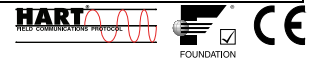


Rosemount Compact Orifice Flowmeter Series

**INTEGRATED DESIGN FOR LIMITED
STRAIGHT PIPE RUN, CLOSED LOOP
CONTROL, AND GENERAL PURPOSE
MONITORING APPLICATIONS**

- *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*



Content

The Rosemount 405 Compact Orifice Series	page 2
Rosemount DP Flow Solutions	page 2
Rosemount 3051SFC Compact Orifice Flowmeter	page 4
Specifications	page 4
Product Certifications	page 8
Dimensional Drawings	page 11
Ordering Information	page 12
Rosemount 3095MFC Compact Orifice Mass Flowmeter	page 15
Specifications	page 15
Product Certifications	page 18
Dimensional Drawings	page 20
Ordering Information	page 21
Rosemount 405 Compact Orifice Primary Element	page 24
Specifications	page 24
Dimensional Drawings	page 27
Ordering Information	page 29
Configuration Data Sheet (CDS)	page 31
Fluid Data Sheet (FDS)	page 34

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

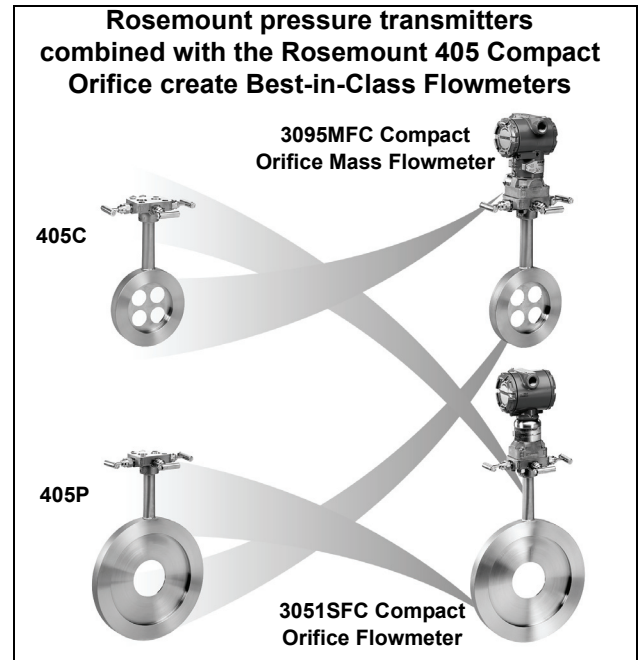
A 3-valve isolation manifold and 1-in (25 mm) thick wafer-style body allows direct mounting while eliminating field connections between the process and the differential pressure-measuring device. The integral configuration results in a robust, inexpensive, and easy-to-install assembly.

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.

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 DP Flow Solutions

Annubar Flowmeter Series: Rosemount 3051SFA, 3095MFA, 485, and 285

The state-of-the-art, fifth generation Rosemount 485 *Annubar* combined with the 3051S or 3095MV MultiVariable transmitter creates an accurate, repeatable and dependable insertion-type flowmeter. The Rosemount 285 provides a commercial product offering for your general purpose applications.

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

Compact Orifice Flowmeters can be installed between existing flanges, up to a Class 600 (PN100) rating. In tight fit applications, a conditioning orifice plate version is available, requiring only two diameters of straight run upstream.

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

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.

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 is easy to specify and order. The 1595 Conditioning Orifice provides superior performance in tight fit applications.

405 Compact Orifice Series Selection Guide

Rosemount 3051SFC Compact Orifice Flowmeter

See ordering information on page 12.

- Combines the Rosemount 3051S scalable pressure transmitter with the 405 Compact Orifice Primary
- Accuracy up to $\pm 0.75\%$ of volumetric rate
- Remote display and interface assembly enables direct mounting with “at-grade” operator interface
- *FOUNDATION*[®] fieldbus protocol available
- Ideal fluid type: liquid



3051SFC Compact Orifice Flowmeter

Rosemount 3095MFC Compact Orifice Mass Flowmeter

See ordering information on page 21.

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



3095MFC Compact Orifice Mass Flowmeter

Rosemount 405 Compact Orifice Primary

See ordering information on page 29.

