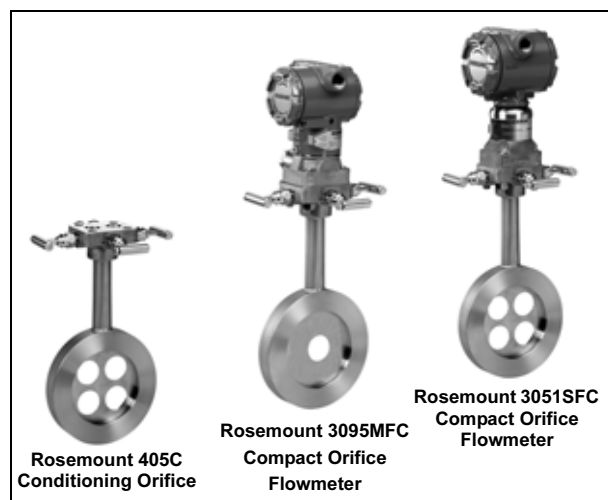


Rosemount Compact Orifice Flowmeter Series

- *Reduced installation cost compared to a traditional orifice plate*
- *Accurate and repeatable*
- *Easy-to-install direct mount assembly*
- *Self-centering*
- *Based on ASME/ISO corner tap design*
- *Patent-pending technology*
- *Scalable MultiVariable™ Transmitter enables pressure, temperature, and fully compensated mass and energy flow*
- *WirelessHART™ capabilities extend the full benefits of PlantWeb® to previously inaccessible locations*



WirelessHART
Expanding the Possibilities

HART
High Accuracy Real-time Communications

FOUNDATION

CE

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The Rosemount 405 Compact Orifice Series

Best-in-Class Integrated DP Flowmeters

By integrating Rosemount pressure transmitters with the 405 Compact Orifice Series primary element, Rosemount provides the highest performing DP Flowmeters. This fully integrated flowmeter eliminates the need for fittings, tubing, valves, adapters, manifolds, and mounting brackets, thereby reducing welding and installation time.

Less Expensive than an Orifice Plate Installation

Direct mounting minimizes total installed cost by reducing engineering, procurement, labor, and material expenditures while offering unsurpassed utility.

Direct Mount

A 3-valve isolation manifold and 1-in (25 mm) thick wafer-style body allows direct mounting while eliminating field connections between the process and the differential pressure-measuring device. The integral configuration results in a robust, inexpensive, and easy-to-install assembly.

Accurate and Repeatable

The 405C Conditioning Orifice is ideal for limited pipe run measurements in gas, liquid, or steam applications (8-in. (200 mm) nominal diameter and smaller lines). The 405C Conditioning Orifice delivers consistent and accurate measurements one would expect from traditional orifice plate technology.

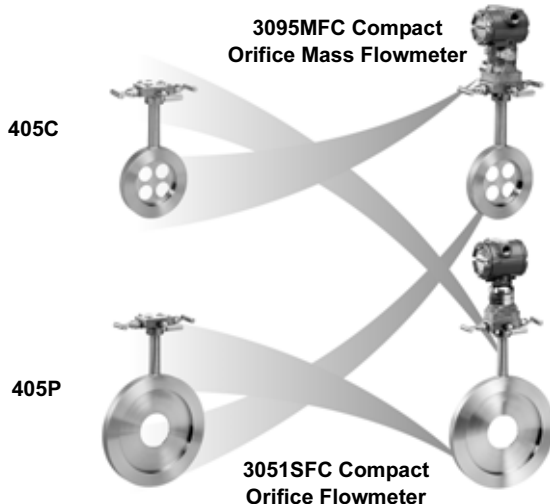
Centering Mechanism

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

Based on ASME/ISO Corner Tap Design

The incorporation of design features from proven standards results in a product that performs in a predictable manner and operates on well-known principles.

Rosemount pressure transmitters combined with the Rosemount 405 Compact Orifice create Best-in-Class Flowmeters



Advanced *PlantWeb*® Functionality



Rosemount orifice flowmeters power *PlantWeb* through a scalable architecture, advanced diagnostics, and MultiVariable capabilities. This reduces operational and maintenance expenditures while improving throughput and utilities management.

Rosemount Pressure Solutions

Rosemount 3051S Series of Instrumentation

Highest performing scalable pressure, flow and level measurement solutions drive better plant efficiency and more productivity. Innovative features include wireless, advanced diagnostics, and multivariable technologies.

Rosemount 3095 Mass Flow Transmitter

Accurately measures differential pressure, static pressure and process temperature to dynamically calculate fully compensated mass flow.

Rosemount 305, 306 and 304 Manifolds

Factory-assembled, calibrated and seal-tested transmitter-to-manifold assemblies reduce installation costs.

Rosemount 1199 Diaphragm Seals

Provides reliable, remote measurements of process pressure and protects the transmitter from hot, corrosive, or viscous fluids.

Orifice Plate Primary Element Systems: Rosemount 1495 and 1595 Orifice Plates, 1496 Flange Unions and 1497 Meter Sections

A comprehensive offering of orifice plates, flange unions and meter sections that are easy to specify and order. The 1595 Conditioning Orifice provides superior performance in tight fit applications.

Rosemount 3051SFA Annubar® Flowmeters, Rosemount 3095MFA Annubar Flowmeters, and Rosemount 485 Annubar Flowmeter Series

The state-of-the-art, fifth generation Rosemount 485 Annubar combined with the Rosemount MultiVariable transmitter technology creates an accurate, repeatable and dependable insertion-type flowmeter.

Rosemount 3051SFC Compact Orifice Flowmeters, Rosemount 3095MFC Compact Orifice Flowmeters, and Rosemount 405 Compact Orifice Flowmeter Series

Compact Orifice Flowmeters can be installed between existing flanges, up to a Class 600 (PN100) rating. A conditioning orifice plate version offers installation in tight fit applications requiring only two diameters of straight run upstream after a flow disturbance.

Rosemount 3051SFP Integral Orifice Flowmeters, Rosemount 3095MFP Integral Orifice Flowmeters, and Rosemount 1195 Integral Orifice Flowmeter Series

These integral orifice flowmeters eliminate the inaccuracies that become more pronounced in small orifice line installations. The completely assembled, ready to install flowmeters reduce cost and simplify installation.

405 Compact Orifice Series Selection Guide

Rosemount 3051SFC Compact Orifice Flowmeter

See ordering information on page 20.

- Combines the Rosemount 3051S scalable pressure transmitter with the 405 Compact Orifice Primary
- Utilize the 3051S MultiVariable pressure transmitter for differential pressure, static pressure and process temperature measurement combinations
- Accuracy up to $\pm 0.55\%$ of mass flow rate
- Provides superior calculations including fully compensated mass, energy, and totalized flow
- Accuracy up to $\pm 0.80\%$ of volumetric rate
- Remote display and interface assembly enables direct mounting with “at-grade” operator interface
- *FOUNDATION*® fieldbus protocol available



**3051SFC Compact
Orifice Flowmeter**



**3095MFC Compact Orifice
Flowmeter**

Rosemount 3095MFC Compact Orifice Flowmeter

See ordering information on page 34.

- Combines the Rosemount 3095MV MultiVariable mass flow transmitter with the 405 Compact Orifice Primary
- Accuracy up to $\pm 0.70\%$ of mass flow rate
- Measures differential pressure, static pressure, and process temperature (remotely) all in one flowmeter assembly
- Dynamically calculates compensated mass flow
- *FOUNDATION* fieldbus protocol available

Rosemount 405 Compact Orifice Primary

See ordering information on page 43.

- Integral manifold head allows direct mounting of DP transmitters
- Accuracy up to $\pm 0.5\%$ of discharge coefficient uncertainty
- Direct mounting capability to ANSI 600# rating
- Self-centering alignment ring



**405C Conditioning
Orifice**

**405P Compact
Orifice**

Rosemount 3051SFC Compact Orifice Flowmeter

SPECIFICATIONS

Performance

System Reference Accuracy

Fully-Compensated Mass, Energy, and Actual Volumetric Flow Accuracy

Flow performance specifications assume device is configured for full compensation of static pressure, process temperature, density, viscosity, gas expansion, discharge coefficient, and thermal correction variances over a specified operating range.

Percent (%) of flow rate

Type	Beta	Classic MV ⁽¹⁾ (8:1 flow turndown)	Ultra for Flow (14:1 flow turndown)
3051SFC1C	0.4 0.65	±0.60% ±1.05%	±0.55% ±1.00%
3051SFC1P ⁽²⁾	0.4 0.65 ⁽³⁾	±2.30%	±2.25%
3051SFC1P ⁽⁴⁾	0.4 0.65 ⁽³⁾	±1.80%	±1.75%
3051SFC1P ⁽⁵⁾	0.4 0.65 ⁽³⁾	±1.30%	±1.25%

(1) For a Range 1 DP sensor, add 0.25% uncertainty.

(2) Line size of 1/2-in. (15mm).

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

(4) Line sizes of 1-in. (25,4 mm) and 1 1/2-in. (38,1 mm).

(5) Line size of 2-in. (50,8 mm) and greater.

Uncompensated Flow Accuracy

Percent (%) of flow rate

Type	Beta	Classic (8:1 flow turndown)	Ultra (8:1 flow turndown)	Ultra for Flow (14:1 flow turndown)
3051SFCDC	0.4 0.65	±1.05% ±1.35%	±0.85% ±1.20%	±0.80% ±1.15%
3051SFCDP ⁽¹⁾	0.4 0.65 ⁽²⁾	±2.45%	±2.35%	±2.30%
3051SFCDP ⁽³⁾	0.4 0.65 ⁽²⁾	±2.00%	±1.90%	±1.85%
3051SFCDP ⁽⁴⁾	0.4 0.65 ⁽²⁾	±1.55%	±1.45%	±1.40%

(1) Line size of 1/2-in. (15mm).

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

(3) Line sizes of 1-in. (25,4 mm) and 1 1/2-in. (38,1 mm).

(4) Line size of 2-in. (50,8 mm) and greater.

Repeatability

±0.1%

Line Sizes

- 1/2-in. (15 mm) – not available for the 3051SFC_C
- 1-in. (25 mm) – not available for the 3051SFC_C
- 1 1/2-in. (40 mm) – not available for the 3051SFC_C
- 2-in. (50 mm)
- 3-in. (80 mm)
- 4-in. (100 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.

