do not lift the product by the orifice holes. Holes have sharp edges that may cause personal injury. Lift the product by the casting neck.

Straight Run Requirements

Table 2-1. 405C Straight Pipe Requirements

Upstream (inlet) side of primary	Beta ⁽¹⁾	0.40	0.65
	Single 90° bend or tee	2	2
	Two or more 90 ° bends in the same plane	2	2
	Two or more 90° bends in different plane	2	2
	Up to 10° of swirl		
	Reducer (1 line size)	2	2
	Butterfly valve (75% open)	2	N/A
	Downstream (outlet) side of primary	2	2

Table 2-2. 405P Straight Pipe Requirements

Upstream (inlet) side of primary	Beta ^{(1) (2) (3)}	0.40	0.65
	Reducer	5	12
	Single 90° bend or tee	16	44
	Two or more 90 ° bends in the same plane	10	44
	Two or more 90° bends in different plane	50	60
	Expander	12	28
	Ball / Gate valve fully open	12	18
		6	7

(1) Consult an Emerson Process Management representative if disturbance is not listed.

(2) Recommended lengths represented in pipe diameters per ISO 5167.

(3) Refer to ISO 5167 for recommended lengths when using flow straighteners.

Bolting a transmitter to the Rosemount 405

If the 405 is ordered separately from the 3051, or 3095M transmitter and will be used in a direct mount configuration, it will need to be assembled to the transmitter. Follow the directions below to assemble the 405 to a transmitter with a coplanar configuration.

NOTE

Units shipped from the factory direct mounted are pressure tested and characterized with the primary attached. Factory assembly is recommended for best performance.



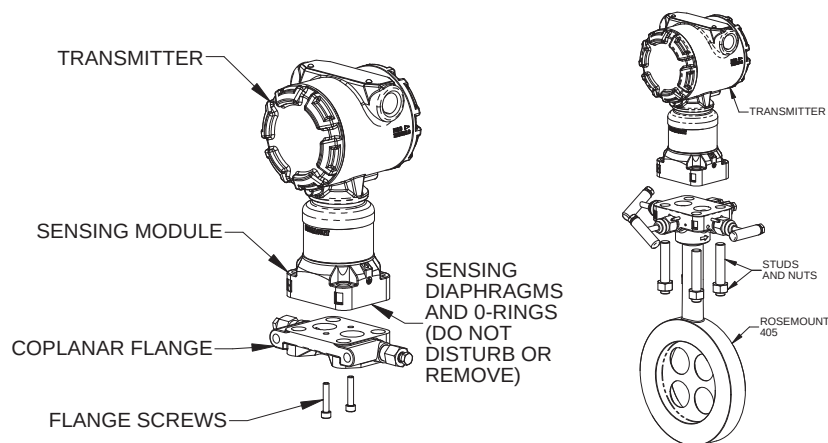
1. Remove the body bolts (4) from the transmitter.
2. Remove the socket head cap screws from the bottom of the coplanar flange and remove the coplanar flange.

NOTE

Protect the transmitter sensing diaphragms and do not remove the o-rings in transmitter sensor module.

3. Carefully assemble the 405 to the pressure transmitter sensor making sure the "H" and "L" on transmitter and primary match.
4. Use studs and nuts supplied with the 405 to connect the transmitter sensor to the manifold head of the 405.
5. Preload to 150 lbs/in. then final torque at 300 lbs/in.

Figure 2-2. Bolting the 405
to a transmitter



LOCATION AND ORIENTATION

The 405 has two mounting methods:

- integral mount (or direct mount)
- remote mount.

An integrally mounted 405 may be shipped with the transmitter already bolted directly to the sensor.

Direct Mount Installation

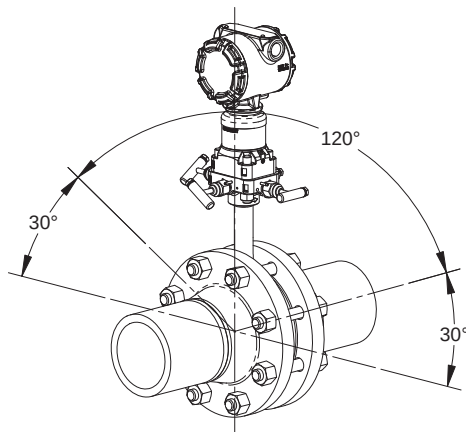
NOTE

The maximum acceptable temperature for direct mounting is 450 °F (232 C°). Refer to "Location and Orientation" beginning on page 2-4 if the process could potentially exceed this temperature.

⚠ Gas in Horizontal Pipes

The 405 should be mounted above the pipe to ensure that condensate does not collect on the transmitter sensing diaphragms. Orient the unit within the 120° recommended zone as shown in Figure 2-3.

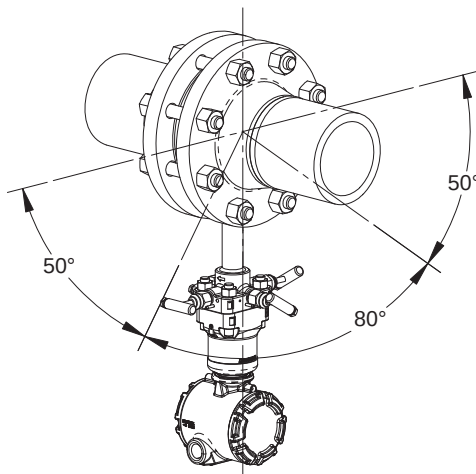
Figure 2-3. Direct Mount Gas in
Horizontal Pipes



⚠ Liquid or Steam in Horizontal Pipes

The 405 should be mounted below the pipe to ensure that gases do not collect on the transmitter sensing diaphragms. Orient the unit within the 80° recommended zone as shown in Figure 2-4.

Figure 2-4. Direct Mount Liquid or Steam in Horizontal Pipes



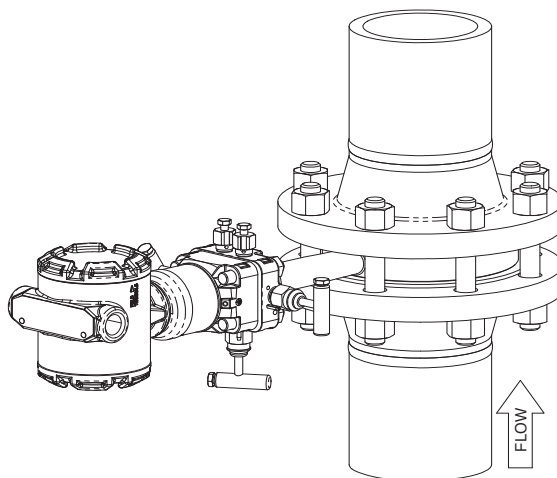
⚠ Liquid in Vertical Pipes

The 405 should be mounted with the vents on top to allow gas to be bled off.

NOTE

The 405 should not be used in vertical liquid or steam applications if the fluid is flowing down.

Figure 2-5. Direct Mount Liquid in Vertical Pipes



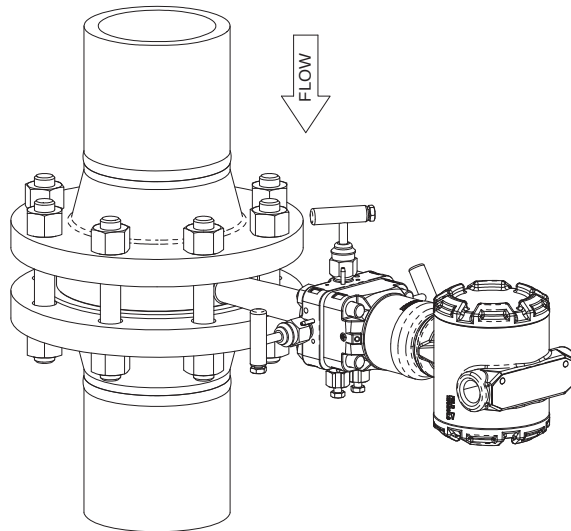
⚠ Gas in Vertical Pipes

The 405 should be mounted with vents on bottom to allow condensate drainage.

NOTE

Due to drain vent orientation, a direct mount 405 should not be used in vertical gas applications if the fluid is flowing up. Consider remote mounting the pressure transmitter to facilitate condensate draining.

Figure 2-6. Direct Mount Gas in Vertical Pipes

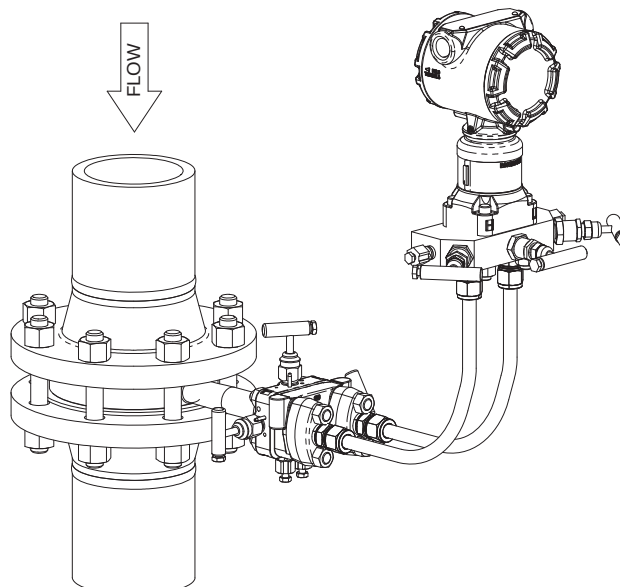


Remote Mount Installation

⚠ Gas in Vertical or Horizontal Pipes

Mount the transmitter above the 405 with the instrument lines sloping down.

Figure 2-7. Remote Mount Gas in Vertical or Horizontal Pipes



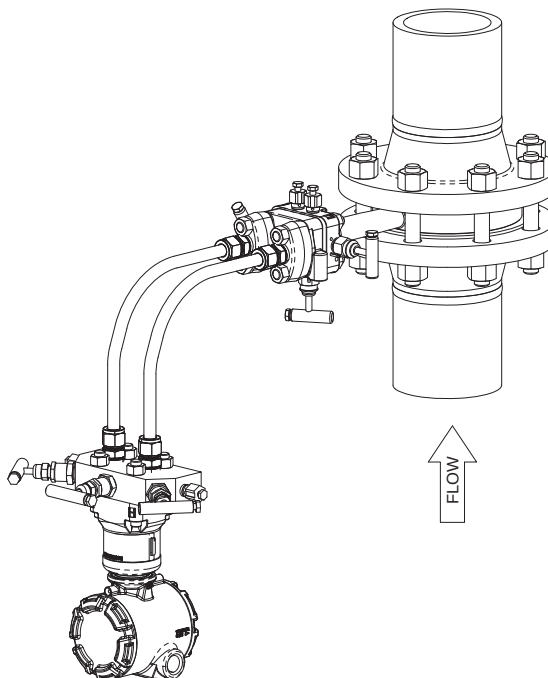
Liquid or Steam in Vertical or Horizontal Pipes

Mount the transmitter below the 405 with the instrument lines sloping up.

NOTE

The 405 should not be used in vertical liquid or steam applications if the fluid is flowing down.

Figure 2-8. Remote Mount
Liquid in Vertical or Horizontal
Pipes



Process Connections (Remote Mount Only)

The 405 is available with either 1/4-in. – 18 NPT connections (standard) or 1/2-in. – 14 NPT connections (option code E). The 1/2-in. connections can be rotated to attain connection centers of 2-in. (51 mm), 2 1/8-in. (54 mm), or 2 1/4-in. (57 mm). The threads are Class 2; use a lubricant or sealant when making the process connections.

Ensure all four flange studs are installed and tightened prior to applying pressure to prevent process leakage. When properly installed, the flange studs will protrude through the top of the module housing.

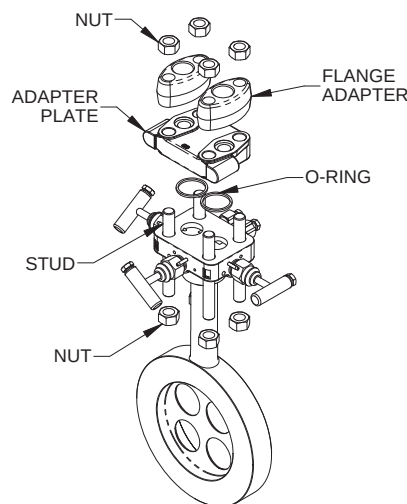
NOTE

Do not attempt to loosen or remove the flange studs while the 405 is in service.

Perform the following to install flange adapters to the head of the 405.

- ⚠ 1. Place o-ring in the groove on bottom of the flange adapter.
2. Position flange adapters over NPT connections on the adapter plate.
3. Insert studs through 405 head, adapter plate, and flange adapters.
4. Thread nuts onto studs. Tighten nuts to 300 in-lbs. (34 N-m).

Figure 2-9. Installing the Flange
Adapters to a 405



When compressed, PTFE o-rings tend to cold flow, which aids in their sealing capabilities. When removing adapter plates or adapters, visually inspect the o-rings. Replace them if there are any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them. If you replace the o-rings, retorque the nuts after installation to compensate for cold flow.

High Temperature Units (Option Code T)

⚠ Inconel® o-rings should be replaced any time the unit is disassembled.

INSTALLATION

Install the 405 according to the procedure below.

- ⚠ 1. Orient the assembly according to the guidelines provided in "Location and Orientation" beginning on page 2-4. Ensure that the flow arrow is pointing in the same direction as the process flow.

NOTE

An ANSI alignment ring is provided standard with the 405. If a DIN or JIS alignment ring is required, it must be ordered as an option. Contact an Emerson Process Management sales representative for additional information.

NOTE

For ease of installation, the gasket may be secured to the flange face with small pieces of tape. Be sure the gasket and/or tape do not protrude into the pipe.

2. If using an alignment ring with through holes, proceed to step 9.
3. Insert two studs through the flange holes located opposite the head of the 405.

4. Place the alignment ring on the 405 body (see Figure 2-10).
5. Insert gaskets.
6. Insert the 405 between the flanges so that the indentations on the alignment ring contact the installed studs. The studs must contact the alignment ring in the indentation marked with the appropriate flange rating to ensure proper alignment.
7. Install remaining studs and nuts (hand tight). Ensure that three of the studs are in contact with the alignment ring.
8. Lubricate studs and tighten nuts in a cross pattern to the appropriate torque per local standards.

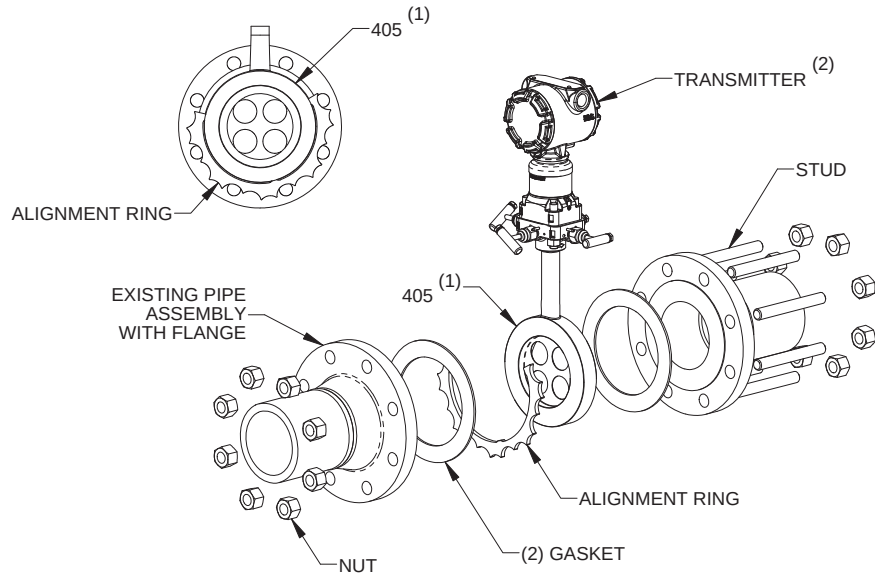
Steps 9-12 are for use with alignment rings that have through holes.