- Integral manifold head allows direct mounting of DP transmitters
- Ideal fluid types: liquid, gas, and steam
- 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

Percent (%) of volumetric flow rate

TABLE 1. 3051SFC Compact Orifice Flowmeter

Type	Beta	Classic (8:1 flow turndown)	Ultra (8:1 flow turndown)	Ultra for Flow (14:1 flow turndown)
3051SFCC	0.4	±1.05%	±0.85%	±0.75%
3051SFCC	0.65	±1.20%	±1.05%	±0.95%
3051SFCCP ⁽¹⁾⁽²⁾	0.4 0.65 ⁽³⁾	±2.00%	±1.90%	±1.85%
3051SFCCP ⁽⁴⁾	0.4 0.65 ⁽³⁾	±1.55%	±1.45%	±1.40%

(1) Line sizes 1/2 to 1 1/2-in. (12.7 to 38.1 mm).

(2) Discharge Coefficient Uncertainty for 1/2-in. units with Beta = 0.65 is +2.25%. Contact the factory for flow accuracy.

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

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

Repeatability

±0.1%

Line Sizes

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

Output

HART

- 4–20 mA ADC, flow rate output. Digital HART protocol superimposed on 4–20 mA signal, available to any host that conforms to the HART protocol.

FOUNDATION Fieldbus (output code F)

- 17.5 mA for all configurations (including LCD display option)

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

Power Supply

4–20 mA option

- External power supply required. Standard transmitter (4–20 mA) operates on 10.5 to 42.4 v dc with no load

FOUNDATION Fieldbus option

- External power supply required. Transmitters operate on 9.0 to 32.0 V dc transmitter terminal voltage

Process Temperature Limits

Direct Mount Electronics

- 450 °F (232 °C)

Remote Mount Electronics

- 850 °F (454 °C) – Stainless Steel

Electronics Temperature Limits

Ambient

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

Storage

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

Pressure Limits⁽¹⁾

Direct Mount Electronics

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

Static Pressure Limits

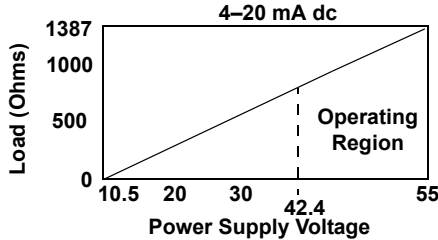
- Range 1A: Operates within specification between static line pressures of 0.5 psia to 2000 psig (0.03 to 138 bar)
- Ranges 2A– 3A: Operates within specifications between static line pressures of 0.5 psia and 3626 psig (0.03 bar-A to 250 bar-G)

(1) Static pressure selection may effect pressure limitations.

Load Limitations

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

Max. Loop Resistance = 43.5 (Power Supply Voltage – 10.5)



HART communication requires a minimum loop resistance of 250 ohms.

Overpressure Limits

Flowmeters withstand the following limits without damage:

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

TABLE 2. Overpressure Limits⁽¹⁾

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

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

Humidity Limits

- 0–100% relative humidity

Inert Sensor Fill Fluid

Not available with Performance Class 3: Ultra for Flow

Dynamic Performance

	4 - 20 mA (HART®) ⁽¹⁾	FOUNDATION Fieldbus ⁽³⁾	Typical Transmitter Response Time
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Total Response Time (Td + Tc)⁽²⁾:

3051S_C, Ranges 2-5:	100 milliseconds	152 milliseconds
Range 1:	255 milliseconds	307 milliseconds
Range 0:	700 milliseconds	752 milliseconds
3051S_T:	100 milliseconds	152 milliseconds
3051S_L:	See <i>Instrument Toolkit</i> TM	See <i>Instrument Toolkit</i>

Dead Time (Td)	45 milliseconds (nominal)	97 milliseconds
Update Rate	22 times per second	22 times per second

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

Turn-On Time

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

Damping

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

Failure Mode Alarm

HART 4–20mA (output code A)

- If self-diagnostics detect a gross transmitter failure, the analog signal will be driven offscale to alert the user. Rosemount standard, NAMUR, and custom alarm levels are available (see Table 3 below)
- High or low alarm signal is software-selectable or hardware-selectable via the optional switch (option D1)

TABLE 3. Alarm Configuration

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

(1) Analog output levels are compliant with NAMUR recommendation NE 43.