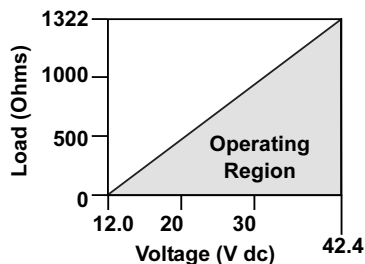
- 3051SFC with Measurement Type D (4–20 mA):
10.5 to 42.4 V dc with no load
- 3051SFC with Measurement Types 1-7:
12 to 42.4 V dc with no load
- 3051SFC HART Diagnostics transmitter:
12 to 42.4 Vdc with no load

Load Limitations

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

3051SFC with Measurement Types 1-7 3051S HART Diagnostics Transmitter (option code DA1)

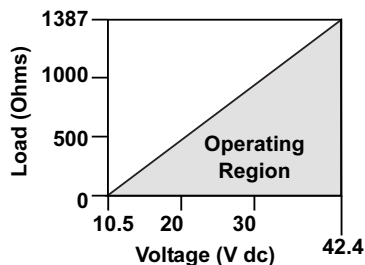
Maximum Loop Resistance = $43.5 * (\text{Power Supply Voltage} - 12.0)$



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

3051SFC with Measurement Type D

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



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

ASP™ Diagnostics Suite for HART

(3051SFC with Measurement Type D and option DA1)

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

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

FOUNDATION fieldbus

(3051SFC with Measurement Type D)

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.

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet

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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	35 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 Engineering Assistant.

ASP™ Diagnostics Suite for FOUNDATION fieldbus (Option Code D01)

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

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

Wireless Self-Organizing Networks (3051SFC with Measurement Type D only)

Output

WirelessHART, 2.4 GHz DSSS.

Wireless, 2.4 GHz DSSS or 900 MHz FHSS.

Local Display (WirelessHART only)

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

Local Display

The optional five-digit LCD can display primary variable in engineering units. Display updates at update rate up to once per minute.

Update Rate

WirelessHART, user selectable 8 sec. to 60 min.

Wireless, user selectable 15 sec. to 60 min.

Power Module (WirelessHART only)

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

(1) Reference conditions are 70 °F (21 °C), and routing data for three additional network devices.

NOTE: Continuous exposure to ambient temperature limits of -40 °F or 185 °F (-40 °C or 85 °C) may reduce specified life by less than 20 percent.

Power Module

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

(1) Reference conditions are 70 °F (21 °C), and routing data for three additional network devices.

NOTE: Continuous exposure to ambient temperature limits of -40 °F or 185 °F (-40 °C or 85 °C) may reduce specified life by less than 20 percent.

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

(1) Static pressure selection may affect pressure limitations.

Static Pressure Limit

3051SFC with Measurement Types 3, 4, 7, and D

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

4500 psig (310,3 bar) for option code P9

6092 psig (420 bar) for option code P0 (Classic only)

Range 1: 0.5 psia to 2000 psig (0,03 to 137,90 bar)

3051SFC with Measurement Types 1, 2, 5, and 6

Operates within 0.5 psia (0,03 bar) and the values in the table below:

Static Pressure	Differential Pressure		
	Range 1	Range 2	Range 3
Range D, J GP/AP	800 psi (57,91 bar)	800 psi (57,91 bar)	800 psi (57,91 bar)
Range E, K GP/AP	2000 psi (137,9 bar)	3626 psi (250 bar)	3626 psi (250 bar)

Burst Pressure Limits

Coplanar or traditional process flange

10000 psig (689,5 bar).

Overpressure Limits

Transmitters withstand the following limits without damage:

3051SFC with Measurement Types 3, 4, 7, and D

Range 1: 2000 psig (137,9 bar)

Ranges 2–3: 3626 psig (250,0 bar)

3051SFC with Measurement Types 1, 2, 5, and 6

Static Pressure	Differential Pressure		
	Range 1	Range 2	Range 3
Range D, J GP/AP	1600 psi (110,3 bar)	1600 psi (110,3 bar)	1600 psi (110,3 bar)
Range E, K GP/AP	2000 psi (137,9 bar)	3626 psi (250 bar)	3626 psi (250 bar)

Flowmeter Overpressure Limits⁽¹⁾

Standard ⁽¹⁾	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).

Process Temperature Limits

Direct Mount Transmitter

- -40 to 450 °F (-40 to 232 °C)

Remote Mount Transmitter

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

Transmitter Temperature Limits

Ambient

–40 to 185 °F (–40 to 85 °C)

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

With option code P0: –4 to 185 °F (–20 to 85 °C)

With Inert Fill⁽²⁾: 0 to 185 °F (–17 to 85 °C)

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

(2) Inert fill temperature limits only apply to 3051SFC with Measurement Types 1, 2, 5, and 6.

Storage

–50 to 230 °F (–46 to 110 °C)

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

With wireless output (code X): –40 to 185 °F (–40 to 85 °C)

With Inert Fill⁽¹⁾: 0 to 185 °F (–17 to 85 °C)

(1) Inert fill temperature limits only apply to 3051SFC with Measurement Types 1, 2, 5, and 6.

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.

Humidity Limits

- 0–100% relative humidity

Turn-On Time

Performance within specifications less than 5 seconds for 3051SFC with Measurement Types 1–7 and 2 seconds for 3051SFC with Measurement Type D (typical) after power is applied to the transmitter.

Damping

Analog output response to a step change is user-selectable from 0 to 60 seconds for one time constant. For 3051SFC with measurement types 1–7, differential pressure (DP), static pressure (AP/GP), process temperature (PT), Mass Flow, and Energy Flow can be individually adjusted. This software damping is in addition to sensor module response time.

Failure Mode Alarm

HART 4-20mA (output option code A)

If self-diagnostics detect a gross transmitter failure, the analog signal will be driven offscale to alert the user. Rosemount standard (default), NAMUR, and custom alarm levels are available (see Table 1).

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

TABLE 1. 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 SIS Safety Transmitter (option QT).

Rosemount Compact Orifice Flowmeter Series

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Safety-Certified Transmitter Failure Values (3051SFC with Measurement Type D Only)

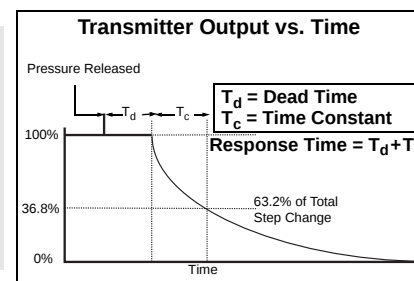
Safety accuracy: 2.0%⁽¹⁾

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⁽¹⁾

	4 - 20 mA (HART) ⁽²⁾	Fieldbus protocol ⁽³⁾⁽⁴⁾	Typical Transmitter Response Time
Total Response Time (Td + Tc)⁽⁵⁾			
3051SFC with Measurement			
Types 1-7:			
DP Range 1:	310 milliseconds		
DP Range 2:	170 milliseconds		
DP Range 3:	155 milliseconds		
AP & GP:	240 milliseconds		
Type D⁽⁶⁾:			
DP Ranges 2-3:	100 milliseconds	152 milliseconds	
DP Range 1:	255 milliseconds	307 milliseconds	
Dead Time (Td)			
3051SFC with Measurement			
Types 1-7:			
DP:	100 milliseconds		
AP & GP:	140 milliseconds		
Type D⁽⁷⁾:			
DP:	45 milliseconds (nominal)	97 milliseconds	
Types 1, 3, 5, and 7 only:			
Process Temp RTD Interface:	1 second		
Update Rate			
3051SFC with Measurement			
Types 1-7:			
DP:	22 times per second		
Type D:			
DP:	22 times per second	22 times per second	
Types 1, 2, 5, and 6 only:			
AP & GP:	11 times per second		
Types 1, 3, 5, and 7 only:			
Process Temp RTD Interface:	1 time per second		
Types 1-4 Calculated Variables:			
Mass or Volumetric Flow Rate:	22 times per second		
Energy Flow Rate:	22 times per second		
Totalized Flow:	1 time per second		



(1) Does not apply to wireless output code X. See "Wireless Self-Organizing Networks (3051SFC with Measurement Type D only)" on page 6 for wireless transmit rate.

(2) Dead time and update rate apply to all models and ranges; analog output only

(3) Transmitter fieldbus output only, segment macro-cycle not included.

(4) FOUNDATION fieldbus not applicable with 3051SFC with Measurement Types 1-7.

(5) Nominal total response time at 75 °F (24 °C) reference conditions.

(6) For option code DA1, add 45 milliseconds (nominal) to 4-20 mA (HART) total response time values.

(7) For option code DA1, dead time (Td) is 90 milliseconds (nominal).

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Rosemount Compact Orifice Flowmeter Series

Physical

Temperature Measurement

Remote RTD

- 100 Ohm platinum with $\frac{1}{2}$ -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

- $\frac{1}{2}$ -in. x $\frac{1}{2}$ -in. NPT, 316 SST

Electronic Connections for Remote Mount

$\frac{1}{2}$ –14 NPT, G $\frac{1}{2}$, 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.

Process-Wetted Parts

Integral Manifolds / Remote Manifolds

316 SST

Process Isolating Diaphragms

316L SST (UNS S31603)

Alloy C-276 (UNS N10276)

Drain/Vent Valves

316 SST, Alloy C-276, or Alloy 400/K-500 material

(Drain vent seat: Alloy 400, Drain vent stem: Alloy K-500)

Process Flanges and Adapters

Plated carbon steel

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

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

Cast Alloy 400: M-30C per ASTM A494

Wetted O-rings

Glass-filled PTFE

(Graphite-filled PTFE with Isolating Diaphragm code 6)

Non-Wetted Parts

Electronics Housing

Low-copper aluminum alloy or SST: CF-3M (Cast 316L SST)

or CF-8M (Cast 316 SST) NEMA 4X, IP 66,

IP 68 (66 ft (20 m) for 168 hours)

Note: IP 68 not available with Wireless Output

Coplanar Sensor Module Housing

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

Sensor Module Fill Fluid

Silicone or inert halocarbon (Inert is not available with 3051S_CA). In-Line series uses Fluorinert® FC-43.

Sensor mounting (including nuts, bolts, and gasket)

SST

Bolts

CS

Paint

Polyurethane

Cover O-rings

Buna-N

Wireless Antenna

PBT/ polycarbonate (PC) integrated omnidirectional antenna

Power Module

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

Transmitter Connections

Remote Mount

- Available with $\frac{1}{4}$ -in. (standard) or $\frac{1}{2}$ -in. (option code E) connections

Orifice Type

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

Rosemount Compact Orifice Flowmeter Series

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December 2008

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 3051SFC_C)

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 2. $\beta = 0.4$ ⁽¹⁾

Line Size	3051SFC_C	3051SFC_P
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)

(1) Tolerance = ± 0.002 -in.

TABLE 3. $\beta = 0.65$ ⁽¹⁾⁽²⁾

Line Size	3051SFC_C	3051SFC_P
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)

(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)

(1) Measurement in lb (kg).