9. Place the alignment ring on the 405 body (see Figure 2-10).
10. Insert the 405 between the flanges. Insert one stud through the flange hole located opposite the 405 head; passing through the alignment ring through hole and the opposite flange hole. The stud must contact the alignment ring through the through hole marked with the appropriate flange rating to ensure proper alignment.
11. Repeat step 10 for a second (2) stud opposite the 405 head.
12. Insert gaskets.
13. Install remaining studs and nuts (hand tight). Ensure that three of the studs are in contact with the alignment ring.
14. Lubricate studs and tighten nuts in a cross pattern to the appropriate torque per local standards.

NOTE

Standard $\frac{1}{16}$ -in. gaskets are recommended for use with the 405. Using other gaskets could potentially caused a bias shift in the measurement.

Figure 2-10. 405 Installation



(1) This installation drawing applies to both the 405P and 405C.

(2) Applies to both the 3051SFC (uses a 3051S transmitter) and a 3095MFC (uses a 3095M transmitter).

Remote RTD Installation

A remote RTD requires that the process piping be modified. Follow site specific requirements for installation. Install the RTD thermowell in close proximity downstream⁽¹⁾ of the primary element. The standard supplied RTD connection cable is 12 ft long. Consult factory for longer lengths.

Drill a $\frac{5}{8}$ -in. (16 mm) to $\frac{3}{4}$ -in. (19 mm) hole at the RTD location and weld on a customer supplied 1-in. (25mm) tall $\frac{1}{2}$ inch -14 NPT weld coupling. The RTD thermowell threads into the weld coupling. The thermowell material is 316 SST with $\frac{1}{2}$ -14 ANPT threads. When installed It will be inserted $1\frac{1}{2}$ -in. (38 mm) into the pipe internal diameter.

For remote RTD applications with pipe diameters less than 2 inches (50mm) consult factory.

(1) For the 405P, at least six pipe diameters downstream of the primary element. For the 405C, two pipe diameters downstream of the primary element.

Section 3 Commissioning

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Direct Mount Applications	page 3-2
Remote Mount Applications	page 3-5

SAFETY MESSAGES

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

⚠️WARNING

Explosions could result in death or serious injury:

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

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

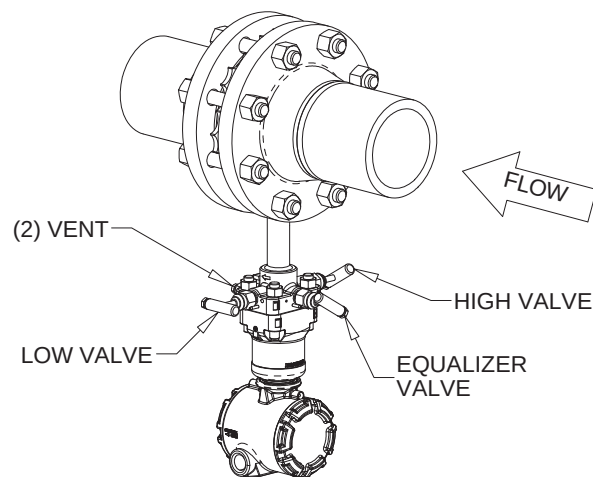
- Make sure only qualified personnel perform the installation.
- If the line is pressurized, serious injury or death could occur by opening valves.

DIRECT MOUNT APPLICATIONS

Liquid Service

- ⚠
1. Pressurize line.
 2. Open the equalizer valve.
 3. Open the high and low side valves.
 4. Bleed drain/vent valves until no gas is apparent in the liquid.
 5. Close the vent/drain valves.
 6. Close the low side valve.
 7. Check the transmitter zero according to the transmitter product manual so that the output on the test meter reads zero percent of span.
 8. Close the equalizer valve.
 9. Open the low side valve. The system is now operational.

Figure 3-1. Direct Mount Liquid Service

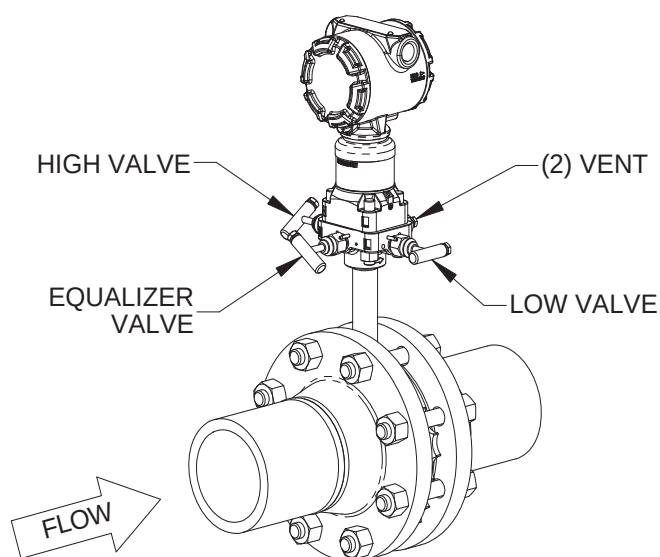


Gas Service



1. Pressurize line.
2. Open the equalizer valve.
3. Open the high and low side valves.
4. Open drain/vent valves to ensure no liquid is present.
5. Close the vent/drain valves.
6. Close the low side valve.
7. Check the transmitter zero according to the transmitter product manual so that the output on the test meter reads zero percent of span.
8. Close the equalizer valve.
9. Open the low side valve. The system is now operational.

Figure 3-2. Direct Mount Gas Service

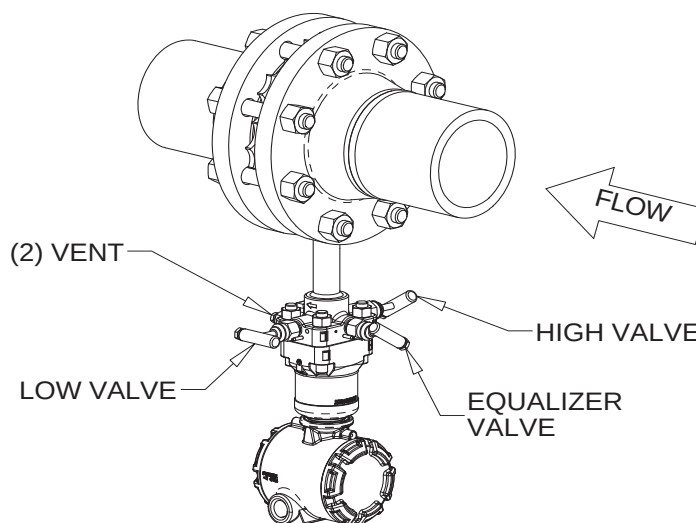


Steam Service



1. Remove pressure from line.
2. Open equalizer, high, and low side valves.
3. Zero electronics.
4. Fill manifold and transmitter with water via drain vents.
5. Close low side valve.
6. Pressurize line.
7. Gently tap electronics body, manifold head, and 405 body with a small wrench to dislodge any entrapped air.
8. Zero electronics.
9. The system is now operational.

Figure 3-3. Direct Mount
Steam Service

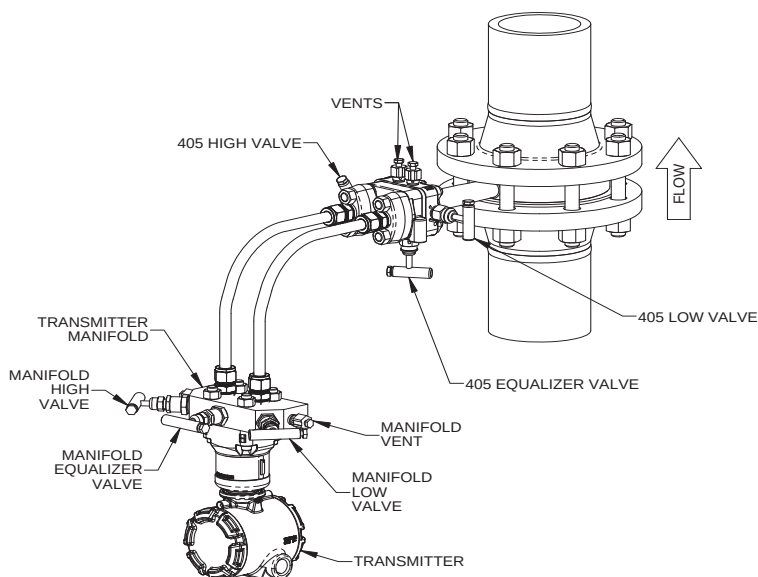


REMOTE MOUNT APPLICATIONS

Liquid Service

- ⚠
1. Zero electronics and pressurize line.
 2. Open equalizer valves on transmitter manifold and 405.
 3. Open high and low side transmitter manifold valves and 405 valves.
 4. Bleed drain vent valves on transmitter manifold until no air is present.
 5. Close drain vent valves.
 6. Close equalizer valve on 405.
 7. Check transmitter zero. If transmitter does not read zero repeat steps 1-7.
 8. Close equalizer valve on transmitter manifold.

Figure 3-4. Remote Liquid
Service

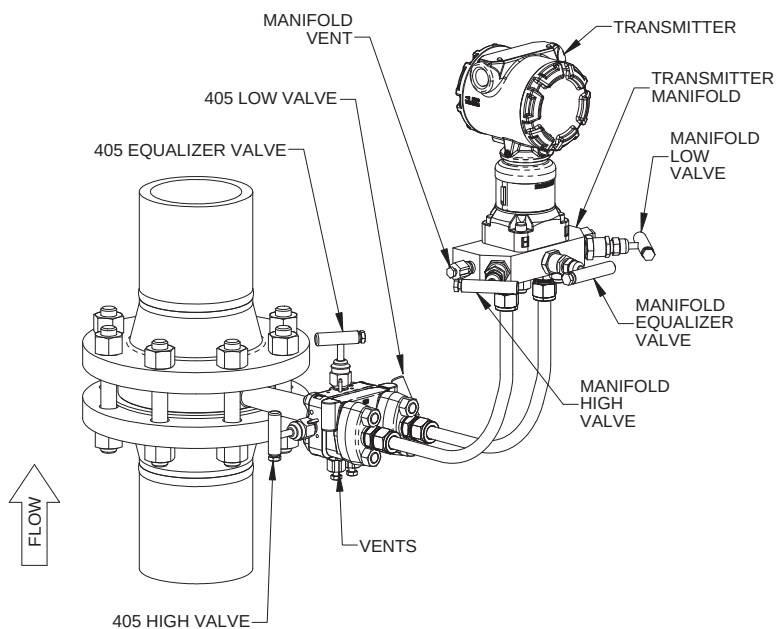


Gas Service



1. Zero electronics and pressurize line.
2. Open equalizer valves on transmitter manifold and 405.
3. Open high and low side transmitter manifold valves and 405 valves.
4. Open drain/vent valves on transmitter manifold to ensure no liquids are present.
5. Close drain/vent valves.
6. Close low side transmitter manifold valve.
7. Close 405 equalizer valve.
8. Check transmitter zero. If transmitter does not read zero repeat steps 1-7.
9. Close equalizer on transmitter manifold.
10. Open low side valve on transmitter manifold. The system is now operational.

Figure 3-5. Remote Gas Service

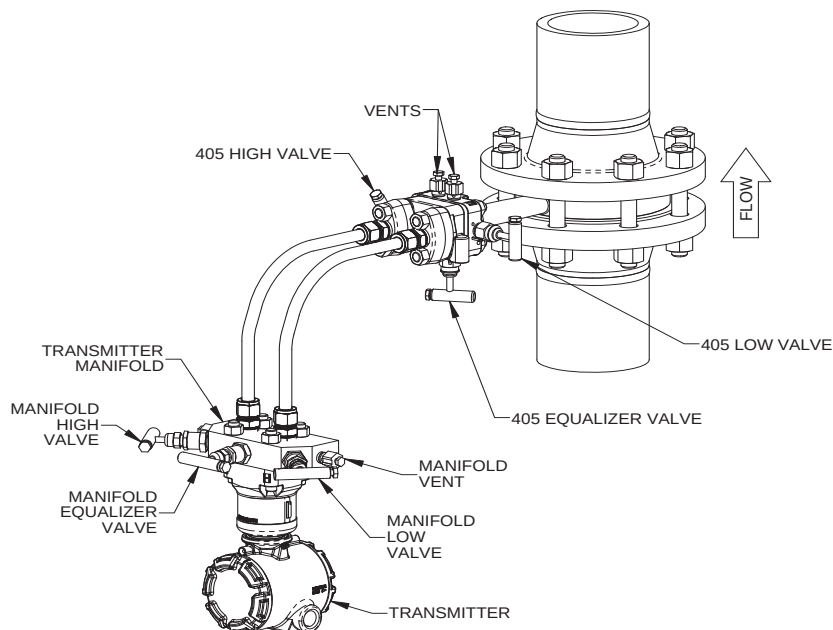


Steam Service



1. Remove pressure from line.
2. Open equalizer valves, high side valves, and low side valves on both the 405 and transmitter manifold.
3. Zero electronics.
4. Fill transmitter manifold, instrument lines, and 405 with water via drain vents on transmitter manifold.
5. Close 405 equalizer valve and transmitter manifold vents.
6. Close low side transmitter manifold valve.
7. Pressurize line.
8. Gently tap electronics body, transmitter manifold, instrument lines, and 405 with a small wrench to dislodge any trapped air.
9. Check transmitter zero. If transmitter does not read zero repeat steps 4-8.
10. Close the transmitter equalizer and open low side valve on transmitter manifold. The system is now operational.

Figure 3-6. Remote Steam Service



Section 4 Operation and Maintenance

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Troubleshooting	page 4-1
RTD Maintenance	page 4-3

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.

TROUBLESHOOTING

If a malfunction is suspected despite the absence of a diagnostic messages 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.

Symptom	Possible Cause	Corrective Action
Questionable accuracy or erroneous flow signal	Improper installation	- Is the flow arrow pointed in the direction of the flow? - Verify that the cross reservoirs are perfectly level with one another. - Is there sufficient straight run upstream and downstream of the flowmeter?
	System leaks	Check for leaks in instrument piping. Repair and seal all leaks.
	Contamination/plugging	Remove the flowmeter and check for contamination.
	Closed valve	Verify that both 3095MFC (PH & PL) or (MH & ML) valves are open. Verify that vent, equalizer, and line valves are properly positioned per the "start up procedure."
	Calibration	Is the calibration too high or low for the flow rate?
	Connections (remote mount only)	Verify that the high side of the electronics is connected to the high side of the flowmeter. Check the same for the low side.
	Entrapped air (liquid applications)	Are there uneven water legs caused by air entrapment in the instrument connections? If so, bleed air.
	3095MFC misalignment	Misalignment of the flowmeter beyond 3 degrees will cause an erroneous signal.
Spiking flow signal	Operating conditions	Are the operating conditions in compliance with those given at the time the flowmeter was purchased? Check the flow calculation and the fluid parameters for accuracy. Double-check pipe inside diameter for proper sizing.
	Two-phase flow	The flowmeter is a head measurement device and will not accurately measure a two-phase flow.
Spiking flow signal (Stream Service)	Improper insulation (Vertical pipes only)	Added insulation may be required to ensure that a phase change occurs at the cross reservoirs.
	Excessive vibration	Check the impulse piping for vibration.
Milliamp reading is zero		- Check if power polarity is reversed - Verify voltage across terminals (should be 10–55V dc) - Check for bad diode in terminal block - Replace electronics terminal block
Electronics not in communication		- Check power supply voltage at electronics (10.5V minimum) - Check load resistance (250 ohms minimum) - Check if unit is addressed properly - Replace electronics board
Milliamp reading is low or high		- Check pressure variable reading for saturation - Check if output is in alarm condition - Perform 4–20 mA output trim - Replace electronics board
No response to changes in applied flow		- Check test equipment - Check impulse piping for blockage - Check for disabled span adjustment - Check electronics security switch - Verify calibration settings (4 and 20 mA points) - Contact factory for replacement
Low reading/high reading		- Check impulse piping for blockage - Check test equipment - Perform full sensor trim (if software revision is 35 or higher) - Contact factory for replacement
Erratic reading for pressure variable		- Check impulse piping for blockage - Check damping - Check for EMF interference - Contact factory for replacement

Check Flow Direction

Check that the flow arrow on the neck of the 405 points in the direction of flow. If the DP transmitter is remote mounted from the 405, be sure that the impulse tubing is connected correctly from the 405 to the DP transmitter (high to high and low to low).