Installation Considerations

Straight Run Requirements

TABLE 4. 3051SFC_C 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
Downstream (outlet) side of primary	Butterfly valve (75% to 100% open)	2	N/A
		2	2

TABLE 5. 3051SFC_P 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
Downstream (outlet) side of primary	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.

Pipe Orientation

Pipe orientation for both 3051SFC_C Compact Conditioning and standard 3051SFC_P 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)

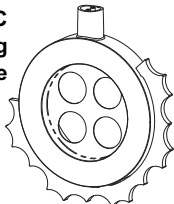
R = Remote mount acceptable

NR = Not recommended

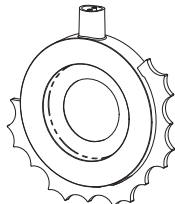
Pipe Centering

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

**3051SFC_C
Conditioning
Orifice**



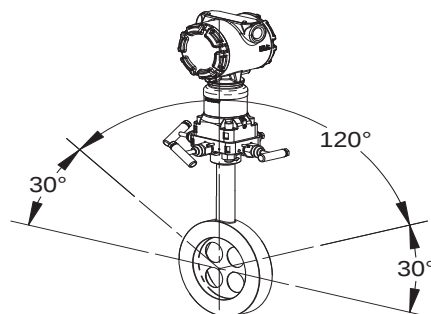
**3051SFC_P
Compact
Orifice**



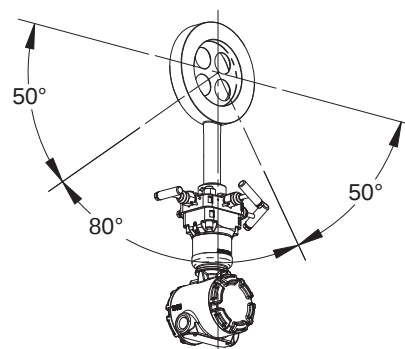
Flowmeter Orientation

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

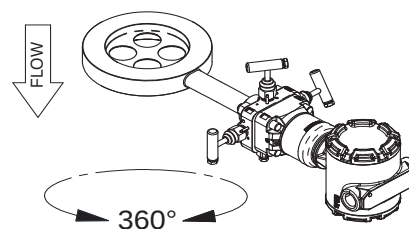
Gas (Horizontal)



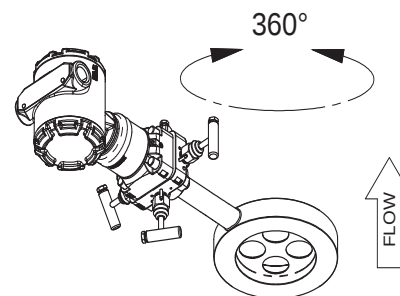
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



Rosemount 3051SFC with Measurement Types 1-7 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

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).

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 with Differential Pressure Ranges = 2 to 5 inclusive with Static Pressure = Range 4 only. P9 and P0 options also.
All other Model 3051SMV 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) (2004/108/EC)

EN 61326-1:2006 and EN 61326-2-3:2006

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.
- 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 03151-1206; Non-incendive for Class I, Division 2, Groups A, B, C, and D Enclosure Type 4X
For entity parameters see control drawing 03151-1206.

Canadian Standards Association (CSA)

All CSA hazardous approved transmitters are certified per ANSI/ISA 12.27.01-2003.

- 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, 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 03151-1207;
For entity parameters see control drawing 03151-1207.

European Certifications

- I1** ATEX Intrinsic Safety
Certificate No.: 08ATEX0064X  II 1G
Ex ia IIC T4 (T_a = -60 °C to 70 °C) -HART
CE 1180

Input Parameters

Loop / Power	Groups
U _i = 30 V	HART
I _i = 300 mA	HART
P _i = 1.0 W	HART
C _i = 14.8 nF	HART
L _i = 0	HART

Special conditions for safe use (x)

The apparatus is not capable of withstanding the 500V test as defined in Clause 6.3.12 of EN 60079-11. This must be considered during installation.

- N1** ATEX Type n
Certificate No.: Baseefa 08ATEX0065X  II 3 G
Ex nA nL IIC T4 (T_a = -40 °C TO 70 °C)
U_i = 45 Vdc max
IP66
CE

Special conditions for safe use (x)

The apparatus is not capable of withstanding the 500V insulation test required by Clause 6.8.1 of EN 60079-15. This must be taken into account when installing the apparatus.

- ND** ATEX Dust
Certificate No.: BAS01ATEX1303X  II 1 D
T105°C (-20 °C ≤ T_{amb} ≤ 85 °C)
V_{max} = 42.4 volts max
A = 24 mA
IP66
CE 1180

Special conditions for safe use (x)

1. The user must ensure that the maximum rated voltage and current (42.4 volts, 22 milliamperes, 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 60079-11.
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 3051SMV must be securely screwed in place to maintain the ingress protection of the enclosure. (The 3051SMV SuperModule must be properly assembled to the 3051SMV housing to maintain ingress protection.)

E1 ATEX Flameproof
Certificate No.: KEMA 00ATEX2143X  II 1/2 G
Ex d IIC T6 (-50 °C ≤ T_{amb} ≤ 65 °C)
Ex d IIC T5 (-50 °C ≤ T_{amb} ≤ 80 °C)
V_{max} = 42.4V
CE 1180

Special conditions for safe use (x)

1. Appropriate ex d blanking plugs, cable glands, and wiring needs to be suitable for a temperature of 90 °C.
2. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for maintenance shall be followed in detail to assure safety during its expected lifetime.
3. The 3051SMV does not comply with the requirements of IEC 60079-1 Clause 5.2, Table 2 for all joints. Contact Emerson Process Management for information on the dimensions of flameproof joints.

Japanese Certifications

- E4** TIIS Flameproof
Consult factory for availability
- I4** TIIS Intrinsically Safe
Consult factory for availability

China (NEPSI) Certifications

- E3** China Flameproof
Ex d II B+H₂T3~T5
- I3** China Intrinsic Safety
Ex ia IIC T3/T4

IECEX Certifications

- I7** IECEX Intrinsic Safety
Certificate No.: IECEXBAS08.0025X
Ex ia IIC T4 (T_a = -60 °C to 70 °C) -HART
IP66

Input Parameters

Loop / Power	Groups
U _i = 30 V	HART
I _i = 300 mA	HART
P _i = 1.0 W	HART
C _i = 14.8 nF	HART
L _i = 0	HART

Special conditions for safe use (x)

The 3051SMV HART 4-20mA is not capable of withstanding the 500V test as defined in clause 6.3.12 of IEC 60079-11. This must be taken into account during installation.

- N7** IECEX Type n
Certificate No.: IECEXBAS08.0026X
Ex nAnL IIC T4 (T_a = -40 °C to 70 °C)
U_i = 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 6.8.1 of IEC 60079-15.

- E7** IECEX Flameproof
Certificate No.: IECEXKEM08.0010X
Ex d IIC T6 (-50 °C ≤ T_{amb} ≤ 65 °C)
Ex d IIC T5 (-50 °C ≤ T_{amb} ≤ 80 °C)
V_{max} = 42.4V

Special conditions for safe use (x)

1. Appropriate ex d blanking plugs, cable glands, and wiring needs to be suitable for a temperature of 90 °C.
2. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for maintenance shall be followed in detail to assure safety during its expected lifetime.
3. The 3051SMV does not comply with the requirements of IEC 60079-1 Clause 5.2, Table 2 for all joints. Contact Emerson Process Management for information on the dimensions of flameproof joints.

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
- K2** Combination of E2 and I2
- K4** Combination of E4 and I4
- K5** Combination of E5 and I5
- K6** Combination of E6 and I6
- K7** Combination of E7, I7, and N7
- KA** Combination of E1, E6, I1, and I6
- KB** Combination of E5, E6, I5, and I6
- KC** Combination of E5, E1, I5 and I1
- KD** Combination of E5, E6, E1, I5, I6, and I1

Rosemount 3051SFC with Measurement Type D 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
Emerson Process Management LTDA — Sorocaba, Brazil
Emerson Process Management (India) Pvt. Ltd. — Daman, India

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).

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-100, 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) (2004/108/EC)

EN 61326-1:1997 + A1, A2, and A3 – Industrial

Radio and Telecommunications Terminal Equipment Directive (R&TTE)(1999/5/EC)

Emerson Process Management complies with the R&TTE Directive.

HART & FOUNDATION Fieldbus 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/IE 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)

All CSA hazardous approved transmitters are certified per ANSI/ISA 12.27.01-2003.

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/IF 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/IA ATEX Intrinsic Safety

Certificate No.: BAS01ATEX1303X  II 1G
Ex ia IIC T4 (T_a = -60 °C to 70 °C) -HART/Remote
Display/Quick Connect/HART Diagnostics
Ex ia IIC T4 (T_a = -60 °C to 70 °C) -FOUNDATION fieldbus
Ex ia IIC T4 (T_a = -60 °C to 40 °C) -FISCO
CE 1180

Input Parameters

Loop / Power	Groups
U _i = 30 V	HART / FOUNDATION fieldbus/ Remote Display / Quick Connect / HART Diagnostics
U _i = 17.5 V	FISCO
I _i = 300 mA	HART / FOUNDATION fieldbus/ Remote Display / Quick Connect / HART Diagnostics
I _i = 380 mA	FISCO
P _i = 1.0 W	HART / Remote Display / Quick Connect / HART Diagnostics
P _i = 1.3 W	FOUNDATION fieldbus
P _i = 5.32 W	FISCO
C _i = 30 nF	SuperModule Platform / Quick Connect
C _i = 11.4 nF	HART / HART Diagnostics
C _i = 0	FOUNDATION fieldbus / Remote Display / FISCO
L _i = 0	HART / FOUNDATION fieldbus/ FISCO / Quick Connect / HART Diagnostics
L _i = 60 µH	Remote Display

Special conditions for safe use (x)

- The apparatus, excluding the Types 3051 S-T and 3051 S-C (In-line and Coplanar SuperModule Platforms 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.
- The terminal pins of the Types 3051 S-T and 3051 S-C must be protected to IP20 minimum.

Product Data Sheet

00813-0100-4810, Rev JA

December 2008

Rosemount Compact Orifice Flowmeter Series

N1 ATEX Type n

Certificate No.: BAS01ATEX3304X  II 3 G

EEx nAnL IIC T4 ($T_a = -40\text{ °C TO } 70\text{ °C}$)

$U_i = 45\text{ Vdc max}$

IP66



Special conditions for safe use (x)

The apparatus is not capable of withstanding the 500V insulation test required by Clause 6.8.1 of EN 60079-15.

This must be taken into account when installing the apparatus.

ND ATEX Dust

Certificate No.: BAS01ATEX1374X  II 1 D

$T_{105\text{ °C}} (-20\text{ °C} \leq T_{\text{amb}} \leq 85\text{ °C})$

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

$A = 22\text{ mA}$

IP66

 1180

Special conditions for safe use (x)

1. The user must ensure that the maximum rated voltage and current (42.4 volts, 22 milliamperes, 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. (The 3051S SuperModule must be properly assembled to the 3051S housing to maintain ingress protection.)

E1 ATEX Flameproof

Certificate No.: KEMA00ATEX2143X  II 1/2 G

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

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

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

 1180

Special conditions for safe use (x)

1. Appropriate ex d blanking plugs, cable glands, and wiring needs to be suitable for a temperature of 90 °C.
2. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for maintenance shall be followed in detail to assure safety during its expected lifetime.
3. The 3051S does not comply with the requirements of EN 60079-1 Clause 5.2, Table 2 for all joints. Contact Emerson Process Management for information on the dimensions of flameproof joints.

Japanese Certifications

E4 TIIS Flameproof

Ex d IIC T6

Certificate	Description
TC15682	Coplanar with Junction Box Housing
TC15683	Coplanar with PlantWeb Housing
TC15684	Coplanar with PlantWeb Housing and LCD Display
TC15685	In-Line SST with Junction Box Housing
TC15686	In-Line Alloy C-276 with Junction Box Housing
TC15687	In-Line SST with PlantWeb Housing
TC15688	In-Line Alloy C-276 with PlantWeb Housing
TC15689	In-Line SST with PlantWeb Housing and LCD Display
TC15690	In-Line Alloy C-276 with PlantWeb Housing and LCD Display
TC17102	Remote Display

China (NEPSI) Certifications

I3 China Intrinsic Safety

Certificate No. (manufactured in Chanhassen, MN):

GYJ081078

Certificate No. (manufactured in Singapore): GYJ06367

Ex ia IIC T3~T5

Input Parameters

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

E3 China Flameproof

Certificate No.: GYJ06366

Ex d IIB+H₂ T3~T5

IECEEx Certifications

E7 IECEEx Flameproof

Certificate No.: IECEExKEM08.0010X

Ex d IIC T6 (-50 °C ≤ T_{amb} ≤ 65 °C)

Ex d IIC T5 (-50 °C ≤ T_{amb} ≤ 80 °C)

V_{max} = 42.4V

Special conditions for safe use (x)

1. Appropriate ex d blanking plugs, cable glands, and wiring needs to be suitable for a temperature of 90 °C.
2. This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for maintenance shall be followed in detail to assure safety during its expected lifetime.
3. The 3051S does not comply with the requirements of IEC 60079-1 Clause 5.2, Table 2 for all joints. Contact Emerson Process Management for information on the dimensions of flameproof joints.

I7/IG IECEEx Intrinsic Safety

Certificate No.: IECEExBAS04.0017X

Ex ia IIC T4 (T_a = -60 °C to 70 °C) -HART/Remote

Display/Quick Connect/HART Diagnostics

Ex ia IIC T4 (T_a = -60 °C to 70 °C) -FOUNDATION fieldbus

Ex ia IIC T4 (T_a = -60 °C to 40 °C) -FISCO

IP66

Input Parameters

Loop / Power	Groups
U _i = 30 V	HART / FOUNDATION fieldbus/ Remote Display / Quick Connect / HART Diagnostics
U _i = 17.5 V	FISCO
I _i = 300 mA	HART / FOUNDATION fieldbus/ Remote Display / Quick Connect / HART Diagnostics
I _i = 380 mA	FISCO
P _i = 1.0 W	HART / Remote Display / Quick Connect / HART Diagnostics
P _i = 1.3 W	FOUNDATION fieldbus
P _i = 5.32 W	FISCO
C _i = 30 nF	SuperModule Platform / Quick Connect
C _i = 11.4 nF	HART / HART Diagnostics
C _i = 0	FOUNDATION fieldbus / Remote Display / FISCO / Quick Connect / HART Diagnostics
L _i = 0	HART / FOUNDATION fieldbus / FISCO / Quick Connect / HART Diagnostics
L _i = 60 μH	Remote Display

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 IECEEx Type n

Certificate No.: IECEExBAS04.0018X

Ex nC IIC T4 (T_a = -40 °C to 70 °C)

U_i = 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 60079-15.

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

K2 Combination of E2 and I2

K5 Combination of E5 and I5

K6 Combination of E6 and I6

K7 Combination of E7, I7, and N7

KA Combination of E1, I1, E6, and I6

KB Combination of E5, I5, I6 and E6

KC Combination of E5, E1, I5 and I1

KD Combination of E5, I5, E6, I6, E1, and I1

Rosemount 3051SFC Wireless 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
Emerson Process Management LTDA — Sorocaba, Brazil
Emerson Process Management (India) Pvt. Ltd. — Daman, India

Telecommunication Compliance

All wireless devices require certification to ensure that they adhere to regulations regarding the use of the RF spectrum. Nearly every country requires this type of product certification. Emerson is working with governmental agencies around the world to supply fully compliant products and remove the risk of violating country directives or laws governing wireless device usage.

FCC and IC Approvals

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: This device may not cause harmful interference this device and must accept any interference received, including interference that may cause undesired operation.

This device must be installed to ensure a minimum antenna separation distance of 20cm from all persons.

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).

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-100, 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) (2004/108/EC)

EN 61326-1:1997 A1, A2, A3⁽¹⁾

EN 61326-1:2006

EN 61326-2-3:2006

(1) Only applies to "Operating Frequency and Protocol" option code 1.

Radio and Telecommunications Terminal Equipment Directive (R&TTE)(1999/5/EC)

Emerson Process Management complies with the R&TTE Directive.

Hazardous Locations Certifications

North American Certifications

Factory Mutual (FM) Approvals

- 15** FM Intrinsically Safe, Non-Incendive, and Dust Ignition-proof.
Intrinsically Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G.
Zone Marking: Class I, Zone 0, AEx ia IIC
Temperature Codes T4 ($T_{amb} = -50$ to 70° C)
Non-Incendive for Class I, Division 2, Groups A, B, C, and D.
Dust Ignition-proof for Class II/III, Division 1, Groups E, F, and G.
Ambient temperature limits: -50 to 85° C
For use with Rosemount SmartPower options
00753-9220-0001 only.
Enclosure Type 4X / IP66

CSA - Canadian Standards Association

All CSA hazardous approved transmitters are certified per ANSI/ISA 12.27.01-2003.

- 16** CSA Intrinsically Safe
Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D.
Temp Code T3C
Enclosure Type 4X / IP66
For use with Rosemount SmartPower options
00753-9220-0001 only.

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European Certifications

I1 ATEX Intrinsic Safety
Certificate No.: BAS01ATEX1303X  II 1G
Ex ia IIC T4 (T_a = -60 °C to 70 °C)
IP66
For use with Rosemount SmartPower options
00753-9220-0001 only.
CE 1180

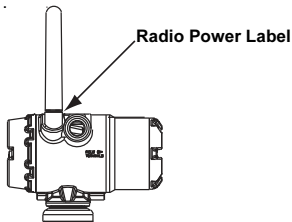
CE 

Country ⁽¹⁾	Restriction
Bulgaria	General authorization required for outdoor use and public service
France	Outdoor use limited to 10mW e.i.r.p.
Italy	If used outside of own premises, general authorization is required.
Norway	May be restricted in the geographical area within a radius of 20 km from the center of Ny-Alesund.
Romania	Use on a secondary basis. Individual license required.

(1) Only applies to "Operating Frequency and Protocol" option code 1.

Radio Power Label (See Figure 1) indicates output power configuration of the radio. Devices with this label are configured for output power less than 10 mW e.i.r.p. At time of purchase the customer must specify ultimate country of installation and operation.

Figure 1.



IECEx Certifications

I7 IECEx Intrinsic Safety
Certificate No.: IECEx BAS 04.0017X
Ex ia IIC T4 (T_a = -60 °C to 70 °C)
For use with Rosemount SmartPower options
00753-9220-0001 only.
IP66

DIMENSIONAL DRAWINGS

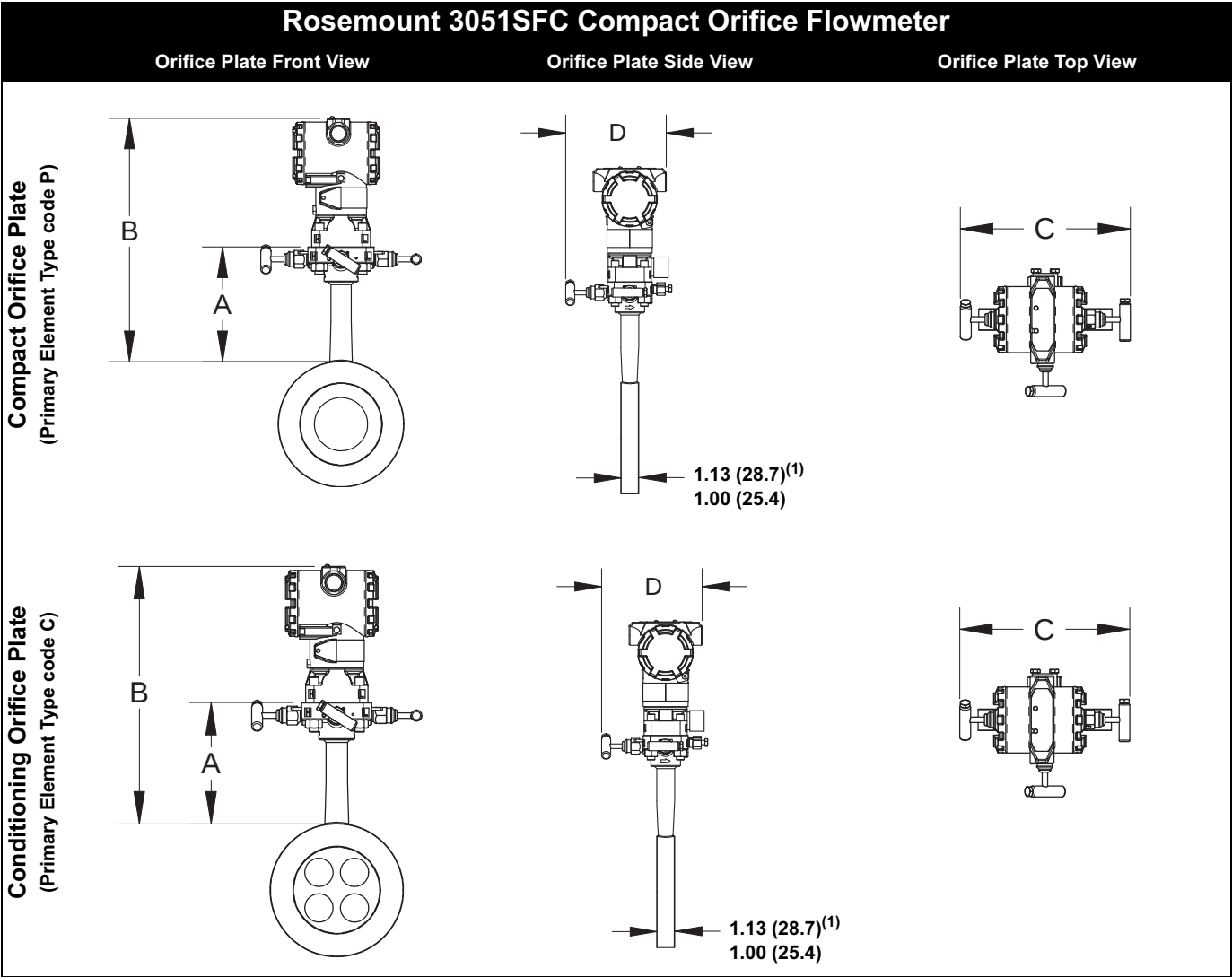


TABLE 6. Dimensional Drawings⁽¹⁾⁽²⁾

Primary Element 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) The Compact Orifice product will go through a design revision to accommodate the future integral RTD option. Until this release, the wafer thickness will be 1.00-in. After the design revision, the wafer thickness will be 1.13-in.