Check Orientation

Improper orientation can result in inaccurate measurements.

Check Zero

The transmitter may read off in the high or low direction if not zeroed properly at start-up/commissioning. Refer to the appropriate transmitter reference manual for additional information.

Check Valves

The correct valve setting for flow measurement are; equalizer valve fully closed, high and low side valves fully open.

Check Configuration/Scaling

Is the 20mA DP URL of the 405 set properly? This may involve sizing the 405 in the Toolkit Software program to confirm.

Confirm the DCS or PLC and transmitter on 405 are scaled consistently.

Is the square root being taken in the DCS or transmitter attached to the 405? The square root should not be taken in both places.

Check 3095M Configuration

If a Rosemount 3095M transmitter is being used, its enhanced functionality should be taken into account during configuration and troubleshooting. The square root should not be taken in the DCS if a 3095M transmitter is being used.

See the Rosemount 3095M reference manual (document number 00809-0100-4716) for additional information.

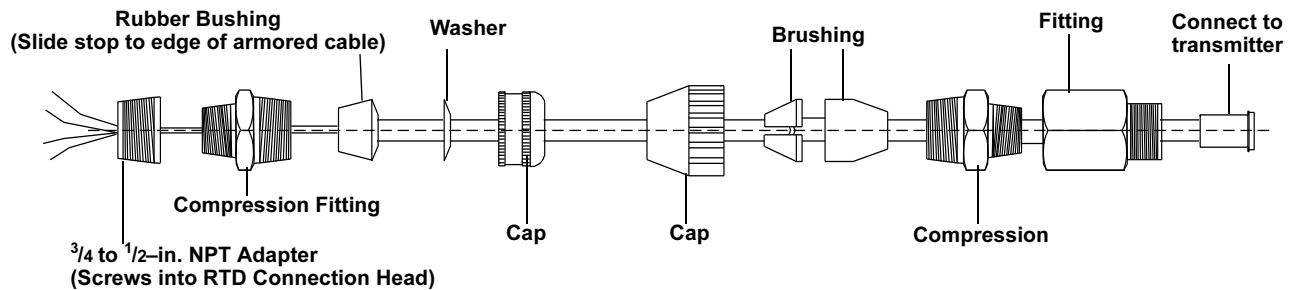
RTD MAINTENANCE

This section covers RTD maintenance procedures.

Remote Mount

If an RTD needs to be replaced on a remote mount, proceed as follows:

1. Close instrument valves to ensure that the pressure is disconnected from the transmitter.
2. Open the bleed valves on the transmitter to remove all pressure.
3. Remove the cap.
4. Remove the RTD wiring only from the terminal.
5. Remove the Terminal Housing from the head.
6. Pull the RTD wire out of the nipple and remove the RTD. The RTD is in a thermowell, so 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. This diagram is for a typical RTD transmitter wiring connection.
10. Open the instrument valves.



Appendix A Reference Data

Rosemount 3051SFC Compact Orifice Flowmeter	page A-1
Rosemount 3095MFC Compact Orifice Mass Flowmeter	page A-16
Rosemount 405 Compact Orifice Primary Element	page A-28
Spare Parts	page A-37

Rosemount 3051SFC Compact Orifice Flowmeter

SPECIFICATIONS

Performance

System Reference Accuracy

Percent (%) of volumetric flow rate

Table A-1. 3051SFC Compact Orifice Flowmeter

Type	Beta	Classic (8:1 flow turndown)	Ultra (8:1 flow turndown)	Ultra for Flow (14:1 flow turndown)
3051SFCC	0.4	±1.05%	±0.85%	±0.80%
	0.65	±1.35%	±1.20%	±1.15%
3051SFCP ⁽¹⁾	0.4	±2.45%	±2.35%	±2.30%
	0.65 ⁽²⁾			
3051SFCP ⁽¹⁾	0.4	±2.00%	±1.90%	±1.85%
	0.65 ⁽²⁾			
3051SFCP ⁽¹⁾	0.4	±1.55%	±1.45%	±1.40%
	0.65 ⁽²⁾			

(1) Line sizes ¹/₂-in. (15mm)

(2) For 0.65 beta and ReD < 10,000 add an additional 0.5% to the Discharge Coefficient Uncertainty.

Repeatability

±0.1%

Line Sizes

- ¹/₂-in. (15 mm) – not available for the 3051SFCC
- 1-in. (25 mm) – not available for the 3051SFCC
- ¹/₂-in. (40 mm) – not available for the 3051SFCC
- 2-in. (50 mm)
- 3-in. (80 mm)
- 4-in. (100 mm)
- 6-in. (150 mm)
- 8-in. (200 mm)

Performance Statement Assumptions

- Measured pipe I.D

Sizing

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

Functional

Service

- Liquid
- Gas
- Steam

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

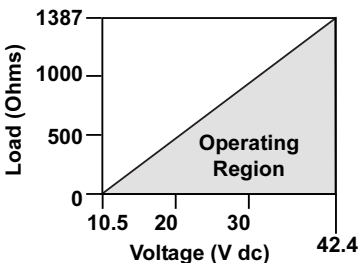
External power supply required.
Standard transmitter (4–20 mA): 10.5 to 42.4 V dc with no load
3051S SIS Safety transmitter: 12 to 42 Vdc with no load
3051S HART Diagnostics transmitter: 12 to 42 Vdc with no load

Load Limitations

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

Standard Transmitter

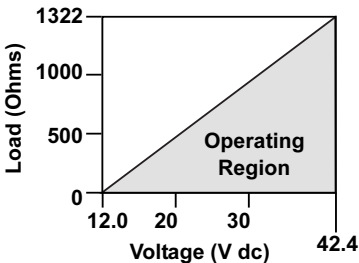
Maximum Loop Resistance = $43.5 * (\text{Power Supply Voltage} - 10.5)$



The HART communicator requires a minimum loop resistance of 250Ω for communication.

3051S SIS Safety Transmitter (output code B)
3051S HART Diagnostics Transmitter (option code DA1)

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



The HART communicator requires a minimum loop resistance of 250Ω for communication.

HART Diagnostics Suite (Option Code DA1)

The 3051S HART Diagnostics Transmitter provides Abnormal Situation Prevention (ASP) indication, device operating hours, variable logging, 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 3051S ASP algorithm uses these values and highly flexible configuration options for customization to detect many user-defined or application specific abnormal situations (e.g. plugged impulse line detection).

The device operating hours are logged along with the occurrence of diagnostic events 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 V dc 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 3051S 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	-
Transducer	-
LCD Block	-
Analog Input 1, 2	20 milliseconds
PID with Auto-tune	25 milliseconds
Input Selector	20 milliseconds
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 3095 Engineering Assistant.

FOUNDATION fieldbus Diagnostics Suite (Option Code D01)

3051S FOUNDATION fieldbus Diagnostics provide Abnormal Situation Prevention (ASP) 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 3051S ASP algorithm uses these values and highly flexible configuration options for customization to detect many user-defined or application specific abnormal situations (e.g. plugged impulse line detection).

Process Temperature Limits

Direct Mount Electronics

- 450 °F (232 °C)

Remote Mount Electronics

- 850 °F (454 °C) – Stainless Steel

Electronics Temperature Limits

Ambient

- 40 to 185 °F (–40 to 85 °C)
- With Integral Mount LCD Display⁽¹⁾: –40 to 175 °F (–40 to 80 °C)
- With Option Code P0: –4 to 185 °F (–20 to 85 °C)

Storage

- 50 to 230 °F (–46 to 110 °C)
- With Integral Mount LCD Display: –40 to 185 °F (–40 to 85 °C)
- With Wireless Output (Code X): –40 to 185 °F (–40 to 85 °C)

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

Differential Pressure Limits

Maximum differential pressure (DP) up to 800 inH₂O.

Pressure Limits⁽¹⁾

Direct Mount Electronics

- Pressure retention per ANSI B16.5 600# or DIN PN

Static Pressure Limits

- Range 1A: Operates within specification between static line pressures of 0.5 psia to 2000 psig (0.03 to 138 bar)
- Ranges 2A– 3A: Operates within specifications between static line pressures of 0.5 psia and 3626 psig (0.03 bar-A to 250 bar-G)

Vibration Limits

Qualified per IEC61298-3 (1998) for field with high vibration level or pipeline with high vibration level (10-60Hz 0.21mm displacement peak amplitude / 60 - 500Hz 3g).

The weight and length of the transmitter assembly shall not exceed 5.8 lbs and 7.75-in.

Burst Pressure Limits

Coplanar or traditional process flange

- 10000 psig (689,5 bar).

Overpressure Limits

Flowmeters withstand the following limits without damage:

- Range 1A: 2000 psig (138 bar)
- Ranges 2A–3A: 3626 psig (250 bar)

Table A-2. Overpressure Limits⁽¹⁾

Standard	Type	Carbon Steel Rating	Stainless Steel Rating
ANSI/ASME	Class 150	285 (20)	275 (19)
ANSI/ASME	Class 300	740 (51)	720 (50)
ANSI/ASME	Class 600	1480 (102)	1440 (99)
<i>At 100 °F (38 °C), the rating decreases with increasing temperature.</i>			
DIN	PN 10/40	580 (40)	580 (40)
DIN	PN 10/16	232 (16)	232 (16)
DIN	PN 25/40	580 (40)	580 (40)
<i>At 248 °F (120 °C), the rating decreases with increasing temperature.</i>			

(1) Carbon Steel and Stainless Steel Ratings are measured in psig (bar).

Humidity Limits

- 0–100% relative humidity

Turn-On Time

Performance within specifications less than 2 seconds (typical) after power is applied to the transmitter

Damping

Analog output response to a step input change is user-selectable from 0 to 60 seconds for one time constant. This software damping is in addition to sensor module response time

Failure Mode Alarm

HART 4-20mA (output option codes A and B)

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 Table A-3).

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

(1) Static pressure selection may effect pressure limitations.

Table A-3. 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) (3)}	20.2 - 23.0 mA	3.6 - 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.

(3) Not available with the 3051S SIS Safety Transmitter.

3051S SIS Safety Transmitter Failure Values

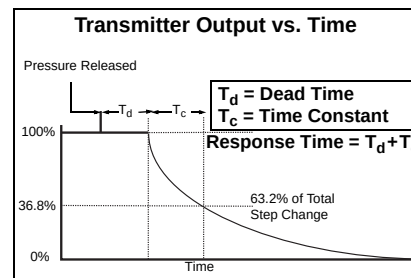
Safety accuracy: 2.0%⁽¹⁾

Safety response time: 1.5 seconds

- (1) 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%.

Dynamic Performance

	4 - 20 mA (HART®) ⁽¹⁾	Fieldbus protocol ⁽²⁾	Typical Transmitter Response Time
Total Response Time (Td + Tc)⁽³⁾:			
3051S_C, Ranges 2A - 3A:	100 milliseconds	152 milliseconds	
Range 1A:	255 milliseconds	307 milliseconds	
Process Variable Response Time			
3051S SIS, Ranges 2A - 3A:	220 milliseconds	Not Applicable	
Range 1A:	375 milliseconds	Not Applicable	
Dead Time (Td)⁽⁴⁾	45 milliseconds (nominal)	97 milliseconds	
Update Rate			
3051S	22 times per second	22 times per second	
3051S SIS	11 times per second	Not Applicable	



(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. For option code DA1, add 40 milliseconds (nominal) to 4-20 mA (HART®) total response time values.

(4) For option code DA1, dead time (Td) is 85 milliseconds (nominal).

Physical

Temperature Measurement

Remote RTD

- 100 Ohm platinum with 1/2-in. NPT nipple and union (078 series with Rosemount 644 housing)
Model 0078D21N00A025T32Ex
Connection Head: 00644-4410-0011
- Standard RTD cable is shielded armored cable, length is 12 feet (3.66 m)

Thermowell with Remote RTD

- 1/2-in. x 1/2-in. NPT, 316 SST

NOTE

Remote temperature measurement is not available for 1/2-in., 1-in., and 1 1/2-in. sizes.

Electronic Connections for Remote Mount

1/2–14 NPT, G1/2, and M20 × 1.5 (CM20) conduit. *HART* interface connections fixed to terminal block for output code A

Material of Construction

Body/Plate

- 316 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 must be replaced when the 405 is disassembled.

Transmitter Connections

Remote Mount

- Available with 1/4-in. (standard) or 1/2-in. (option code E) connections

Orifice Type

- Square edged
- Corner tapped
- Concentric
- Wafer-style

Process Connections

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 alignment ring is included as standard when ordering.

Typical Orifice Hole Sizes (For 3051SFCC)

Beta is calculated by: $(\beta) = d_C / \text{Pipe ID}$, where the calculated bore is equal to 2 x typical orifice hole size ($d_C = 2d$). The table below shows the diameter of each of the four typical orifice holes.

Table A-4. $\beta = 0.4$ ⁽¹⁾⁽²⁾

Line Size	3051SFCC	3051SFCP
1/2-in. (15 mm)	Not Available	0.249 (6.325)
1-in. (25 mm)	Not Available	0.420 (10.668)
1 1/2-in. (40 mm)	Not Available	0.644 (16.358)
2-in. (50 mm)	0.413 (10.490)	0.827 (21.006)
3-in. (80 mm)	0.614 (15.596)	1.227 (31.166)
4-in. (100 mm)	0.805 (20.447)	1.610 (40.894)
6-in. (150 mm)	1.213 (30.810)	2.426 (61.620)
8-in. (200 mm)	1.596 (40.538)	3.192 (81.077)

Table A-5. $\beta = 0.65$ ⁽¹⁾⁽²⁾

Line Size	3051SFCC	3051SFCP
1/2-in. (15 mm)	Not Available	0.404 (10.262)
1-in. (25 mm)	Not Available	0.682 (17.323)
1 1/2-in. (40 mm)	Not Available	1.047 (26.594)
2-in. (50 mm)	0.620 (15.748) ⁽³⁾	1.344 (34.138)
3-in. (80 mm)	0.997 (25.324)	1.994 (50.648)
4-in. (100 mm)	1.308 (33.223)	2.617 (66.472)
6-in. (150 mm)	1.971 (50.063)	3.942 (100.127)
8-in. (200 mm)	2.594 (65.888)	5.188 (131.775)

(1) Measurement is in inches (millimeters)

(2) Tolerance = ± 0.002 -in.

(3) Beta (β) = 0.60-in. (15.24 mm) for 2-in. line size only.

Weight

Line Size	Direct Mount (D3) ⁽¹⁾	Remote Mount (R3) ⁽¹⁾
1/2-in. (15 mm)	11.20 (5.08)	8.0 (3.63)
1-in. (25 mm)	11.70 (5.31)	8.5 (3.86)
1 1/2-in. (40 mm)	12.45 (5.65)	9.25 (4.20)
2-in. (50 mm)	13.20 (5.99)	10.0 (4.54)
3-in. (80 mm)	13.95 (6.32)	11.75 (5.33)
4-in. (100 mm)	14.95 (6.78)	13.5 (6.12)
6-in. (150 mm)	20.45 (9.28)	17.25 (7.83)
8-in. (200 mm)	24.95 (11.32)	21.75 (9.87)

(1) Measurement in lb (kg).