(2) Measurement in inches (millimeters).

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ORDERING INFORMATION

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

Model	Product Description
3051SFC	Compact Orifice Flowmeter
Code	Transmitter Feature Board Measurement Type
1	MultiVariable (Fully Compensated Mass and Energy Flow) – Differential and Static Pressures with Temperature
2	MultiVariable (Compensated Flow) – Differential and Static Pressures
3	MultiVariable (Compensated Flow) – Differential Pressure and Temperature
4	MultiVariable (Compensated Flow) – Differential Pressure
5	MultiVariable (Direct Measurement) – Differential and Static Pressures with Temperature
6	MultiVariable (Direct Measurement) – Differential and Static Pressures
7	MultiVariable (Direct Measurement) – Differential Pressure and Temperature
D	Differential Pressure
Code	Primary Element Type
C	Conditioning Orifice Plate
P	Orifice Plate
Code	Material Type
S	316 SST
H ⁽¹⁾	Alloy C-276
Code	Line Size
005 ⁽²⁾	1/2-in. (15 mm)
010 ⁽²⁾	1-in. (25 mm)
015 ⁽²⁾	1 1/2-in. (40 mm)
020	2-in. (50 mm)
030	3-in. (80 mm)
040	4-in. (100 mm)
060	6-in. (150 mm)
080	8-in. (200 mm)
Code	Primary Element Style
N	Square Edged
Code	Beta Ratio
040	0.40 Beta Ratio (β)
065 ⁽³⁾	0.65 Beta Ratio (β)
Code	Temperature Measurement
R ⁽⁴⁾	Remote Thermowell and RTD
0 ⁽⁵⁾	No Temperature Sensor
Code	Transmitter 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 inH ₂ O (0 to 62,2 mbar)
2	0 to 250 inH ₂ O (0 to 623 mbar)
3	0 to 1000 inH ₂ O (0 to 2,5 bar)
Code	Static Pressure Range
A ⁽⁶⁾	None
D	Absolute 0.5 to 800 psia (0,033 to 55,2 bar)
E ⁽⁷⁾	Absolute 0.5 to 3626 psia (0,033 to 250 bar)
J	Gage -14.2 to 800 psig (-0,979 to 55,2 bar)
K ⁽⁷⁾	Gage -14.2 to 3626 psig (-0,979 to 250 bar)
Code	Output Protocol
A	4–20 mA with digital signal based on HART protocol
F ⁽⁸⁾⁽⁹⁾	FOUNDATION fieldbus protocol: AI block, Link Master, Input Selector Block (Requires PlantWeb housing)
X ⁽⁹⁾⁽¹⁰⁾	Wireless (Requires wireless options and wireless housing 5A)

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

Code	Transmitter Housing Style	Material ⁽¹¹⁾	Conduit Entry Size
00	None (Customer-supplied electrical connection)		
01 ⁽⁹⁾⁽¹²⁾	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	G1/2
1J	PlantWeb Housing	SST	1/2-14 NPT
1K	PlantWeb Housing	SST	M20 x 1.5 (CM20)
1L	PlantWeb Housing	SST	G1/2
2A ⁽⁹⁾	Junction Box Housing	Aluminum	1/2-14 NPT
2B ⁽⁹⁾	Junction Box Housing	Aluminum	M20 x 1.5 (CM20)
2C ⁽⁹⁾	Junction Box Housing	Aluminum	G1/2
2E ⁽⁹⁾	Junction Box housing with output for remote display and interface	Aluminum	1/2-14 NPT
2F ⁽⁹⁾	Junction Box housing with output for remote display and interface	Aluminum	M20 x 1.5 (CM20)
2G ⁽⁹⁾	Junction Box housing with output for remote display and interface	Aluminum	G1/2
2J ⁽⁹⁾	Junction Box Housing	SST	1/2-14 NPT
2M ⁽⁹⁾	Junction Box housing with output for remote display and interface	SST	1/2-14 NPT
5A ⁽⁹⁾	Wireless PlantWeb housing	Aluminum	M20 x 1.5 (CM20)
7J ⁽⁹⁾⁽¹³⁾	Quick Connect (A size Mini, 4-pin male termination)		
Code	Transmitter Performance Class		
3051S MultiVariable SuperModule, Measurement Types 1, 2, 5, and 6			
3	Ultra for Flow: 0.55% flow rate accuracy, 14:1 flow turndown, 10-yr stability. limited 12-yr warranty		
5	Classic MV: 0.6% flow rate accuracy, 8:1 flow turndown, 5-yr stability		
3051S Single Variable SuperModule, Measurement Types 3, 4, 7, and D			
1 ⁽¹⁴⁾	Ultra: 0.85% flow rate accuracy, 8:1 flow turndown, 10-yr stability, limited 12-yr warranty		
2	Classic: 1.05% flow rate accuracy, 8:1 flow turndown, 5-yr stability		
3 ⁽¹⁵⁾	Ultra for Flow: 0.55% flow rate accuracy, 14:1 flow turndown, 10-yr stability. limited 12-yr warranty		
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 (T _{max} = 850 °F)		
Flow Calibration			
WC ⁽¹⁶⁾	Discharge Coefficient Verification (3 point)		
WD ⁽¹⁶⁾	Discharge Coefficient Verification (10 point)		
Pressure Testing			
P1	Hydrostatic Testing		
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		
QP	Calibration Data Certificate and Tamper Evident Seal		
Safety Certification			
QS ⁽¹⁷⁾⁽¹⁸⁾	Certificate of FMEDA data		
QT ⁽⁹⁾⁽¹⁹⁾	Safety Certified to IEC 61508 with certificate of FMEDA data		

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Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

Material Traceability Certifications

Q8⁽²⁰⁾ Material Traceability Certification per EN 10204:2004 3.1

Code Conformance

J2 ANSI B31.1

J3 ANSI B31.3

J4 ANSI B31.8

Material Conformance

J5⁽²¹⁾ NACE MR-0175-91 / ISO 15156

Country Certification

J1 Canadian Registration

Product Certifications

E1 ATEX Flameproof

I1 ATEX Intrinsic Safety

IA⁽⁹⁾ ATEX FISCO Intrinsic Safety; for FOUNDATION fieldbus protocol only

N1 ATEX Type n

ND ATEX Dust

K1 ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E1, I1, N1, and ND)

E4 TIIS Flameproof

I4⁽²²⁾ TIIS Intrinsic Safety

K4⁽²²⁾ TIIS Flameproof, Intrinsic Safety (combination of E4 and I4)

E5 FM Explosion-proof, Dust Ignition-proof

I5 FM Intrinsically Safe, Division 2

K5 FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)

E6 CSA Explosion-proof, Dust Ignition-proof, Division 2

I6 CSA Intrinsically Safe

K6 CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)

E7 IECEx Flameproof, Dust Ignition-proof

I7 IECEx Intrinsic Safety

N7 IECEx Type n

K7 IECEx Flameproof, Dust Ignition-proof, Intrinsic Safety, Type n (combination of E7, I7, and N7)

E3⁽¹⁾ China Flameproof

I3⁽¹⁾ China Intrinsic Safety

KA⁽²³⁾ ATEX and CSA Flameproof, Intrinsically Safe, Division 2 (combination of E1, I1, E6, and I6)

Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.

KB FM and CSA Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5, E6, I5, and I6)

Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.

KC⁽²³⁾ FM and ATEX Explosion-proof, Intrinsically Safe, Division 2 (combination of E5, E1, I5, and I1)

Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.

KD⁽²³⁾ FM, CSA, and ATEX Explosion-proof, Intrinsically Safe (combination of E5, I5, E6, I6, E1, and I1)

Note: Only available on Housing Style codes 1A, 1J, 2A, 2J, 2E, or 2M.

Alternative Transmitter Material of Construction

L1 Inert Sensor Fill Fluid (not available with Differential Pressure range code 1A)

L2 Graphite-filled (PTFE) o-ring

LA Inert sensor fill fluid and graphite-filled (PTFE) o-ring

Digital Display⁽²⁴⁾

M5 PlantWeb LCD display

M7⁽¹⁸⁾⁽²⁵⁾ Remote mount LCD display and interface, PlantWeb housing, no cable, SST bracket

M8⁽¹⁸⁾⁽²⁵⁾⁽²⁶⁾ Remote mount LCD display and interface, PlantWeb housing, 50 foot cable, SST bracket

M9⁽¹⁸⁾⁽²⁵⁾⁽²⁶⁾ Remote mount LCD display and interface, PlantWeb housing, 100 foot cable, SST bracket