Installation Considerations

Straight Run Requirements

Table A-6. 3051SFCC Straight Pipe Requirements⁽¹⁾

Upstream (inlet) side of primary	Beta	0.40	0.65
	Reducer (1 line size)	2	2
	Single 90° bend or tee	2	2
	Two or more 90 ° bends in the same plane	2	2
	Two or more 90° bends in different plane	2	2
	Up to 10° of swirl	2	2
	Butterfly valve (75% to 100% open)	2	N/A
	Downstream (outlet) side of primary	2	2

Table A-7. 3051SFCP Straight Pipe Requirements⁽¹⁾⁽²⁾⁽³⁾

Upstream (inlet) side of primary	Beta	0.40	0.65
	Reducer (1 line size)	5	12
	Single 90° bend or tee	16	44
	Two or more 90 ° bends in the same plane	10	44
	Two or more 90° bends in different plane	50	60
	Expander	12	28
	Ball / Gate valve fully open	12	18
	Downstream (outlet) side of primary	6	7

(1) Consult an Emerson Process Management representative if disturbance is not listed.

(2) Recommended lengths represented in pipe diameters per ISO 5167.

(3) Refer to ISO 5167 for recommended lengths when using flow straighteners.

Pipe Orientation

Pipe orientation for both 3051SFCC Compact Conditioning and standard 3051SFCP Compact Orifice.

Orientation/ Flow Direction	Process ⁽¹⁾		
	Gas	Liquid	Steam
Horizontal	D/R	D/R	D/R
Vertical Up	R	D/R	R
Vertical Down	D/R	NR	NR

(1) D = Direct mount acceptable (recommended)

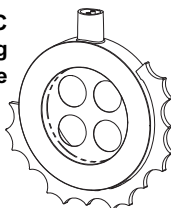
R = Remote mount acceptable

NR = Not recommended

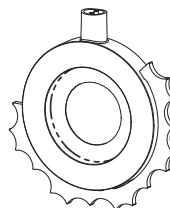
Pipe Centering

Improper centering of any orifice type device can cause an error of up to $\pm 5\%$ in small line sizes. A centering mechanism (centering ring) independent of flange rating comes standard with the 405 Compact Orifice Series.

3051SFCCD
Conditioning
Orifice



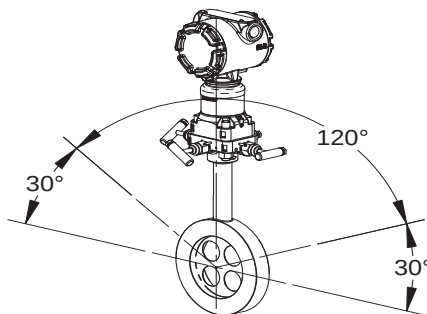
3051SFCDP
Compact
Orifice



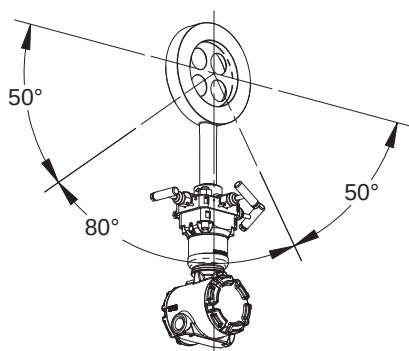
Flowmeter Orientation

Flowmeter orientation for both 3051SFC Conditioning Compact Orifice and standard Compact Orifice.

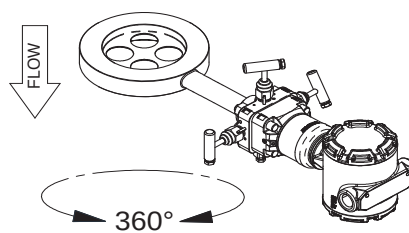
Gas (Horizontal)



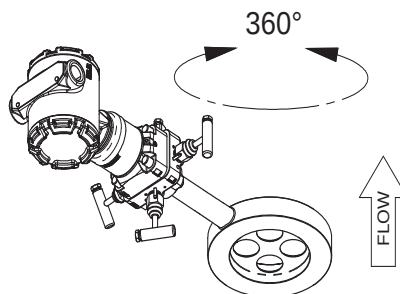
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



DIMENSIONAL DRAWINGS

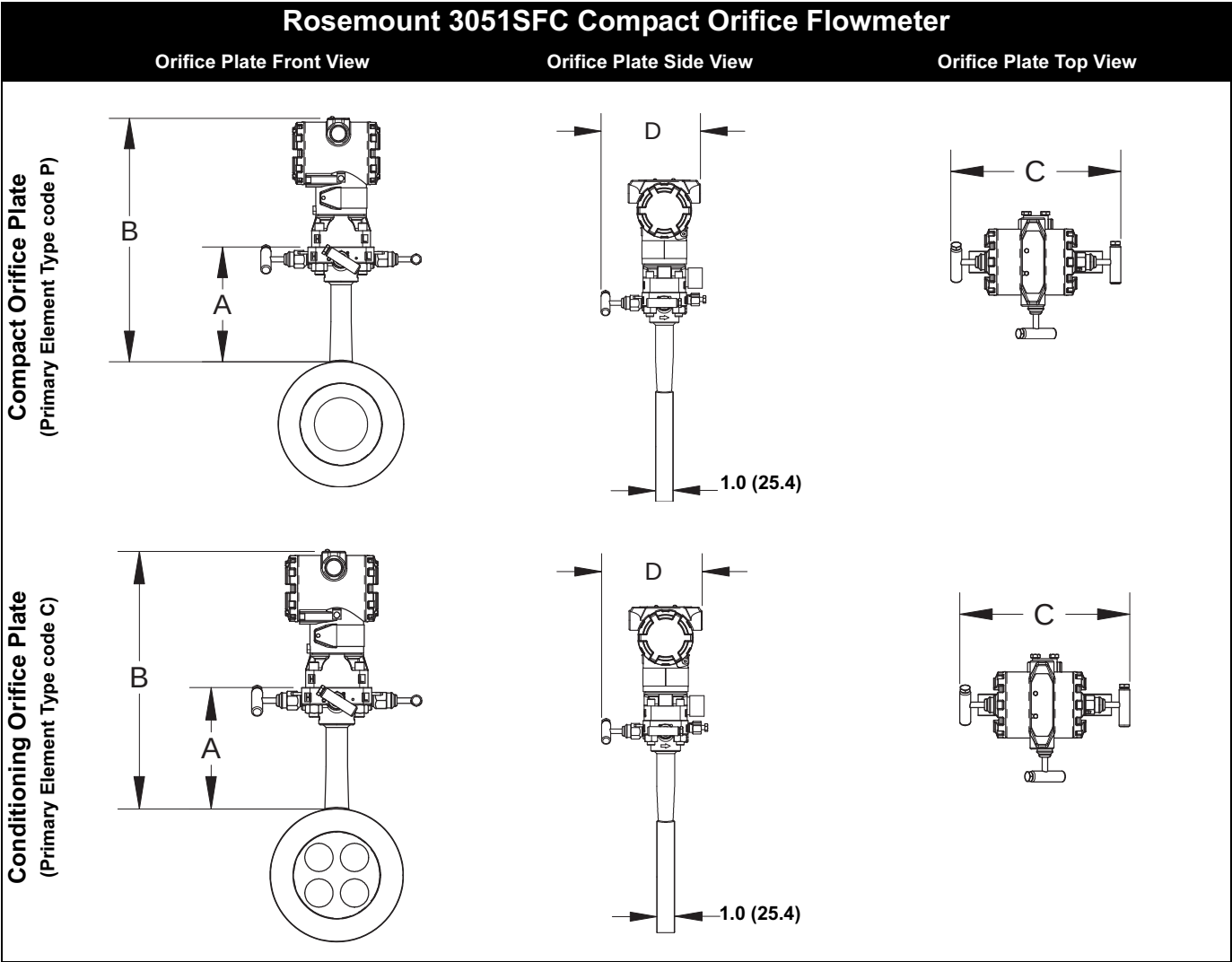


Table A-8. Dimensional Drawings⁽¹⁾

Plate Type	A	B	Transmitter Height	C	D
Type P and C	5.50 (140)	Transmitter Height + A	7.75 (197)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open

(1) Measurement in inches (millimeters).

Rosemount Compact Orifice Flowmeter Series

Reference Manual
00809-0100-4810, Rev DA
September 2007

ORDERING INFORMATION

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

Model	Product Description		
3051SFC	Compact Orifice Flowmeter		
Code	Measurement Type		
D	Differential Pressure		
Code	Primary Element Type		
C	Conditioning Orifice Plate		
P	Orifice Plate		
Code	Material Type		
S	316 Stainless Steel (SST)		
Code	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)		
Code	Primary Element Style		
N	Square Edged		
Code	Beta Ratio		
040	0.40 Beta Ratio (β)		
065 ⁽²⁾	0.65 Beta Ratio (β)		
Code	Temperature Measurement		
R	Remote Thermowell and RTD		
0	No Temperature Sensor		
Code	Electronics Connection Platform		
3	Direct-mount, 3-valve integral manifold, SST		
7	Remote-mount, 1/4-in. NPT connections		
9	Special		
Code	Differential Pressure Range		
1	0 to 25 in H ₂ O (0 to 62.2 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)		
Code	Static Pressure Range		
A	None		
D	Absolute 0 to 800 psia (0 to 55.2 bar)		
E	Absolute 0 to 3626 psia (0 to 250 bar)		
J	Gage -14.7 to 800 psig (-1 to 55.2 bar)		
K	Gage -14.7 to 3626 psig (-1 to 250 bar)		
Code	Output Protocol		
A	4–20 mA with digital signal based on HART protocol		
F ⁽³⁾	FOUNDATION fieldbus protocol		
X	Wireless		
Code	Electronics Housing Style	Material	Conduit Entry Size
01	Assemble to Rosemount 753R Web-based Monitoring Indicator		
1A	PlantWeb Housing	Aluminum	1/2-14 NPT
1B	PlantWeb Housing	Aluminum	M20 x 1.5 (CM20)
1C	PlantWeb Housing	Aluminum	G 1/2
1J	PlantWeb Housing	316L SST	1/2-14 NPT
1K	PlantWeb Housing	316L SST	M20 x 1.5 (CM20)
1L	PlantWeb Housing	316L SST	G 1/2

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

2A	Junction Box Housing	Aluminum	1/2-14 NPT
2B	Junction Box Housing	Aluminum	M20 x 1.5 (CM20)
2C	Junction Box Housing	Aluminum	G1/2
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 x 1.5 (CM20)
2G	Junction Box housing with output for remote display and interface	Aluminum	G1/2
2J	Junction Box Housing	316L SST	1/2-14 NPT
2M	Junction Box housing with output for remote display and interface	316L SST	1/2-14 NPT
5A	Wireless PlantWeb housing	Aluminum	M20 x 1.5 (CM20)
7J ⁽⁴⁾	Quick Connect (A size Mini, 4-pin male termination)		
Code	Electronics Performance Class for Flow		
1 ⁽⁵⁾	Ultra: up to ± 0.85% flow rate accuracy, 8:1 flow turndown, 10-year stability, limited 12-year warranty		
2	Classic: up to ± 1.05% flow rate accuracy, 8:1 flow turndown, 5-year stability		
3 ⁽⁵⁾	Ultra for Flow: up to ± 0.75% flow rate accuracy, 14:1 flow turndown, 10-year stability. limited 12-year warranty		
5	Classic 2: 0.xx% flow rate accuracy, 8:1 flow turndown, 5-year stability		
Code	Options		
Installation Accessories			
G	DIN alignment ring (PN 16)		
H	DIN alignment ring (PN 40, 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 (Tmax = 850 °F)		
Flow Calibration			
WC ⁽⁶⁾	Discharge coefficient verification (3 point)		
WD ⁽⁶⁾	Discharge coefficient verification (full 10 point)		
Pressure Testing			
P1	Hydrostatic testing with certificate		
Special Cleaning			
P2	Cleaning for special processes		
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 Data Certificate for Transmitter		
Safety Certification			
QS	Certificate of FMEDA data		
QT	Safety Certified to IEC 61508 with certificate of FMEDA data		
Material Traceability Certifications			
Q8	Material Cert per ISO 10474 3.1.B and EN 10204 3.1.B		
Code Conformance			
J2	ANSI B31.1		
J3	ANSI B31.3		
J4	ANSI B31.8		
J5 ⁽⁷⁾	NACE MR-0175 / ISO 15156		
Country Certification			
J1	Canadian Registration		
Product Certifications			
E1	ATEX Flameproof		
I1	ATEX Intrinsically Safe		
IA ⁽⁸⁾	ATEX FISCO Intrinsically Safe; for FOUNDATION fieldbus protocol only		
N1	ATEX Type n		

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ND	ATEX Dust
K1	ATEX Flameproof, Intrinsically Safe, Type n, Dust (combination of E1, I1, N1, and ND)
E4	TIIS Flameproof
E5	FM Explosion-proof
I5	FM Intrinsically Safe, Non-incendive
K5	FM Explosion-proof, Intrinsically Safe, Non-incendive (combination of E5 and I5)
E6	CSA Explosion-proof, Division 2
I6	CSA Intrinsically Safe
K6	CSA Explosion-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)
E7 ⁽⁸⁾	SAA Flameproof, Dust Ignition-proof
I7	IECEx Intrinsically Safe
N7	IECEx Type n
K7	SAA Flameproof, Dust Ignition-proof, IECEx Intrinsically Safe, and Type n (combination of E7, I7, and N7)
KA	ATEX and CSA Flameproof, Intrinsically Safe (combination of E1, I1, E6, and I6) <i>Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.</i>
KB	FM and CSA Explosion-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6) <i>Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.</i>
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Non-incendive (combination of E5, E1, I5, and I1) <i>Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.</i>
KD	FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1) <i>Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.</i>
Alternative Transmitter Material of Construction	
L1	Inert Sensor Fill Fluid (not available with Differential Pressure range code 1A)
L2	Graphite-filled Teflon® (PTFE) o-ring
LA	Inert sensor fill fluid and graphite-filled Teflon (PTFE) o-ring
Display⁽⁹⁾	
M5	<i>PlantWeb</i> LCD display
M8 ⁽⁵⁾⁽¹⁰⁾	Remote mount LCD display and interface, <i>PlantWeb</i> housing, 50 foot cable, SST bracket
M9 ⁽⁵⁾⁽¹⁰⁾	Remote mount LCD display and interface, <i>PlantWeb</i> housing, 100 foot cable, SST bracket
Terminal Blocks	
T1 ⁽⁹⁾	Transient terminal block
T2 ⁽¹¹⁾	Terminal block with WAGO spring clamp terminals
T3 ⁽¹¹⁾	Transient terminal block with WAGO spring clamp terminals
Manifold for Remote Mount Option	
F2	3-Valve Manifold, SST
F6	5-Valve Manifold, SST
<i>PlantWeb</i> Control Functionality	
A01 ⁽¹²⁾	FOUNDATION fieldbus Advanced Control Function Block Suite
<i>PlantWeb</i> Diagnostic Functionality	
D01 ⁽¹²⁾	FOUNDATION fieldbus Diagnostics Suite
DA1 ⁽¹³⁾	HART Diagnostic Suite
Wireless Transmit Rate, Operating Frequency and Protocol	
WA1	HART, Self Organizing Network - 2.4 GHz
WA2	User Configurable Transmit Rate, 900 MHz FHSS, HART
Antenna and SmartPower Options	
WK1	Integral, Omnidirectional Antenna, Long-life Battery Pack
Cold Temperature Procedure	
BRR	-60 °F (-51 °C) Temperature Soak with Power Cycle
Special Configuration (Software)	
C4 ⁽¹⁴⁾	NAMUR alarm and saturation signal levels, high alarm

(1) Not available for Primary Element Type code C.

(2) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for Primary Element Type code C.

(3) Requires *PlantWeb* housing.

(4) Available with output code A only. Available approvals are FM Intrinsically Safe, Non-incendive (option code I5) or ATEX Intrinsically Safe (option code I1). Contact an Emerson Process Management representative for additional information.

- (5) *Not available with Output Protocol code B.*
- (6) *Not available with Primary Element Type code P.*
- (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) *Consult factory for availability.*
- (9) *Not available with Housing code 7J.*
- (10) *Not available with Output Protocol code F or option code DA1.*
- (11) *Available with Output Protocol code A and Plantweb housing only.*
- (12) *Requires PlantWeb housing and output code F.*
- (13) *Requires PlantWeb housing and output code A. Includes Hardware Adjustments as standard. Contact an Emerson Process Management representative regarding availability.*
- (14) *Not available for Output Protocol code F.*

Rosemount 3095MFC Compact Orifice Mass Flowmeter

SPECIFICATIONS

Performance

System Reference Accuracy

Percent (%) of mass flow rate

Table A-9. 3095MFC Compact Orifice Mass Flowmeter

TYPE	BETA	Mass flow (8:1 flow turndown)	Ultra for Flow (10:1 flow turndown)
3095MFCC	0.4	±0.90%	±0.70%
	0.65	±1.30%	±1.15%
3095MFCP ⁽¹⁾	0.4	±2.50%	±2.45%
	0.65 ⁽⁴⁾		
3095MFCP ⁽²⁾	0.4	±2.10%	±2.00%
	0.65 ⁽⁴⁾		
3095MFCP ⁽³⁾	0.4	±1.50%	±1.40%
	0.65 ⁽⁴⁾		

(1) Line sizes ¹/₂-in. (15mm)

(2) Line sizes 1-in. to 1 ¹/₂-in. (25mm to 40mm)

(3) Line sizes 2-in. to 8-in. (50mm to 200mm)

(4) For 0.65 beta and ReD < 10,000 add an additional 0.5% to the Discharge Coefficient Uncertainty.

Repeatability

±0.1%

Line Sizes

- ¹/₂-in. (15 mm) – not available for the 3095MFCC
- 1-in. (25 mm) – not available for the 3095MFCC
- 1 ¹/₂-in. (40 mm) – not available for the 3095MFCC
- 2-in. (50 mm)
- 3-in. (80 mm)
- 4-in. (100 mm)
- 6-in. (150 mm)
- 8-in. (200 mm)

Output

Two-wire 4–20 mA, user-selectable for DP, AP, GP, PT, mass flow, or totalized flow. Digital *HART* protocol superimposed on 4–20 mA signal, available to any host that conforms to the *HART* protocol.

Performance Statement Assumptions

- Measured pipe I.D.
- Electronics are trimmed for optimum flow accuracy

Sizing

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

Functional

Service

- Liquid
- Gas
- Steam

Power Supply

4–20 mA option

- External power supply required. Standard transmitter (4–20 mA) operates on 11 to 55 v dc with no load

Process Temperature Limits

Direct Mount Electronics

- 450 °F (232 °C)

Remote Mount Electronics

- 850 °F (454 °C) – Stainless Steel

Electronics Temperature Limits

Ambient

- -40 to 185 °F (-40 to 85 °C)
- With integral meter: -4 to 175 °F (-20 to 80 °C)

Storage

- -50 to 230 °F (-46 to 110 °C)
- With integral meter: -40 to 185 °F (-40 to 85 °C)

Differential Pressure Limits

Maximum differential pressure (DP) up to 800 inH₂O.

Pressure Limits⁽¹⁾

Direct Mount Electronics

- Pressure retention per ANSI B16.5 600# or DIN PN 100

Overpressure Limits

0 to 2 times the absolute pressure range with a maximum of 3626 psia (250 bar).

Static Pressure Limits

Operates within specification between static pressures of 0.5 psia (0.03 bar-A) and the URL of the static pressure sensor.

Vibration Limits

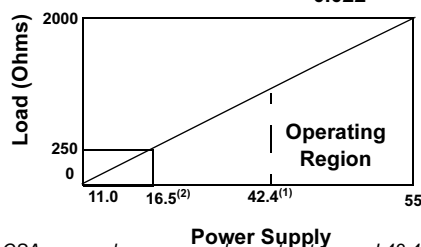
Qualified per IEC61298-3 (1998) for field with high vibration level or pipeline with high vibration level (10-60Hz 0.21mm displacement peak amplitude / 60 - 500Hz 3g).

The weight and length of the transmitter assembly shall not exceed 5.8 lbs and 7.75-in.

Load Limitations

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

$$\text{Maximum Loop Resistance} = \frac{\text{Power Supply} - 11.0}{0.022}$$



- (1) For CSA approval, power supply must not exceed 42.4 V dc.
(2) HART protocol communication requires a loop resistance value between 250-1100 ohms, inclusive.

(1) Static pressure selection may effect pressure limitations.

FOUNDATION fieldbus (output option code V)

Power Supply

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

Current Draw

17.5 mA for all configurations (including LCD display option)

Humidity Limits

- 0–100% relative humidity

Turn-On Time

Digital and analog measured variables will be within specification 7 – 10 seconds after power is applied to the transmitter.

Digital and analog flow output will be within specifications 10 – 14 seconds after power is applied to the transmitter.

Damping

Analog output response to a step input change is user-selectable from 0 to 29 seconds for one time constant. This software damping is in addition to sensor module response time

Failure Mode Alarm

Output Code A

If self-diagnostics detect a non-recoverable transmitter failure, the analog signal will be driven either below 3.75 mA or above 21.75 mA to alert the user. High or low alarm signal is user-selectable by internal jumper pins.

Output Code V

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

Configuration

HART Hand-held Communicator (Model 275 or 375)

- Performs traditional transmitter maintenance functions

3095 MultiVariable Engineering Assistant (EA) software package

- Contains built-in physical property database
- Enables mass flow configuration, maintenance, and diagnostic functions via HART modem (output option code A)
- Enables mass flow configuration via PCMCIA Interface for FOUNDATION fieldbus (output option code V)

Physical Properties Database

- Maintained in Engineering Assistant Software Configurator
- Physical properties for over 110 fluids
- Natural gas per AGA
- Steam and water per ASME
- Other database fluids per American Institute of Chemical Engineers (AIChE)
- Optional custom entry

FOUNDATION fieldbus Function Blocks

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.

5 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.

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.

Physical

Temperature Measurement⁽¹⁾

Remote RTD

- 100 Ohm platinum with 1/2-in. NPT nipple and union (078 series with Rosemount 644 housing)
Model 0078D21N00A025T32Ex
Connection Head: 00644-4410-0011
- Standard RTD cable is shielded armored cable, length is 12 feet (3.66 m)
- Remote RTD material is SST

Thermowell

- 1/2-in. x 1/2-in. NPT, 316 SST

NOTE

Remote temperature measurement is not available for 1/2-in., 1-in., and 1 1/2-in. sizes.

Electronic Connections for Remote Mount

- 1/2–14 NPT, G1/2, and M20 × 1.5 (CM20) conduit. HART interface connections fixed to terminal block for output code A

(1) Static pressure selection may effect pressure limitations.

Material of Construction

Body/Plate

- 316 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.

Transmitter Connections

Remote Mount

- Available with 1/4-in. (standard) or 1/2-in. (option code E) connections

Orifice Type

- Square edged
- Corner tapped
- Concentric
- Wafer-style

Process Connections

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 alignment ring is included as standard when ordering

Typical Orifice Hole Sizes (For 3051MFCC)

Beta is calculated by: $\beta = d_C / \text{Pipe ID}$, where the calculated bore is equal to 2 x typical orifice hole size ($d_C = 2d$). The table below shows the diameter of each of the four typical orifice holes.

Table A-10. $\beta = 0.4^{(1)(2)}$

Line Size	3095MFCC	3095MFCP
1/2-in. (15 mm)	Not Available	0.249 (6.325)
1-in. (25 mm)	Not Available	0.420 (10.668)
1 1/2-in. (40 mm)	Not Available	0.644 (16.358)
2-in. (50 mm)	0.413 (10.490)	0.827 (21.006)
3-in. (80 mm)	0.614 (15.596)	1.227 (31.166)
4-in. (100 mm)	0.805 (20.447)	1.610 (40.894)
6-in. (150 mm)	1.213 (30.810)	2.426 (61.620)
8-in. (200 mm)	1.596 (40.538)	3.192 (81.077)

Table A-11. $\beta = 0.65^{(1)} (2)$

Line Size	3095MFCC	3095MFCP
1/2-in. (15 mm)	Not Available	0.404 (10.262)
1-in. (25 mm)	Not Available	0.682 (17.323)
1 1/2-in. (40 mm)	Not Available	1.047 (26.594)
2-in. (50 mm)	0.620 (15.748) ⁽³⁾	1.344 (34.138)
3-in. (80 mm)	0.997 (25.324)	1.994 (50.648)
4-in. (100 mm)	1.308 (33.223)	2.617 (66.472)
6-in. (150 mm)	1.971 (50.063)	3.942 (100.127)
8-in. (200 mm)	2.594 (65.888)	5.188 (131.775)

(1) Measurement is in inches (millimeters)

(2) Tolerance = ± 0.002 -in.

(3) Beta (β) = 0.60-in. (15.24 mm) for 2-in. line size only.

Weight

Line Size (in.)	Direct Mount (D3) ⁽¹⁾	Remote Mount (R3) ⁽¹⁾
1/2-in. (15 mm)	11.20 (5.08)	8.0 (3.63)
1-in. (25 mm)	11.70 (5.31)	8.5 (3.86)
1 1/2-in. (40 mm)	12.45 (5.65)	9.25 (4.20)
2-in. (50 mm)	13.20 (5.99)	10 (4.54)
3-in. (80 mm)	13.95 (6.32)	11.75 (5.33)
4-in. (100 mm)	14.95 (6.78)	13.5 (6.12)
6-in. (150 mm)	20.45 (9.28)	17.25 (7.83)
8-in. (200 mm)	24.95 (11.32)	21.75 (9.87)

(1) Measurement in lb (kg).

Installation Considerations

Straight Run Requirements

Table A-12. 3095MFCC Straight Pipe Requirements⁽¹⁾

	Beta	0.40	0.65
Upstream (inlet) side of primary	Reducer (1 line size)	2	2
	Single 90° bend or tee	2	2
	Two or more 90° bends in the same plane	2	2
	Two or more 90° bends in different plane	2	2
	Up to 10° of swirl	2	2
	Butterfly valve (75% to 100% open)	2	N/A
	Downstream (outlet) side of primary	2	2

Table A-13. 3095MFCP Straight Pipe Requirements⁽¹⁾⁽²⁾⁽³⁾

	Beta	0.40	0.65
Upstream (inlet) side of primary	Reducer	5	12
	Single 90° bend or tee	16	44
	Two or more 90° bends in the same plane	10	44
	Two or more 90° bends in different plane	50	60
	Expander	12	28
	Ball / Gate valve fully open	12	18
	Downstream (outlet) side of primary	6	7

(1) Consult an Emerson Process Management representative if disturbance is not listed.

(2) Recommended lengths represented in pipe diameters per ISO 5167.

(3) Refer to ISO 5167 for recommended lengths when using flow straighteners.

Pipe Orientation

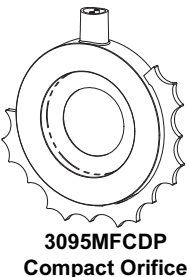
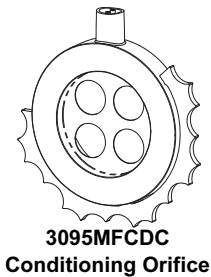
Pipe orientation for both 3095MFCC Compact Conditioning Mass Orifice and standard 3095MFCP Compact Mass Orifice.

Orientation/ Flow Direction	Process ⁽¹⁾		
	Gas	Liquid	Steam
Horizontal	D/R	D/R	D/R
Vertical Up	R	D/R	R
Vertical Down	D/R	NR	NR

(1) D = Direct mount acceptable (recommended)
R = Remote mount acceptable
NR = Not recommended

Pipe Centering

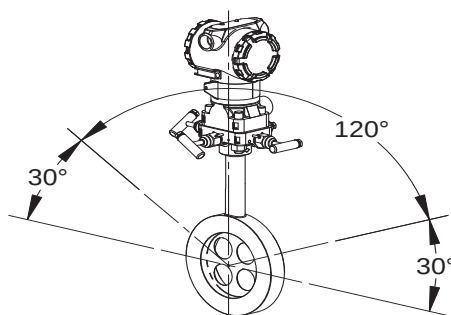
Improper centering of any orifice type device can cause an error of up to $\pm 5\%$ in small line sizes. A centering mechanism (centering ring) independent of flange rating comes standard with the 405 Compact Orifice Series.



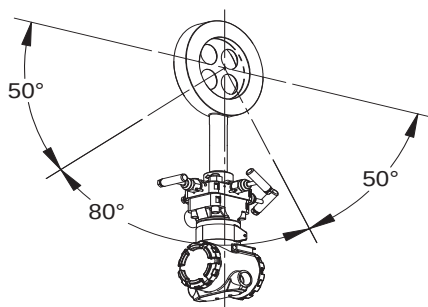
Flowmeter Orientation

Flowmeter orientation for both 3095MFC Conditioning Compact Orifice and standard Compact Orifice.