Terminal Blocks

T1⁽²⁷⁾ Transient terminal block

T2⁽⁹⁾⁽²⁸⁾ Terminal block with WAGO® spring clamp terminals

T3⁽⁹⁾⁽²⁸⁾ Transient terminal block with WAGO spring clamp terminals

Manifold for Remote Mount Option

F2 3-Valve Manifold, SST

F6 5-Valve Manifold, SST

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

PlantWeb Control Functionality	
A01 ⁽⁹⁾⁽²⁹⁾	FOUNDATION fieldbus Advanced Control Function Block Suite
PlantWeb Diagnostic Functionality	
D01 ⁽⁹⁾⁽²⁹⁾	FOUNDATION fieldbus Diagnostics Suite
DA1 ⁽⁹⁾⁽³⁰⁾	HART Diagnostic Suite
PlantWeb Enhanced Measurement Functionality	
H01 ⁽⁹⁾⁽²⁹⁾⁽³¹⁾	Fully Compensated Mass Flow Block
Code	Wireless Options - Select code from each wireless category (example: WA2WK1)
Wireless Transmitter Rate	
WA	User Configurable Burst Rate
Operating Frequency and Protocol	
3	2.4 GHz DSSS, WirelessHART™
Omnidirectional Wireless Antenna	
WK	Long Range, Integral Antenna
SmartPower™	
1	Long-life Power Module Adapter, Intrinsically Safe NOTE: Long-life Power Module must be shipped separately, order Part No. 00753-9220-0001.
Code	Options
Cold Temperature	
BRR ⁽²²⁾	-60 °F (-51 °C) Cold Temperature Start-up
Special Configuration (Software)	
C4 ⁽¹⁷⁾⁽³²⁾	NAMUR alarm and saturation signal levels, high alarm
C5 ⁽¹⁷⁾⁽³²⁾	NAMUR alarm and saturation signal levels, low alarm
C6 ⁽¹⁷⁾⁽³²⁾	Custom alarm and saturation signal levels, high alarm <i>Note: Requires option code C1, custom software configuration. A Configuration Data Sheet must be completed, see document number 00806-0100-4810.</i>
C7 ⁽¹⁷⁾⁽³²⁾	Custom alarm and saturation signal levels, low alarm <i>Note: Requires option code C1, custom software configuration. A Configuration Data Sheet must be completed, see document number 00806-0100-4810.</i>
C8 ⁽¹⁷⁾⁽³²⁾	Low alarm (standard Rosemount alarm and saturation signal levels)
Special Configuration (Hardware)	
D1 ⁽¹⁷⁾⁽¹⁸⁾	Hardware Adjustment (zero, span, security).
D4	External ground screw
DA ⁽¹⁷⁾⁽¹⁸⁾	Hardware adjustment (zero, span, security) and external ground screw
Conduit Electrical Connector	
ZE ⁽³³⁾	M12, 4-pin, Male Connector (eurofast)
ZM ⁽³³⁾	A size Mini, 4-pin, Male Connector (minifast)

(1) Consult an Emerson Process Management representative for availability.

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

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

(4) Option code R is required for Measurement Type codes 1, 3, 5, and 7.

(5) Required for Measurement Type codes 2, 4, 6, and D.

(6) Required for Measurement Type codes 3, 4, 7, and D.

(7) For Measurement Type 1, 2, 5, and 6 with DP range 1, absolute limits are 0.5 to 2000 psi (0.03 to 137.9 bar) and gage limits are -14.2 to 2000 psig (-0.98 to 137.9 bar).

(8) Requires PlantWeb housing.

(9) Only available with Measurement Type D.

(10) Available approvals are FM Intrinsically Safe, Division 2 (option code I5), CSA Intrinsically Safe (option code I6), ATEX Intrinsic Safety (option code I1; only available with 2.4 GHz), and IECEx Intrinsic Safety (option code I7; only available with 2.4 GHz).

(11) Material specified is cast as follows: CF-8M is the cast version of 316 SST, CF-3M is the cast version of 316L SST. For housing, material is aluminum with polyurethane paint.

(12) Available with output code A only. Not available with approvals. See Rosemount 753R Product Data Sheet, 00813-0100-4379, to specify Web-Based Monitoring Indicator. Does not integrate into plant host systems.

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- (13) Available with output code A only. Available approvals are FM Intrinsically Safe, Division 2 (option code I5), ATEX Intrinsic Safety (option code I1), or IECEx Intrinsic Safety (option code I7). Contact an Emerson Process Management representative for additional information.
- (14) Not available with Wireless Operating Frequency and Protocol option codes 1 or 2.
- (15) Not available with Wireless Operating Frequency and Protocol option codes 1 or 2 or Housing code 01. This option is only available with differential pressure ranges 2 and 3, and silicone fill fluid.
- (16) Not available with Primary Element Type code P.
- (17) Not available with Output Protocol code F or Housing code 01.
- (18) Only available with Measurement Type D. Not available with output code X.
- (19) Not available with output code F or X. Not available with housing code 01 or 7J.
- (20) Instrument valves not included in Traceability Certification.
- (21) 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.
- (22) Only available with Measurement Types 1-7.
- (23) Not available with Temperature Measurement code R.
- (24) Not available with Housing code 01 or 7J.
- (25) Not available with output code F, Housing code 01, option code DA1, or option code QT.
- (26) Cable supplied is Belden 3084A, rated for ambient temperatures up to 167°F (75°C).
- (27) Not available with Housing code 00, 01, 5A, or 7J.
- (28) Available with Output Protocol code A and Plantweb housing only.
- (29) Requires PlantWeb housing and output code F.
- (30) Requires PlantWeb housing and output code A. Includes Hardware Adjustments as standard. Not available with option code QT.
- (31) Requires Rosemount Engineering Assistant version 5.5.1 to configure.
- (32) Not available with output code X.
- (33) Not available with Housing code 00, 01, 5A, or 7J. Available with Intrinsically Safe approvals only. For FM Intrinsically Safe, Division 2 (option code I5) or FM FISCO Intrinsically Safe (option code IE), install in accordance with Rosemount drawing 03151-1009 to maintain outdoor rating (NEMA 4X and IP66).

Rosemount 3095MFC Compact Orifice Mass Flowmeter

SPECIFICATIONS

Performance

System Reference Accuracy

Percent (%) of mass flow rate

TABLE 7. 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. (25 mm to 40 mm)

(3) Line sizes 2-in. to 12-in. (50 mm to 300 mm)

(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)

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 Transmitter

- 450 °F (232 °C)

Remote Mount Transmitter

- 850 °F (454 °C) – Stainless Steel

Transmitter Temperature Limits

Ambient

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

Storage

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

Differential Pressure Limits

Maximum differential pressure (DP) up to 800 inH₂O.

Pressure Limits⁽¹⁾

Direct Mount Transmitter

- 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.

(1) Static pressure selection may effect pressure limitations.

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Product Data Sheet

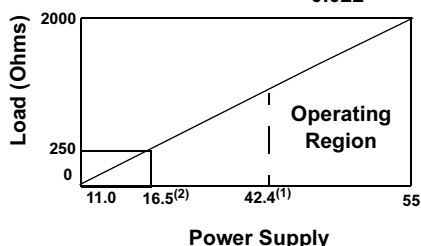
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Load Limitations

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.

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

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

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

Process-Wetted Parts

Integral Manifolds

- 316 SST
- Alloy C-276

Remote Manifolds

- 316 SST
- Alloy C-276

Transmitter Vent Valves and Process Flanges

- 316 SST
- Alloy C-276
- Glass-filled PTFE O-rings

Process Isolating Diaphragms

- 316L SST
- Alloy C-276

Integral Manifold O-Rings

- PTFE/Graphite

Non-Wetted Parts

Sensor Module Fill Fluid

- Silicone oil
- Inert Fill optional

Cover O-rings

- Buna-N

Remote Mounting Brackets

- SST

Electronic Housing

- Low copper aluminum, NEMA 4x, IP65
- SST (optional)

Paint

- Polyurethane

Bolts

- CS

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, Wafer style

Orifice Pressure Taps

- Corner

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

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Typical Orifice Hole Sizes (For 3095MFCC)

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 8. $\beta = 0.4$ ⁽¹⁾

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)

(1) Tolerance = ± 0.002 -in.

TABLE 9. $\beta = 0.65$ ⁽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)

(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.

3095MFC Weight

Line Size	Direct Mount (D3) ⁽¹⁾⁽²⁾	Remote Mount (R3) ⁽¹⁾
1/2-in. (15 mm)	9.50 (4.69)	6.3 (3.11)
1-in. (25 mm)	10.25 (5.06)	7.05 (3.48)
1 1/2-in. (40 mm)	10.75 (5.31)	7.55 (3.73)
2-in. (50 mm)	11.00 (5.43)	7.80 (3.85)
3-in. (80 mm)	13.00 (6.42)	9.80 (4.84)
4-in. (100 mm)	15.50 (7.65)	12.30 (6.07)

(1) Measurement in lb (kg).

(2) Includes 3095 MultiVariable transmitter.

Installation Considerations

Straight Run Requirements

TABLE 10. 3095MFCC 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 11. 3095MFCCP 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

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

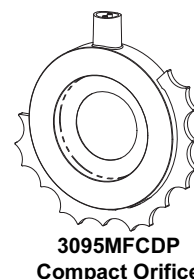
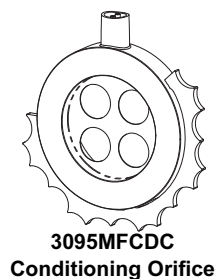
(1) D = Direct mount acceptable (recommended)

R = Remote mount acceptable

NR = Not recommended

Pipe Centering

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



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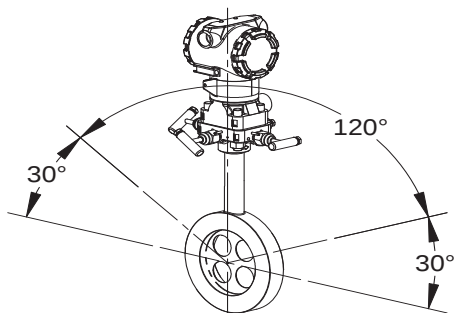
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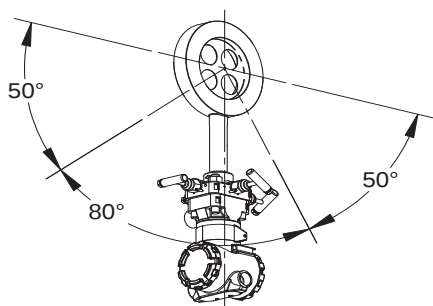
Flowmeter Orientation

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

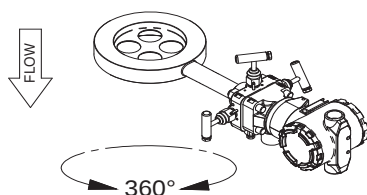
Gas (Horizontal)



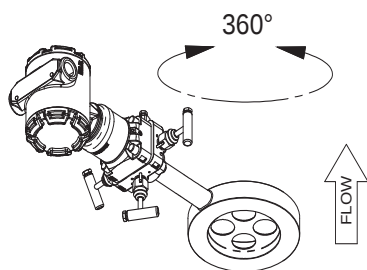
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



PRODUCT CERTIFICATIONS

Rosemount 3095 with HART

European Directive Information

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

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

3095MV 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 ($T_{amb} = -45^{\circ}\text{C}$ to 40°C)
EEx ia IIC T4 ($T_{amb} = -45^{\circ}\text{C}$ to 70°C)
CE 1180

TABLE 12. 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 13. 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 14. 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
$L_o/R_o = 247\text{ }\mu\text{H}/\text{ohm}$	Gas Group IIC
$L_o/R_o = 633\text{ }\mu\text{H}/\text{ohm}$	Gas Group IIB
$L_o/R_o = 633\text{ }\mu\text{H}/\text{ohm}$	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 ($T_{amb} = -45^{\circ}\text{C}$ to 40°C)
EEx nL IIC T4 ($T_{amb} = -45^{\circ}\text{C}$ to 70°C)
 $U_i = 55\text{V}$
CE
The apparatus is designed for connection to a remote temperature sensor such as a resistance temperature detection (RTD)

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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
EEEx d IIC T5 (-50°C ≤ T_{amb} ≤ 80°C)
T6 (-50°C ≤ T_{amb} ≤ 65°C)
CE 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
CE 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

Rosemount 3095 with *Fieldbus*

European Directive Information

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)

3095F_2/3,4/D and 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
Primary Elements, Flowmeter
— See appropriate Primary Element QIG

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

3095 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).