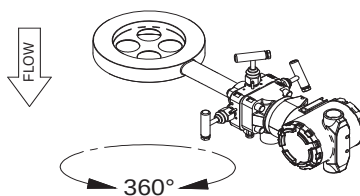
Gas (Horizontal)



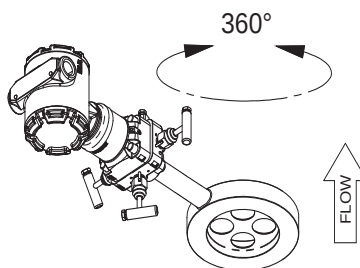
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



DIMENSIONAL DRAWINGS

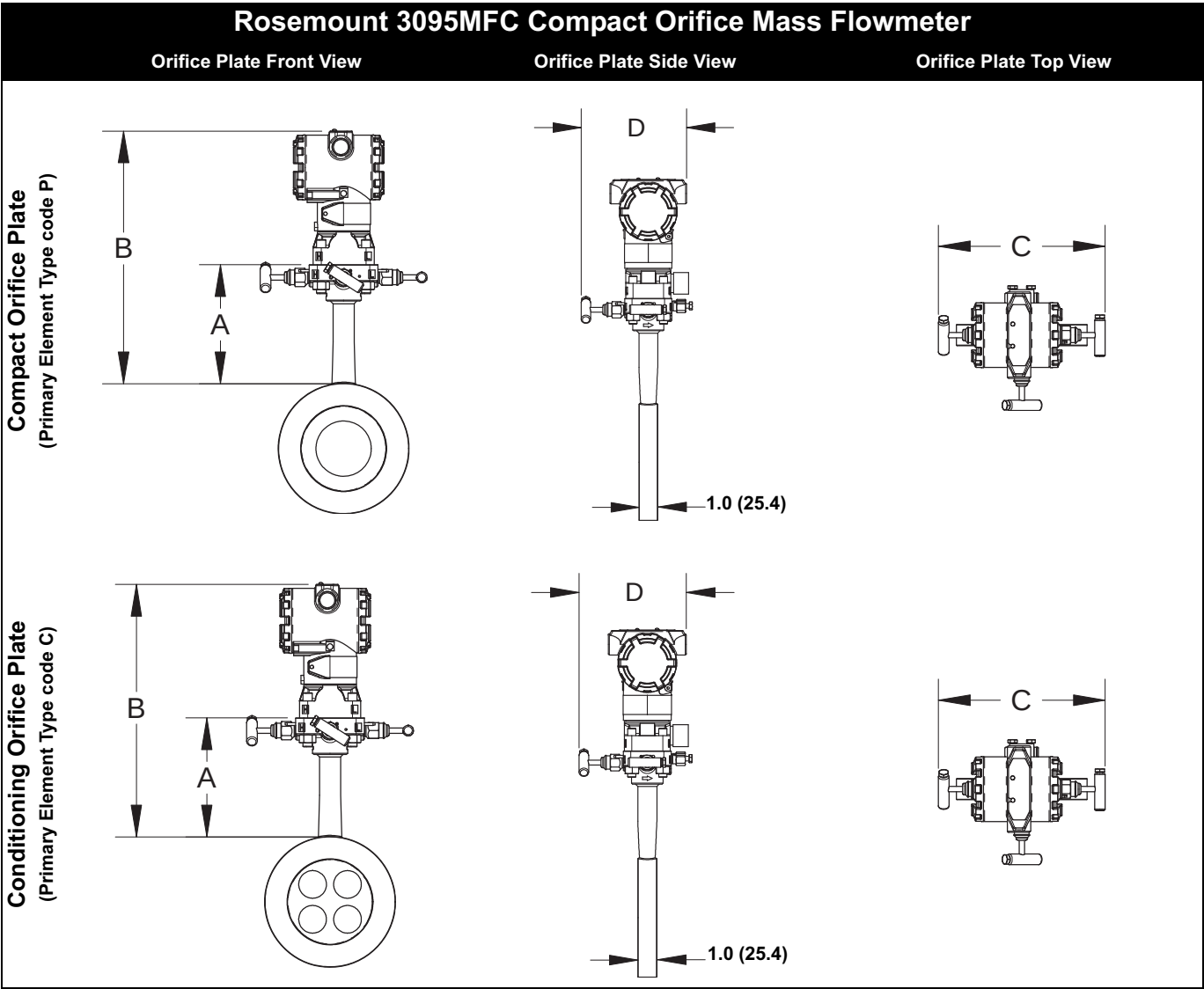


Table A-14. Dimensional Drawings⁽¹⁾

Plate Type	A	B	Transmitter Height	C	D
Type P & C	5.50 (140)	Transmitter Height + A	6.25 (159)	7.75 (197) - closed 8.25 (210) - open	6.0 (152) - closed 6.25 (159) - open

(1) Measurement is in inches (millimeters).

ORDERING INFORMATION

Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Model	Product Description	
3095MFC	Compact Orifice Mass Flowmeter	
Code	Primary Element Type	
C	Conditioning Orifice Plate	
P	Orifice Plate	
Code	Material Type	
S	316 Stainless Steel (SST)	
Code	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)	
Code	Primary Element Style	
N	Square Edged	
Code	Beta Ratio	
040	0.40 Beta Ratio (β)	
065 ⁽²⁾	0.65 Beta Ratio (β)	
Code	Temperature Measurement	
R	Remote Thermowell and RTD	
0	No Temperature Sensor	
Code	Electronics Connection Platform	
3	Direct-mount, 3-valve integral manifold, SST	
7	Remote-mount, 1/4-in. NPT connections	
Code	Differential Pressure Range	
1	0 to 25 in H ₂ O (0 to 62.2 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)	
Code	Static Pressure Range	
B	0 – 8 to 0 – 800 psia (0 –55.16 to 0 – 5515.8 kPa)	
C	0 – 8 to 0 – 800 psig (0 –55.16 to 0 – 5515.8 kPa)	
D	0 – 36.2 to 0 – 3626 psia (0 –250 to 0 – 25000 kPa)	
E	0 – 36.2 to 0 – 3626 psig (0 –250 to 0 – 25000 kPa)	
Code	Output Protocol	
A	4–20 mA with digital signal based on <i>HART</i> protocol	
V	<i>FOUNDATION</i> fieldbus protocol	
Code	Transmitter Housing Material	Conduit Entry Size
1A	Polyurethane-covered aluminum	1/2-14 NPT
1B	Polyurethane-covered aluminum	M20 x 1.5 (CM20)
1C	Polyurethane-covered aluminum	PG 13.5
1J	SST	1/2-14 NPT
1K	SST	M20 x 1.5 (CM20)
1L	SST	PG 13.5

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Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Code	Options
Performance Class	
U3 ⁽³⁾	Ultra for Flow: up to $\pm 0.70\%$ mass flow rate accuracy, up to 10:1 turndown, 10-year stability, limited 12-year warranty
PlantWeb Control Functionality	
A01 ⁽⁴⁾	Advanced Control Function Block Suite
Installation Accessories	
G	DIN alignment ring (PN 16)
H	DIN alignment ring (PN 40, 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 (Tmax = 850 °F)
Flow Calibration	
WC ⁽⁵⁾	Discharge coefficient verification (3 point)
WD ⁽⁵⁾	Discharge coefficient verification (full 10 point)
Pressure Testing	
P1	Hydrostatic Testing with certificate
Special Cleaning	
P2	Cleaning for special processes
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 data certificate for transmitter
Material Traceability Certification	
Q8	Material certification per ISO 10474 3.1.B and EN 10204 3.1.B
Code Conformance	
J2	ANSI B31.1
J3	ANSI B31.3
J4	ANSI B31.8
J5 ⁽⁶⁾	NACE MR-0175 / ISO 15156
Country Certification	
J1	Canadian Registration
Product Certifications	
E1	ATEX Flameproof
I1	ATEX Intrinsically Safe
N1	ATEX Type n
K1	ATEX Flameproof, Intrinsically Safe, Type n, and Dust (combination of E1, I1, N1, and ND)
ND	ATEX Dust
E5	FM Explosion proof
I5	FM Intrinsically Safe, non-incendive
K5	FM Explosion-proof, Intrinsically Safe, Non-Incendive
E6	CSA Explosion proof
I6	CSA Intrinsically Safe, Division 2
K6	CSA Explosion-proof, Intrinsically Safe, Division 2
IE ⁽⁷⁾	FM FISCO Intrinsically Safe; for FOUNDATION fieldbus protocol only
IF ⁽⁶⁾	CSA FISCO Intrinsically Safe; for FOUNDATION fieldbus protocol only
IA ⁽⁶⁾	ATEX FISCO Intrinsically Safe; for FOUNDATION fieldbus protocol only
IG ⁽⁶⁾	IECEx FISCO Intrinsically Safe

Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Alternative Transmitter Material of Construction

L1 Inert Sensor Fill Fluid

Display

M5 Integral mount LCD display

Terminal Blocks

T1 Transient Protection

Manifold for Remote Mount Option

F2 3-Valve Manifold, SST

F6 5-Valve Manifold, SST

Typical Model Number: 3051MFC C S 040 N 040 0 3 B A 1A

- (1) Not available for Primary Element Type code C.
- (2) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for Primary Element Type code C.
- (3) Ultra for Flow applicable for HART protocol, DP ranges 2 and 3 with SST isolator material and silicone fill fluid options only.
- (4) Function Blocks include: Arithmetic, Integrator, Analog Output, Signal Characterizer, Control Selector, and Output Selector.
- (5) Not available with Primary Element Type code P.
- (6) 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.
- (7) Consult factory for availability.

Rosemount 405 Compact Orifice Primary Element

SPECIFICATIONS

Performance

Discharge Coefficient Uncertainty

Table A-15. 405 Compact Orifice Primary Element

Type	Beta	Discharge Coefficient Uncertainty
405C	0.4	±0.50%
(Conditioning Compact)	0.65	±1.00%
405P ⁽¹⁾⁽²⁾	0.4	±1.75%
(Standard Compact)	0.65	±1.75%
405P ⁽³⁾	0.4	±1.25%
(Standard Compact)	0.65	±1.25%

(1) Line sizes $\frac{1}{2}$ to $1\frac{1}{2}$ -in. (12.7 to 38.1 mm).

(2) Discharge Coefficient Uncertainty for $\frac{1}{2}$ -in. units with Beta = 0.65 is ±2.25%.

(3) Line sizes 2 to 8-in. (50.8 to 203.2 mm)

Line Sizes

- $\frac{1}{2}$ -in. (15 mm) – not available for the 405C
- 1-in. (25 mm) – not available for the 405C
- $1\frac{1}{2}$ -in. (40 mm) – not available for the 405C
- 2-in. (50 mm)
- 3-in. (80 mm)
- 4-in. (100 mm)
- 6-in. (150 mm)
- 8-in. (200 mm)

Sizing

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

Functional

Service

- Liquid
- Gas
- Vapor

Operating Process Temperature Limits

Standard (direct/remote mount):

- -40 to 450 °F (-40 to 232 °C)

Extended (remote mount only with option code T):

- -148 to 850 °F (-100 to 454 °C)

Differential Pressure Limits

Maximum differential pressure (DP) up to 800 inH₂O.

Maximum Working Pressure

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

Vibration Limits

Qualified per IEC61298-3 (1998) for field with high vibration level or pipeline with high vibration level (10-60Hz 0.21mm displacement peak amplitude / 60 - 500Hz 3g).

The weight and length of the transmitter assembly shall not exceed 5.8 lbs and 7.75-in.

Physical

Assembly to a transmitter

Select option code C11 for the Rosemount 3051S transmitter (or option code S3 for the Rosemount 3051C or 3095M 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.

Material of Construction

Body/Plate

- 316 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.

Transmitter Connections

Direct Mount

- Integrally mount to 3051 and 3095 transmitters, range 1, 2, and 3.

Remote Mount

- Available with 1/4-in. (standard) or 1/2-in. (option code E) connections

Orifice Plate Type

- Square edged
- Corner tapped
- Concentric
- Wafer-style

Process Connections

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 alignment ring is included as standard when ordering.

Typical Orifice Hole Sizes (For 405C)

Beta is calculated by: $(\beta) = d_C / \text{Pipe ID}$, where the calculated bore is equal to 2 x typical orifice hole size ($d_C = 2d$). The table below shows the diameter of each of the four typical orifice holes.

Table A-16. $\beta = 0.4^{(1)(2)}$

Line Size	405C	405P
1/2-in. (15 mm)	Not Available	0.249 (6.325)
1-in. (25 mm)	Not Available	0.420 (10.668)
1 1/2-in. (40 mm)	Not Available	0.644 (16.358)
2-in. (50 mm)	0.413 (10.490)	0.827 (21.006)
3-in. (80 mm)	0.614 (15.596)	1.227 (31.166)
4-in. (100 mm)	0.805 (20.447)	1.610 (40.894)
6-in. (150 mm)	1.213 (30.810)	2.426 (61.620)
8-in. (200 mm)	1.596 (40.538)	3.192 (81.077)

Table A-17. $\beta = 0.65^{(1)(2)}$

Line Size	405C	405P
1/2-in. (15 mm)	Not Available	0.404 (10.262)
1-in. (25 mm)	Not Available	0.682 (17.323)
1 1/2-in. (40 mm)	Not Available	1.047 (26.594)
2-in. (50 mm)	0.620 (15.748) ⁽³⁾	1.344 (34.138)
3-in. (80 mm)	0.997 (25.324)	1.994 (50.648)
4-in. (100 mm)	1.308 (33.223)	2.617 (66.472)
6-in. (150 mm)	1.971 (50.063)	3.942 (100.127)
8-in. (200 mm)	2.594 (65.888)	5.188 (131.775)

(1) Measurement is in inches (millimeters)

(2) Tolerance = ± 0.002 -in.

(3) Beta (β) = 0.60 (15.24 mm) for 2-in. line size only.

Weight

Line Size (in.)	Direct Mount (D3) ⁽¹⁾	Remote Mount (R3) ⁽¹⁾
1/2-in. (15 mm)	4.0 (1.81)	8.0 (3.63)
1-in. (25 mm)	4.5 (2.04)	8.5 (3.86)
1 1/2-in. (40 mm)	5.25 (2.38)	9.25 (4.20)
2-in. (50 mm)	6.0 (2.72)	10 (4.54)
3-in. (80 mm)	6.75 (3.06)	11.75 (5.33)
4-in. (100 mm)	7.75 (3.52)	13.5 (6.12)
6-in. (150 mm)	13.25 (6.01)	17.25 (7.82)
8-in. (200 mm)	17.75 (8.05)	21.75 (9.87)

(1) Measurement in lb (kg).

Installation Consideration

Straight Pipe Requirement

Use the appropriate lengths of straight pipe upstream and downstream of the 405 to minimize the effects of moderate flow disturbances in the pipe. Table A-18 and Table A-19 lists recommended lengths of straight pipe per ISO 5167.

Table A-18. 405C Straight Pipe Requirements⁽¹⁾

Beta		0.40	0.65
Upstream (inlet side of primary)	Reducer (1 line size)	2	2
	Single 90° bend or tee	2	2
	Two or more 90° bends in the same plane	2	2
	Two or more 90° bends in different plane	2	2
	Up to 10° of swirl	2	2
	Butterfly valve (75% to 100% open)	2	N/A
Downstream (outlet) side of primary		2	2

Table A-19. 405P Straight Pipe Requirements⁽¹⁾⁽²⁾⁽³⁾

Upstream (inlet) side of primary	Beta	0.40	0.65
	Reducer	5	12
	Single 90° bend or tee	16	44
	Two or more 90 ° bends in the same plane	10	44
	Two or more 90° bends in different plane	50	60
	Expander	12	28
	Ball / Gate valve fully open	12	18
Downstream (outlet) side of primary		6	7

(1) Consult an Emerson Process Management representative if disturbance is not listed.

(2) Recommended lengths represented in pipe diameters per ISO 5167.

(3) Refer to ISO 5167 for recommended lengths when using flow straighteners.

Pipe Orientation

Orientation/ Flow Direction	Process ⁽¹⁾		
	Gas	Liquid	Steam
Horizontal	D/R	D/R	D/R
Vertical Up	R	D/R	R
Vertical Down	D/R	NR	NR

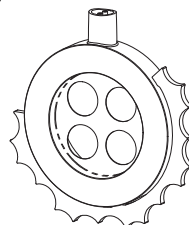
(1) D = Direct mount acceptable (recommended)

R = Remote mount acceptable

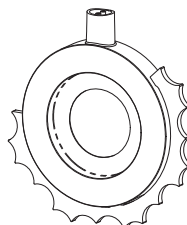
NR = Not recommended

Pipe Centering

Improper centering of any orifice type device can cause an error of up to $\pm 5\%$ in small line sizes. A centering mechanism (centering ring) independent of flange rating comes standard with the 405 Compact Orifice Series.



**405C Conditioning
Orifice**

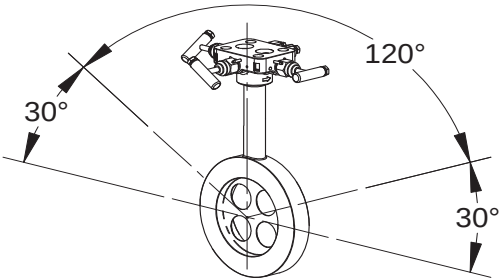


**405P Compact
Orifice**

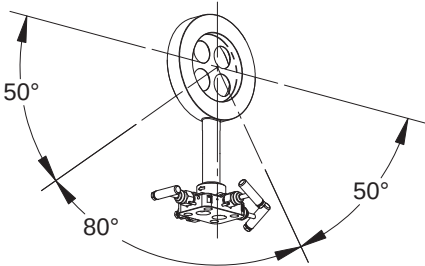
Flowmeter Orientation

Flowmeter orientation for the Conditioning Compact Orifice and standard Compact Orifice.

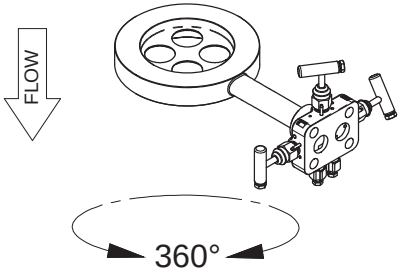
Gas (Horizontal)



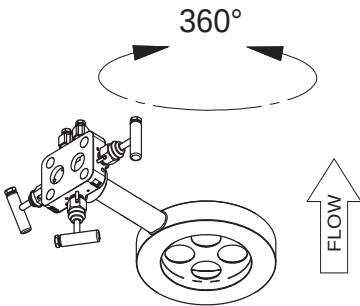
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



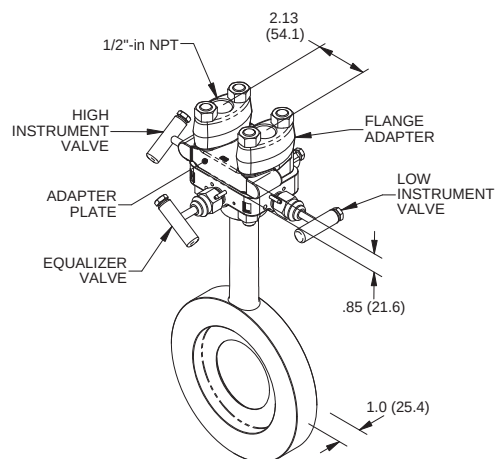
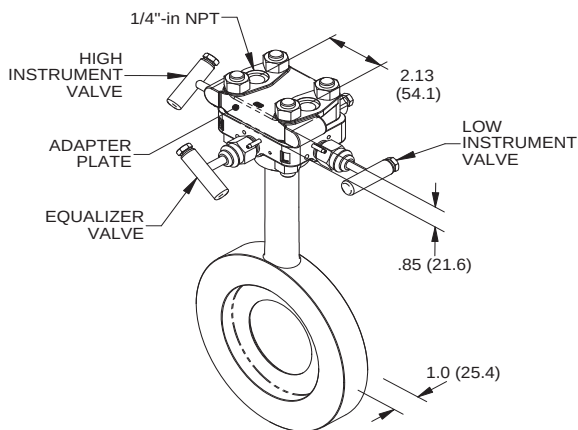
DIMENSIONAL DRAWINGS

Rosemount 405 Compact Orifice Plate (Attach to Transmitter)

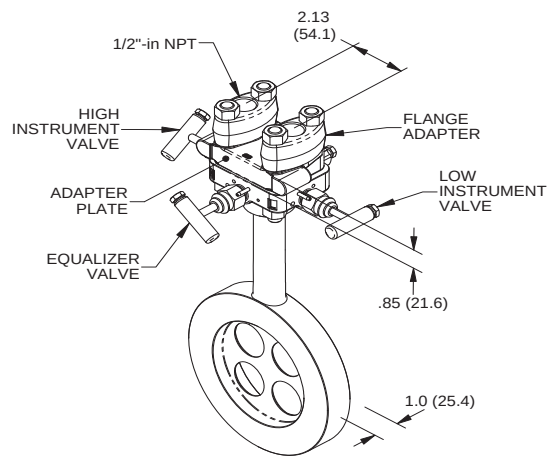
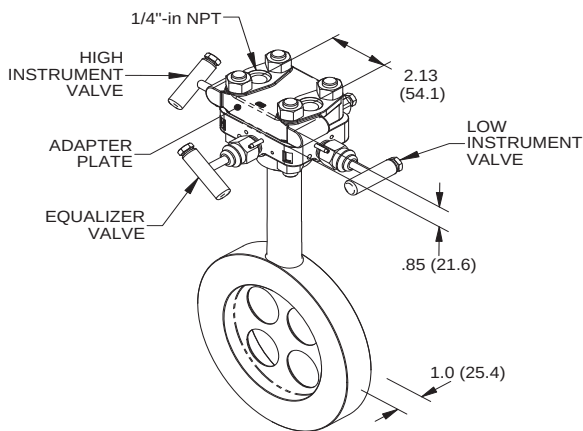
Adapter Plate (R3)

Flange Adapter (R3 with option E)

Compact Orifice Plate
(Primary Element Type code P)



Conditioning Orifice Plate
(Primary Element Type code C)

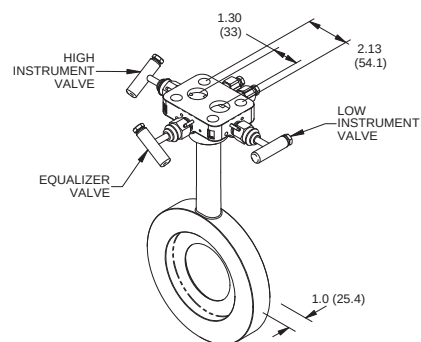
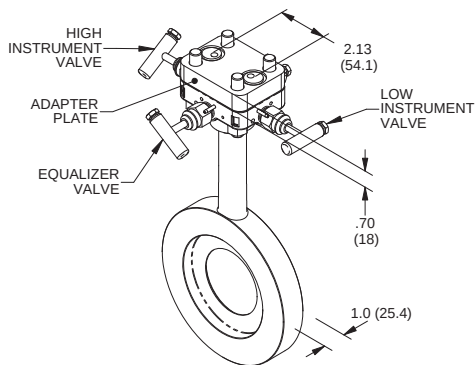


Rosemount 405 Compact Orifice Plate (Direct Mount)

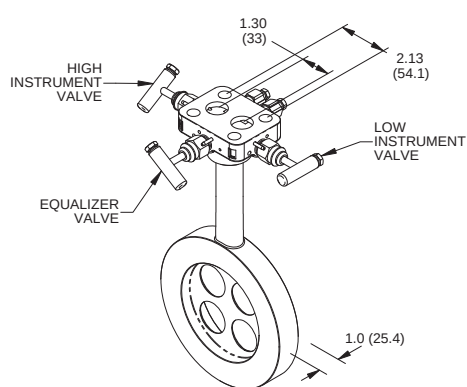
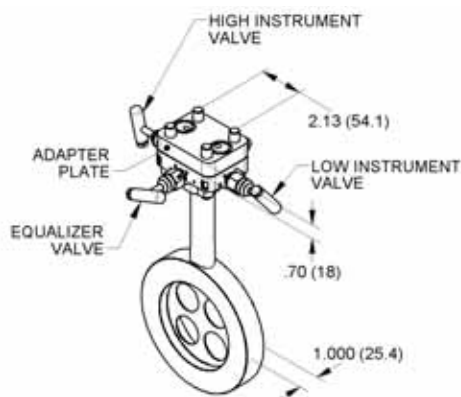
Front View (transmitter connection A3)

Front View (transmitter connection D3)

Compact Orifice Plate
(Primary Element Type code P)



Conditioning Orifice Plate
(Primary Element Type code C)



NOTE

Transmitter connection code A3 is to be used with a traditional style transmitter (such as a Rosemount 1151). This is a stainless steel adapter plate for allowing the direct mount of traditional style transmitters.

ORDERING INFORMATION

Rosemount 405 Compact Orifice Primary Element Ordering Information

Model	Product Description
405	Compact Primary Element
Code	Primary Element Type
C	Conditioning Orifice Plate
P	Orifice Plate
Code	Material Type
S	316 Stainless Steel (SST)
Code	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)
Code	Primary Element Style
N	Square Edged
Code	Beta Ratio
040	0.40 Beta Ratio (β)
065 ⁽²⁾	0.65 Beta Ratio (β)
Code	Transmitter Connection
D3	<i>Coplanar</i> , Direct mount, 3-valve integral manifold, SST
R3	Remote-mount, 1/4-in. NPT connections
A3	Traditional, Direct mount, 3-valve integral manifold with adapter plate, SST
Code	Options
Installation Accessories	
G	DIN alignment ring (PN 16)
H	DIN alignment ring (PN 40, PN 100)
B	JIS Alignment Ring 10K
R	JIS Alignment Ring 20K
S	JIS Alignment Ring 40K
Adapters	
E	Flange adapters 316 SST (1/2-in. NPT)
High Temperature Applications	
T	Graphite valve packing (Tmax = 850 °F)
Flow Calibration	
WC ⁽³⁾	Discharge coefficient verification (3 point)
WD ⁽³⁾	Discharge coefficient verification (full 10 point)
Pressure Testing	
P1	Hydrostatic testing with certificate
Special Cleaning	
P2	Cleaning for special processes
PA	Cleaning per ASTM G93 Level D (section 11.4)
Continued on Next Page	

Rosemount Compact Orifice Flowmeter Series

Reference Manual
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September 2007

Rosemount 405 Compact Orifice Primary Element Ordering Information

Special Inspection

QC1	Visual and Dimensional Inspection with certification
QC7	Inspection and performance certification

Material Traceability Certification

Q8	Material certification per ISO 10474 3.1.B and EN 10204 3.1.B
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Code Conformance

J2	ANSI B31.1
J3	ANSI B31.3
J4	ANSI B31.8
J5 ⁽⁴⁾	NACE MR-0175 / 15156

Country Certification

J1	Canadian Registration
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Typical Model Number: 405 C S 040 N 040 D3

(1) Not available for Primary Element Type code C.

(2) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for Primary Element Type code C.

(3) Not available with Primary Element Type code P.

(4) 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.

SPARE PARTS

Mounting Stud and Nut Kits

Part Number	Part Description
08951-0100-0101	1/2-in. 150# Mounting Kit
08951-0100-0102	1-in. 150# Mounting Kit
08951-0100-0103	1 1/2-in. 150# Mounting Kit
08951-0100-0104	2-in. 150# Mounting Kit
08951-0100-0105	3-in. 150# Mounting Kit
08951-0100-0106	4-in. 150# Mounting Kit
08951-0100-0107	6-in. 150# Mounting Kit
08951-0100-0108	8-in. 150# Mounting Kit
08951-0100-0201	1/2-in. 300# Mounting Kit
08951-0100-0202	1-in. 300# Mounting Kit
08951-0100-0203	1 1/2-in. 300# Mounting Kit
08951-0100-0204	2-in. 300# Mounting Kit
08951-0100-0205	3-in. 300# Mounting Kit
08951-0100-0206	4-in. 300# Mounting Kit
08951-0100-0207	6-in. 300# Mounting Kit
08951-0100-0208	8-in. 300# Mounting Kit
08951-0100-0301	1/2-in. 600# Mounting Kit
08951-0100-0302	1-in. 600# Mounting Kit
08951-0100-0303	1 1/2-in. 600# Mounting Kit
08951-0100-0304	2-in. 600# Mounting Kit
08951-0100-0305	3-in. 600# Mounting Kit
08951-0100-0306	4-in. 600# Mounting Kit
08951-0100-0307	6-in. 600# Mounting Kit
08951-0100-0308	8-in. 600# Mounting Kit

Gasket Kits

Part Number	Part Description
08951-0200-0101	1/2-in. 150# Gasket Kit
08951-0200-0102	1-in. 150# Gasket Kit
08951-0200-0103	1 1/2-in. 150# Gasket Kit
08951-0200-0104	2-in. 150# Gasket Kit
08951-0200-0105	3-in. 150# Gasket Kit
08951-0200-0106	4-in. 150# Gasket Kit
08951-0200-0107	6-in. 150# Gasket Kit
08951-0200-0108	8-in. 150# Gasket Kit
08951-0200-0201	1/2-in. 150# Gasket Kit
08951-0200-0202	1-in. 150# Gasket Kit
08951-0200-0203	1 1/2-in. 150# Gasket Kit
08951-0200-0204	2-in. 150# Gasket Kit
08951-0200-0205	3-in. 150# Gasket Kit
08951-0200-0206	4-in. 150# Gasket Kit
08951-0200-0207	6-in. 150# Gasket Kit
08951-0200-0208	8-in. 150# Gasket Kit
08951-0200-0301	1/2-in. 150# Gasket Kit
08951-0200-0302	1-in. 150# Gasket Kit
08951-0200-0303	1 1/2-in. 150# Gasket Kit
08951-0200-0304	2-in. 150# Gasket Kit
08951-0200-0305	3-in. 150# Gasket Kit
08951-0200-0306	4-in. 150# Gasket Kit
08951-0200-0307	6-in. 150# Gasket Kit
08951-0200-0308	8-in. 150# Gasket Kit

Remote Mount Retrofit Kits

Part Number	Part Description
08951-0300-0001	Remote Retrofit Kit, 1/4-in. NPT
08951-0300-0002	Remote Retrofit Kit, 1/2-in. NPT

Rosemount Compact Orifice Flowmeter Series

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Miscellaneous

Part Number	Part Description
08951-0400-0001	Drain / Vent Replacement Kit
08951-0401-0001	Valve Bonnet, SST
08951-0402-0001	Spare 1/2-in. Alignment Ring
08951-0402-0002	Spare 1-in. Alignment Ring
08951-0402-0003	Spare 1 1/2-in. Alignment Ring
08951-0402-0004	Spare 2-in. Alignment Ring
08951-0402-0005	Spare 3-in. Alignment Ring
08951--0402-0006	Spare 4-in. Alignment Ring
08951--0402-0007	Spare 6-in. Alignment Ring
08951--0402-0008	Spare 8-in. Alignment Ring
08951--0402-0009	Spare 1/2-in. Alignment Ring DN 15 (PN16/PN40/PN100)
08951--0402-0010	Spare 1-in. Alignment Ring DN 25 (PN16/PN40/PN100)
08951--0402-0011	Spare 1 1/2-in. Alignment Ring DN 40 (PN16/PN40/PN100)
08951--0402-0012	Spare 2-in. Alignment Ring DN 50 (PN16/PN40/PN100)
08951--0402-0013	Spare 3-in. Alignment Ring DN 80 (PN16/PN40/PN100)
08951--0402-0014	Spare 4-in. Alignment Ring DN 100 (PN16/PN40/PN100)
08951--0402-0015	Spare 6-in. Alignment Ring DN 150 (PN16)
08951--0402-0016	Spare 6-in. Alignment Ring DN 150 (PN16/PN40/PN100)
08951--0402-0017	Spare 8-in. Alignment Ring DN 200 (PN16)
08951--0402-0018	Spare 8-in. Alignment Ring DN 200 (PN16/PN40/PN100)
08951--0402-0019	Spare 1/2-in. Alignment Ring JIS DN15 (10K/20K/40K)
08951--0402-0020	Spare 1-in. Alignment Ring JIS DN25 (10K/20K/40K)
08951--0402-0021	Spare 1 1/2-in. Alignment Ring JIS DN40 (10K/20K/40K)
08951--0402-0022	Spare 2-in. Alignment Ring JIS DN50 (10K/20K/40K)
08951--0402-0023	Spare 3-in. Alignment Ring JIS DN80 (10K)
08951--0402-0024	Spare 3-in. Alignment Ring JIS DN80 (20K/40K)
08951--0402-0025	Spare 4-in. Alignment Ring JIS DN100 (10K/20K)
08951--0402-0026	Spare 4-in. Alignment Ring JIS DN100 (40K)
08951--0402-0027	Spare 6-in. Alignment Ring JIS DN150 (10K)
08951--0402-0028	Spare 6-in. Alignment Ring JIS DN150 (20K/40K)
08951--0402-0029	Spare 8-in. Alignment Ring JIS DN200 (10K/20K/40K)

Appendix B Product Certifications

3051SFC Product Certifications	page B-1
3095MFC Product Certifications	page B-6
Installation Drawings	page B-9

3051SFC PRODUCT CERTIFICATIONS

Approved Manufacturing Locations

Rosemount Inc. — Chanhassen, Minnesota USA
Emerson Process Management GmbH & Co. — Wessling, Germany
Emerson Process Management Asia Pacific Private Limited — Singapore
Beijing Rosemount Far East Instrument Co., LTD — Beijing, China

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found at www.rosemount.com. A hard copy may be obtained by contacting an Emerson Process Management representative.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the
ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)

Models 3051S_CA4; 3051S_CD2, 3, 4, 5; (*also with P9 option*) Pressure
Transmitters — QS Certificate of Assessment -
EC No. PED-H-20, Module H Conformity Assessment

All other Model 3051S Pressure Transmitters
— Sound Engineering Practice

Transmitter Attachments: Diaphragm Seal - Process Flange - Manifold —
Sound Engineering Practice

Primary Elements, Flowmeter
— See appropriate Primary Element QIG

Electro Magnetic Compatibility (EMC) (89/336/EEC)

All Models: EN 50081-1: 1992; EN 50082-2:1995;
EN 61326-1:1997 – Industrial

Ordinary Location Certification for FM

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).