Rosemount 3095 Fieldbus 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.

- IE FISCO for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F, and G hazardous outdoor locations. Temperature Code T4. Factory Sealed.

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

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

Canadian Standards Association (CSA)

- IF CSA FISCO Intrinsically Safe; for FOUNDATION fieldbus protocol only

European Certifications

- IA ATEX FISCO Intrinsically Safe; for FOUNDATION fieldbus protocol only

Australian Certifications

- IG IECEx FISCO Intrinsic Safety

DIMENSIONAL DRAWINGS

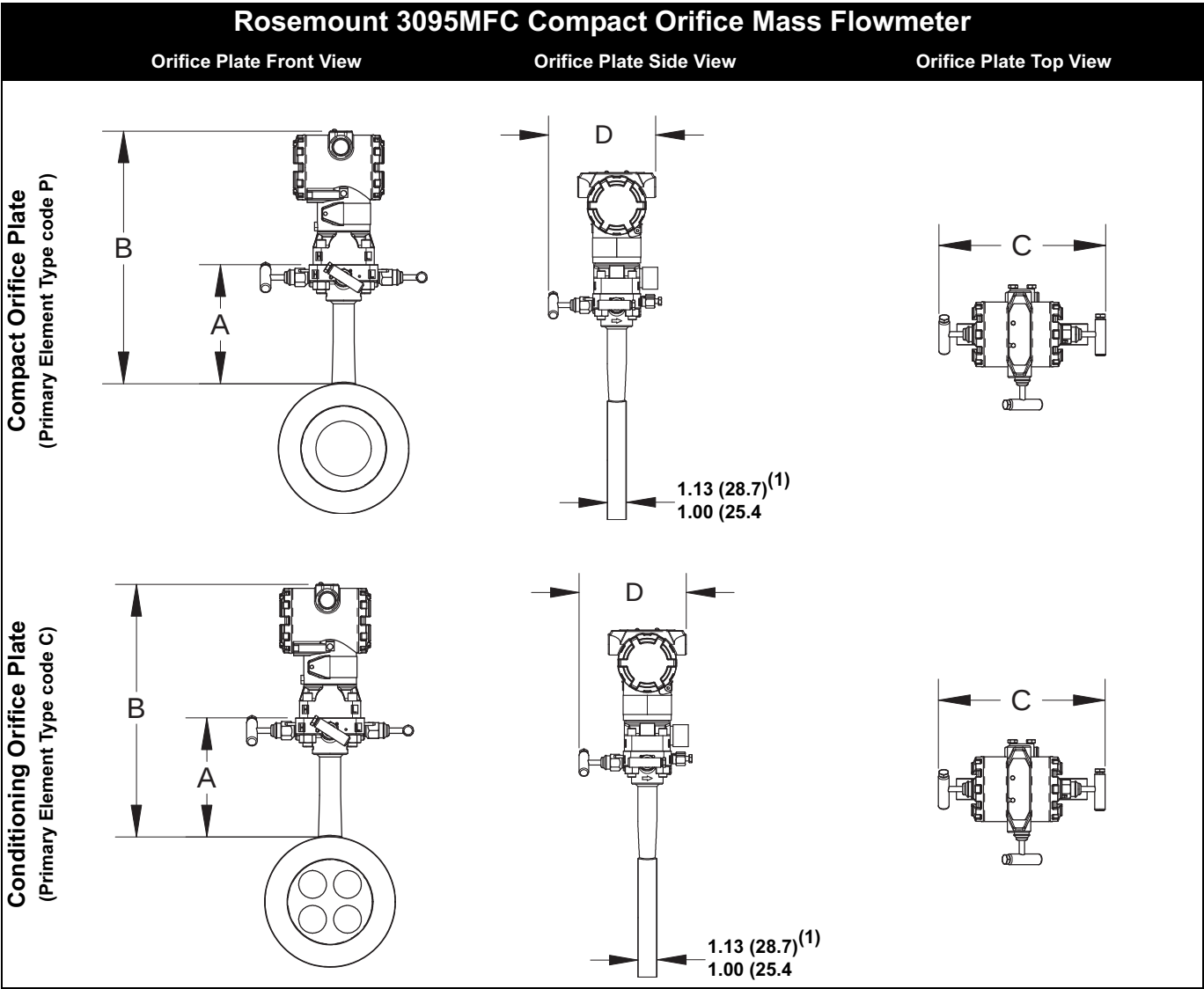


TABLE 15. Dimensional Drawings⁽¹⁾⁽²⁾

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) The Compact Orifice product will go through a design revision to accommodate the future integral RTD option. Until this release, the wafer thickness will be 1.00-in. After the design revision, the wafer thickness will be 1.13-in.

(2) Measurement is in inches (millimeters).

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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)	
H ⁽¹⁾	Alloy C-276	
Code	Line Size	
005 ⁽²⁾	1/2-in. (15 mm)	
010 ⁽²⁾	1-in. (25 mm)	
015 ⁽²⁾	1 1/2-in. (40 mm)	
020	2-in. (50 mm)	
030	3-in. (80 mm)	
040	4-in. (100 mm)	
060	6-in. (150 mm)	
080	8-in. (200 mm)	
Code	Primary Element Style	
N	Square Edged	
Code	Beta Ratio	
040	0.40 Beta Ratio (β)	
065 ⁽³⁾	0.65 Beta Ratio (β)	
Code	Temperature Measurement	
R	Remote Thermowell and RTD	
0	No Temperature Sensor	
Code	Transmitter 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 62,3 mbar)	
2	0 to 250 in H ₂ O (0 to 623 mbar)	
3	0 to 1000 in H ₂ O (0 to 2,5 bar)	
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 HART protocol	
V	FOUNDATION 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	G1/2
1J	SST	1/2-14 NPT
1K	SST	M20 x 1.5 (CM20)
1L	SST	G1/2

Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Code	Options
Performance Class	
U3 ⁽⁴⁾	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 ⁽⁵⁾	Advanced Control Suite: PID, arith, signal char, integ, etc.
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 ($T_{\max} = 850$ °F)
Flow Calibration	
WC ⁽⁶⁾	Discharge Coefficient Verification (3 point)
WD ⁽⁶⁾	Discharge Coefficient Verification (10 point)
Pressure Testing	
P1	Hydrostatic Testing
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 ⁽⁷⁾	Material Traceability Certification per EN 10204:2004 3.1
Code Conformance	
J2	ANSI B31.1
J3	ANSI B31.3
J4	ANSI B31.8
Materials Conformance	
J5 ⁽⁸⁾⁽⁹⁾	NACE MR-0175 / ISO 15156
Country Certification	
J1	Canadian Registration
Product Certifications	
E5	FM Explosion-proof, Dust Ignition-proof
I5	FM Intrinsically Safe, Division 2
K5	FM Explosion-proof, Dust Ignition-proof, Intrinsically Safe, Division 2 (combination of E5 and I5)
E6	CSA Explosion-proof, Dust Ignition-proof, Division 2
I6	CSA Intrinsically Safe, Division 2
I1	ATEX Intrinsic Safety
E1	ATEX Flameproof
N1	ATEX Type n
ND	ATEX Dust
K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust (combination of E1, I1, N1, and ND)
K6	CSA Explosion-proof, Intrinsically Safe, Division 2 (combination of E6 and I6)
I7	IECEx Intrinsic Safety
E4	TIIS Flameproof
Alternative Transmitter Material of Construction	
L1 ⁽⁹⁾	Inert Sensor Fill Fluid
Display	
M5	Integral mount LCD display

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Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

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) Consult factory for availability.
- (2) Not available for Primary Element Type code C.
- (3) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for Primary Element Type code C.
- (4) Ultra for Flow applicable for HART protocol, DP ranges 2 and 3 with SST isolator material and silicone fill fluid options only.
- (5) Function Blocks include: Arithmetic, Integrator, Analog Output, Signal Characterizer, Control Selector, and Output Selector.
- (6) Not available with Primary Element Type code P.
- (7) Instrument valves not included in Traceability Certification.
- (8) 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.
- (9) Not available with DP range 1.

Rosemount 405 Compact Orifice Primary Element

SPECIFICATIONS

Performance

Discharge Coefficient Uncertainty

TABLE 16. 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 12-in. (50 mm to 300 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)

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.

Assembly to a transmitter

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

Physical

Temperature Measurement

Remote RTD

- 100 Ohm platinum with $\frac{1}{2}$ -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 ft. (3.66 m)
- Remote RTD material is SST Thermowell
- $\frac{1}{2}$ -in. x $\frac{1}{2}$ -in. NPT, 316 SST

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.

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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 Type

- Square edged, Wafer style

Orifice Pressure Taps

- Corner

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 17. $\beta = 0.4^{(1)}$

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)

(1) Tolerance = ± 0.002 -in.

TABLE 18. $\beta = 0.65^{(1)(2)}$

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)

(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.

405 Weight

Line Size	Direct Mount (D3) ⁽¹⁾⁽²⁾	Remote Mount (R3) ⁽¹⁾
1/2-in. (15 mm)	3.50 (1.73)	7.5 (3.70)
1-in. (25 mm)	4.25 (2.10)	8.25 (4.07)
1 1/2-in. (40 mm)	4.75 (2.34)	8.75 (4.32)
2-in. (50 mm)	5.00 (2.47)	9.00 (4.44)
3-in. (80 mm)	7.00 (3.45)	11.00 (5.43)
4-in. (100 mm)	9.50 (4.69)	13.50 (6.67)

(1) Measurement in lb (kg).

(2) Includes 405 Direct Mount option D3.

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 19 and Table 20 lists recommended lengths of straight pipe per ISO 5167.