Hazardous Locations Certifications

North American Certifications

FM Approvals

- E5** Explosion-proof for Class I, Division 1, Groups B, C, and D; dust-ignition proof for Class II and Class III, Division 1, Groups E, F, and G; hazardous locations; enclosure Type 4X, conduit seal not required when installed according to Rosemount drawing 03151-1003.
- I5** Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1; Class I, Zone 0 AEx ia IIC when connected in accordance with Rosemount drawing 03151-1006; Non-incendive for Class I, Division 2, Groups A, B, C, and D Enclosure Type 4X
For entity parameters see control drawing 03151-1006.

Canadian Standards Association (CSA)

- E6** Explosion-proof for Class I, Division 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, when installed per Rosemount drawing 03151-1013, CSA Enclosure Type 4X; conduit seal not required.
- I6** Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawings 03151-1016; For entity parameters see control drawing 03151-1016.

European Certifications

- I1** ATEX Intrinsic Safety
Certificate No.: BAS01ATEX1303X  II 1G
EEx ia IIC T5 (-60°C ≤ T_a ≤ 40°C)
T4 (-60°C ≤ T_a ≤ 70°C)
T4 (-60°C ≤ T_a ≤ 40°C) (FISCO)
cE 1180

Table B-1. Input Parameters

Loop / Power	Groups
$U_i = 30 \text{ V}$	HART / FOUNDATION Fieldbus/ Remote Display / SIS
$U_i = 17.5 \text{ V}$	FISCO
$I_i = 300 \text{ mA}$	HART / FOUNDATION Fieldbus/ Remote Display / SIS
$I_i = 380 \text{ mA}$	FISCO
$P_i = 1.0 \text{ W}$	HART / Remote Display / SIS
$P_i = 1.3 \text{ W}$	FOUNDATION Fieldbus
$P_i = 5.32 \text{ W}$	FISCO
$C_i = 30 \text{ nF}$	SuperModule™
$C_i = 11.4 \text{ nF}$	HART / SIS
$C_i = 0$	FOUNDATION Fieldbus / Remote Display / FISCO
$L_i = 0$	HART / FOUNDATION Fieldbus/ SIS / FISCO
$L_i = 60 \text{ } \mu\text{H}$	Remote Display

Special conditions for safe use (x)

1. The apparatus, excluding the Types 3051 S-T and 3051 S-C (In-line and Coplanar SuperModules respectively), is not capable of withstanding the 500V test as defined in Clause 6.4.12 of EN 50020. This must be considered during installation.
2. The terminal pins of the Types 3051 S-T and 3051 S-C must be protected to IP20 minimum.

N1 ATEX Type n
Certificate No.: BAS01ATEX3304X  II 3 G
EEx nL IIC T5 ($T_a = -40 \text{ }^\circ\text{C}$ TO $70 \text{ }^\circ\text{C}$)
 $U_i = 45 \text{ Vdc max}$
IP66


Special conditions for safe use (x)

The apparatus is not capable of withstanding the 500V insulation test required by Clause 9.1 of EN 50021: 1999. This must be taken into account when installing the apparatus.

ND ATEX Dust
Certificate No.: BAS01ATEX1374X  II 1 D
 $T_{105}^\circ\text{C}$ ($-20 \text{ }^\circ\text{C} \leq T_{amb} \leq 85 \text{ }^\circ\text{C}$)
 $V_{max} = 42.4 \text{ volts max}$
 $A = 24 \text{ mA}$
IP66
 1180

Special conditions for safe use (x)

1. The user must ensure that the maximum rated voltage and current (42.4 volts, 22 milliampere, DC) are not exceeded. All connections to other apparatus or associated apparatus shall have control over this voltage and current equivalent to a category “ib” circuit according to EN 50020.
2. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
3. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
4. Cable entries and blanking plugs must be suitable for the ambient range of the apparatus and capable of withstanding a 7J impact test.
5. The 3051S must be securely screwed in place to maintain the ingress protection of the enclosure.

E1 ATEX Flameproof

Certificate No.: KEMA00ATEX2143X  II 1/2 G

EEx d IIC T6 ($-50\text{ °C} \leq T_{\text{amb}} \leq 65\text{ °C}$)

EEx d IIC T5 ($-50\text{ °C} \leq T_{\text{amb}} \leq 80\text{ °C}$)

$V_{\text{max}} = 42.4\text{V}$

CE 1180

Special conditions for safe use (x)

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. The Model 3051S pressure transmitter must include a Series 300S housing integrally mounted to a Series Model 3051S Sensor module as per Rosemount drawing 03151-1023.

Australian Certifications

E7 SAA Explosion-proof and DIP

Certification No.: AUS Ex 3798X

Ex d IIC T6 ($T_a = 60\text{°C}$) IP66

DIP A21 TA T6 ($T_a = 60\text{°C}$) IP66

Special conditions for safe use (x)

1. It is a condition of manufacture that each transmitter module shall be pressure tested in accordance with clause 4.3 of AS 2380.2 at minimum pressure of 1450 kPa. As the model 300S housing passed tests at 4 times the reference pressures (400 kPa for single and 3800 kPa for dual compartment housing) and are not of welded construction, they may be exempted from the routing pressure test of clause 4.3 of AS 2380.2.
2. It is a condition of manufacture that each transmitter module and housing combination shall be subjected to a routine high voltage test in accordance with clause 6.2 of AS 2380.1, with the following variation. The test voltage applied to each single or dual compartment housing shall not be less than 500 V, 47 to 62 Hz, for a period of not less than one minute, with a breakdown current of less than 5 mA.

3. It is a condition of safe use that each housing shall be connected to external circuits via suitable conduit or Standards Australia certified cable glands. Where only one entry is used for connection to external circuits, the unused entry shall be closed by means of the blanking plug supplied by the equipment manufacturer or by a suitable Standards Australia certified blanking plug.
4. It is a condition of safe use that a dielectric strength test shall be applied whenever the terminal block is changed or replaced in either the dual compartment or single compartment housings. The breakdown current shall be less than 5 mA, when 500 V, 47 to 62 Hz, is applied for one minute. Note: if tested with an optional T1 transient protector terminal block fitted, the protection will operate and hence there will be no current indicated.
5. It is a condition of safe use that each transmitter module shall be used with a Model 300S housing, in order to comply with flameproof requirements.
6. It is a condition of safe use that each model 300S housing fitted with a transmitter module shall be marked with the same certification marking code information. Should the housing be replaced after initial supply to another model 300S housing, the replacement housing shall have the same certification marking code information as the housing it replaces.

IECEX Certifications

I7 IECEX Intrinsic Safety

Certificate No.: IECEXBAS04.0017X

Ex ia IIC T5 ($T_a = -60\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$) -*Hart/SIS/Remote Meter*

Ex ia IIC T4 ($T_a = -60\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$) -*Hart/SIS/Remote Meter*

Ex ia IIC T4 ($T_a = -60\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$) -*FOUNDATION Fieldbus*

Ex ia IIC T4 ($T_a = -60\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$) -*FISCO*

IP66

Table B-2. Input Parameters

Loop / Power	Groups
$U_i = 30\text{ V}$	<i>HART / FOUNDATION Fieldbus/ Remote Display / SIS</i>
$U_i = 17.5\text{ V}$	<i>FISCO</i>
$I_i = 300\text{ mA}$	<i>HART / FOUNDATION Fieldbus/ Remote Display / SIS</i>
$I_i = 380\text{ mA}$	<i>FISCO</i>
$P_i = 1.0\text{ W}$	<i>HART / Remote Display / SIS</i>
$P_i = 1.3\text{ W}$	<i>FOUNDATION Fieldbus</i>
$P_i = 5.32\text{ W}$	<i>FISCO</i>
$C_i = 30\text{ nF}$	<i>SuperModule™</i>
$C_i = 11.4\text{ nF}$	<i>HART / SIS</i>
$C_i = 0$	<i>FOUNDATION Fieldbus / Remote Display / FISCO</i>
$L_i = 0$	<i>HART / FOUNDATION Fieldbus/ SIS / FISCO</i>
$L_i = 60\text{ }\mu\text{H}$	<i>Remote Display</i>

Special conditions for safe use (x)

1.The Models 3051S *HART* 4-20mA, 3051S *Fieldbus*, 3051S *Profibus* and 3051S *FISCO* are not capable of withstanding the 500V test as defined in clause 6.4.12 of IEC 60079-11. This must be taken into account during installation.

2.The terminal pins of the Types 3051S-T and 3051S-C must be protected to IP20 minimum.

- N7** IECEx Type n
Certificate No.: IECExBAS04.0018X
Ex nC IIC T5 (Ta = -40 °C to 70 °C)
Ui = 45 Vdc MAX
IP66
Special conditions for safe use (x)
The apparatus is not capable of withstanding the 500 V insulation test required by Clause 8 of IEC 79-15: 1987.

Combinations of Certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

- K1** Combination of E1, I1, N1, and ND
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, I6 and E6
KC Combination of E5, E1, I5 and I1
KD Combination of E5, I5, E6, I6, E1, and I1

3095MFC PRODUCT CERTIFICATIONS

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)

3095M_2/3,4/D Flow Transmitters — QS Certificate of Assessment - EC No. PED-H-20
Module H Conformity Assessment

All other 3095_ Transmitters/Level Controller —
Sound Engineering Practice

Transmitter Attachments: Process Flange - Manifold —
Sound Engineering Practice

3095MFP Integral Orifice Mass Flowmeter —
Refer to declaration of conformity for 1195 Integral Orifice Series classification.

Electro Magnetic Compatibility (EMC) (89/336/EEC)

3095M Flow Transmitters

— EN 50081-1: 1992; EN 50082-2:1995;
EN 61326-1:1997 – Industrial

Ordinary Location Certification for Factory Mutual

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).

Hazardous Locations Certifications

North American Certifications

FM Approvals

- E5 Explosion Proof for Class I, Division 1, Groups B, C, and D.
Dust-Ignition Proof for Class II/Class III, Division 1, Groups E, F, and G.
Enclosure type NEMA 4X. Factory Sealed. Provides nonincendive RTD connections for Class I, Division 2, Groups A, B, C, and D.
- I5 Intrinsically Safe for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F, and G hazardous outdoor locations. Non-incendive for Class I, Division 2, Groups A, B, C, and D. Temperature Code T4. Factory Sealed.

For input parameters and installation see control drawing 03095-1020.

Canadian Standards Association (CSA)

- E6 Explosion Proof for Class I, Division 1, Groups B, C, and D.
Dust-Ignition Proof for Class II/Class III, Division 1, Groups E, F, and G.
CSA enclosure Type 4X suitable for indoor and outdoor hazardous locations. Provides nonincendive RTD connection for Class I, Division 2, Groups A, B, C, and D. Factory Sealed. Install in accordance with Rosemount Drawing 03095-1024. Approved for Class I, Division 2, Groups A, B, C, and D.
- I6 Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D. when installed in accordance with Rosemount drawing 03095-1021.
Temperature Code T3C.

For input parameters and installation see control drawing 03095-1021.

European Certifications

I1 ATEX Intrinsic Safety
Certificate Number: BAS98ATEX1359X  II 1 G

EEx ia IIC T5 ($T_{amb} = -45\text{ °C to }40\text{ °C}$)

EEx ia IIC T4 ($T_{amb} = -45\text{ °C to }70\text{ °C}$)

 1180

Table B-3. Connection Parameters (Power/Signal Terminals)

$U_i = 30\text{V}$

$I_i = 200\text{ mA}$

$P_i = 1.0\text{ W}$

$C_i = 0.012\text{ }\mu\text{F}$

$L_i = 0$

Table B-4. Temperature Sensor Connection Parameters

$U_o = 30\text{V}$

$I_o = 19\text{ mA}$

$P_o = 140\text{ mW}$

$C_i = 0.002\text{ }\mu\text{F}$

$L_i = 0$

Table B-5. Temp Sensor Terminals Connection Parameters

$C_o = 0.066\text{ }\mu\text{F}$

Gas Group IIC

$C_o = 0.560\text{ }\mu\text{F}$

Gas Group IIB

$C_o = 1.82\text{ }\mu\text{F}$

Gas Group IIA

$L_o = 96\text{ mH}$

Gas Group IIC

$L_o = 365\text{ mH}$

Gas Group IIB

$L_o = 696\text{ mH}$

Gas Group IIA

$L_o/R_o = 247\text{ }\mu\text{H/ohm}$

Gas Group IIC

$L_o/R_o = 633\text{ }\mu\text{H/ohm}$

Gas Group IIB

$L_o/R_o = 633\text{ }\mu\text{H/ohm}$

Gas Group IIA

Special Conditions for Safe Use

The 3095, when fitted with the transient terminal block (order code B), are not capable of withstanding the 500 volts insulation test required by EN50 020, Clause 6.4.12 (1994). This condition must be accounted for during installation.

N1 ATEX Type N

Certificate Number: BAS98ATEX3360X  II 3 G

EEx nL IIC T5 ($T_{amb} = -45\text{ °C to }40\text{ °C}$)

EEx nL IIC T4 ($T_{amb} = -45\text{ °C to }70\text{ °C}$)

$U_i = 55\text{V}$



The apparatus is designed for connection to a remote temperature sensor such as a resistance temperature detection (RTD)

Special Conditions for Safe Use

The 3095, when fitted with the transient terminal block (order code B), are not capable of withstanding the 500 volts insulation test required by EN50 021, Clause 9.1 (1995). This condition must be accounted for during installation.

E1 ATEX Flameproof
 Certificate Number: KEMA02ATEX2320X  II 1/2 G
 EEx d IIC T5 ($-50^{\circ}\text{C} \leq T_{\text{amb}} \leq 80^{\circ}\text{C}$)
 T6 ($-50^{\circ}\text{C} \leq T_{\text{amb}} \leq 65^{\circ}\text{C}$)
 € 1180

Special Conditions for Safe Use (x):

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.

ND ATEX Dust
 Certificate Number: KEMA02ATEX2321  II 1 D
 V = 55 Vdc MAX
 I = 23 mA MAX
 IP66
 € 1180

Combinations of Certifications

Stainless steel certification tag is provided when optional approval is specified. Once a device labeled with multiple approval types is installed, it should not be reinstalled using any other approval types. Permanently mark the approval label to distinguish it from unused approval types.

- K5 E5 and I5 combination
- K6 E6 and I6 combination
- K1 I1, N1, E1, and ND combination

INSTALLATION DRAWINGS

See the appropriate reference manual for the transmitter being used in the assembly.

- Rosemount 3051S Series Pressure Transmitter (document number 00809-0100-4801)

Rosemount 3095M Mass Flow Transmitter reference manual
(00809-0100-4716)

Rosemount Compact Orifice Flowmeter Series

Reference Manual
00809-0100-4810, Rev DA
September 2007

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