TABLE 19. 405C 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 20. 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

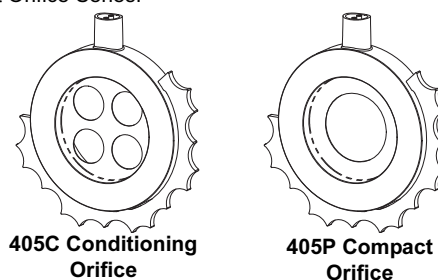
(1) D = Direct mount acceptable (recommended)

R = Remote mount acceptable

NR = Not recommended

Pipe Centering

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



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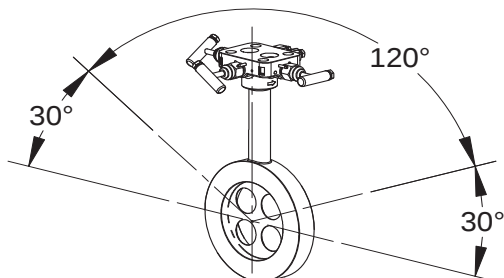
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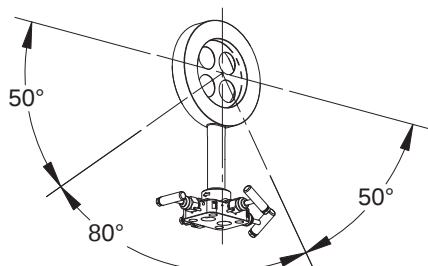
Flowmeter Orientation

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

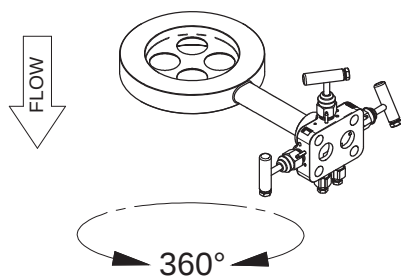
Gas (Horizontal)



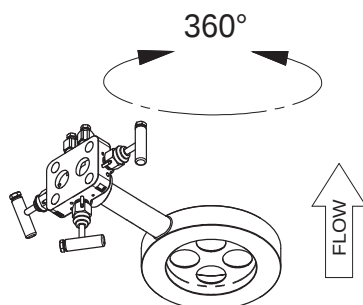
Liquid and Steam (Horizontal)



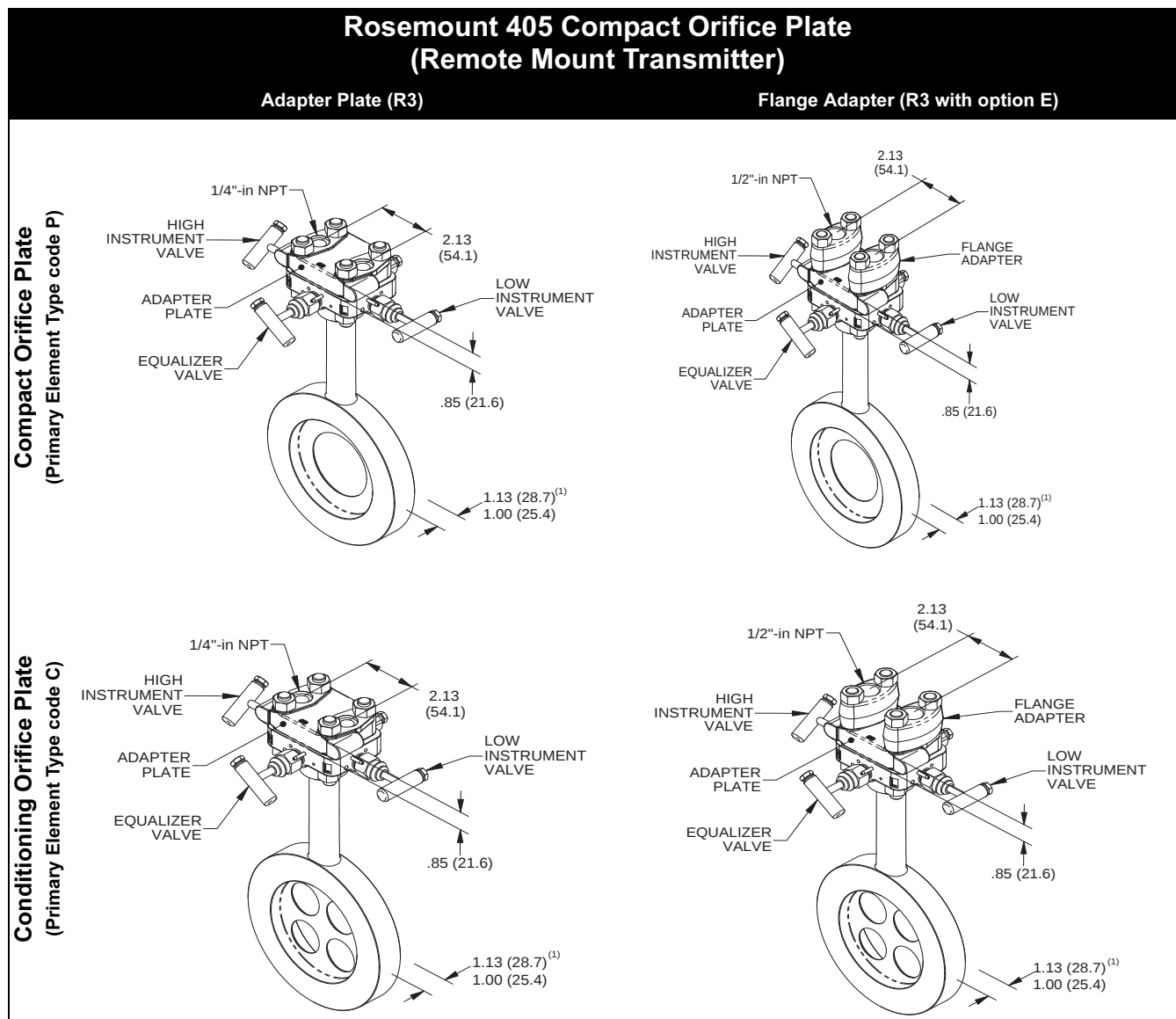
Gas (Vertical)



Liquid (Vertical)



DIMENSIONAL DRAWINGS



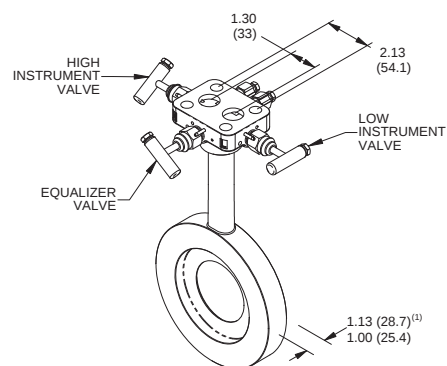
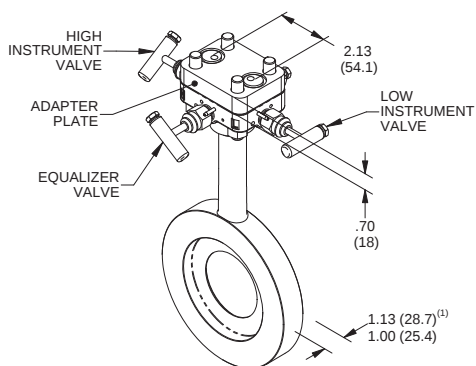
(1) The Compact Orifice product will go through a design revision to accommodate the future integral RTD option. Until this release, the wafer thickness will be 1.00-in. After the design revision, the wafer thickness will be 1.13-in.

Rosemount 405 Compact Orifice Plate (Direct Mount)

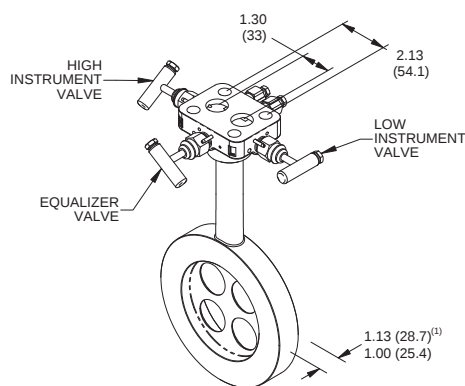
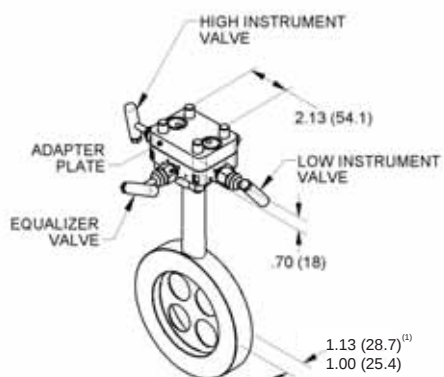
Front View (transmitter connection A3)

Front View (transmitter connection D3)

Compact Orifice Plate
(Primary Element Type code P)



Conditioning Orifice Plate
(Primary Element Type code C)



(1) The Compact Orifice product will go through a design revision to accommodate the future integral RTD option. Until this release, the wafer thickness will be 1.00-in. After the design revision, the wafer thickness will be 1.13-in.

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)
H ⁽¹⁾	Alloy C-276
Code	Line Size
005 ⁽²⁾	1/2-in. (15 mm)
010 ⁽²⁾	1-in. (25 mm)
015 ⁽²⁾	1 1/2-in. (40 mm)
020	2-in. (50 mm)
030	3-in. (80 mm)
040	4-in. (100 mm)
060	6-in. (150 mm)
080	8-in. (200 mm)
Code	Temperature Measurement
N	No Temperature Measurement
R	Remote Thermowell and RTD
Code	Beta Ratio
040	0.40 Beta Ratio (β)
065 ⁽³⁾	0.65 Beta Ratio (β)
Code	Transmitter Connection
D3	Coplanar, 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)
Remote Adapters	
E	Flange adapters 316 SST (1/2-in. NPT)
High Temperature Applications	
T	Graphite valve packing ($T_{\max} = 850^{\circ}\text{F}$)
Flow Calibration	
WC ⁽⁴⁾	Discharge Coefficient Verification (3 point)
WD ⁽⁴⁾	Discharge Coefficient Verification (10 point)
Pressure Testing	
P1	Hydrostatic testing
Special Cleaning	
P2	Cleaning for special processes
PA	Cleaning per ASTM G93 Level D (section 11.4)

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Rosemount 405 Compact Orifice Primary Element Ordering Information

Special Inspection

QC1 Visual and Dimensional Inspection with certificate

QC7 Inspection and performance certificate

Material Traceability Certification

Q8⁽⁵⁾ Material Traceability Certification per En 10204:2004 3.1

Code Conformance

J2 ANSI B31.1

J3 ANSI B31.3

J4 ANSI B31.8

Materials Conformance

J5⁽⁶⁾ NACE MR-0175-91

Country Certification

J1 Canadian Registration

Typical Model Number: 405 C S 040 N 040 D3

(1) Consult factory for availability.

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

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

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

(5) Instrument valves not included in Traceability Certification.

(6) 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.

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