(2) Low alarm must be 0.1 mA less than low saturation and high alarm must be 0.1 mA greater than high saturation.

FOUNDATION Fieldbus (output code F)

- The AI block allows the user to configure HI-HI, HI, LO, or LO-LO, alarms

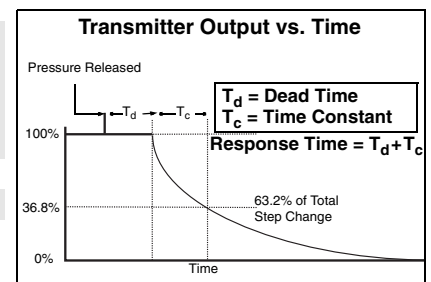
FOUNDATION Fieldbus (output code F)

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)



3051-3051_17A

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet

00813-0100-4810, Rev EA

April 2005

Physical

Temperature Measurement

Remote RTD

- 100 Ohm platinum with 1/2-in. NPT nipple and union (078 series with Rosemount 644 housing)
- Standard RTD cable is shielded armored cable, length is 12 feet (3.66 m)

Thermowell with Remote RTD

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

NOTE

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

Electronic Connections for Remote Mount

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

Material of Construction

Body/Plate

- 316 SST

Manifold Head/Valves

- 316 SST

Flange Studs and Nuts

- Customer supplied
- Available as a spare part

Transmitter Connection Studs and Nuts

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

Gasket and O-rings

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

NOTE

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

Transmitter Connections

Remote Mount

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

Orifice Type

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

Process Connections

Mounts between the following flange configurations:

ASME B16.5 (ANSI):

- Class 150
- Class 300
- Class 600

DIN:

- PN16
- PN40
- PN100

ANSI alignment ring is included as standard when ordering.

Bore Sizes (d)

For 3051SFCC, Beta (β) is calculated by $2 \times d / \text{pipe size}$.

TABLE 4. $\beta = 0.4$ ⁽¹⁾⁽²⁾

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

TABLE 5. $\beta = 0.65$ ⁽¹⁾⁽²⁾

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

(1) Measurement is in inches (millimeters)

(2) Tolerance = ± 0.002 -in.

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

Weight

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

(1) Measurement in lb (kg).

Installation Considerations

Straight Run Requirements

TABLE 6. 3051SFCC Straight Pipe Requirements⁽¹⁾

	Beta	0.40	0.65
	Upstream (inlet) side of primary	Reducer (1 line size)	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% open)		2	2
Downstream (outlet) side of primary		2	2

TABLE 7. 3051SFCP Straight Pipe Requirements⁽¹⁾⁽²⁾⁽³⁾

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

- (1) Consult an Emerson Process Management representative if disturbance is not listed.
- (2) Recommended lengths represented in pipe diameters per ISO 5167.
- (3) Refer to ISO 5167 for recommended lengths when using flow straighteners.

Pipe Orientation

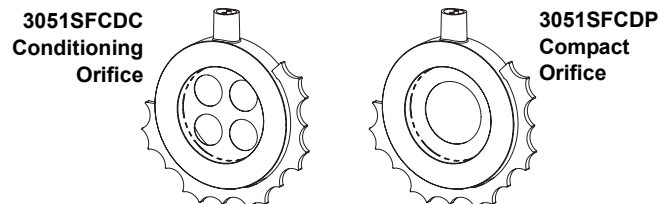
Pipe orientation for both 3051SFCC Compact Conditioning and standard 3051SFCP Compact Orifice.

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

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

Pipe Centering

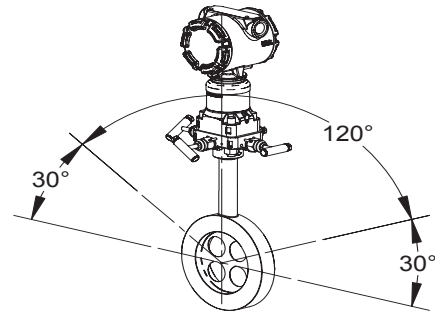
Improper centering of any orifice type device can cause an error of up to ±5% in small line sizes. A centering mechanism (centering ring) independent of flange rating comes standard with the 405 Compact Orifice Series.



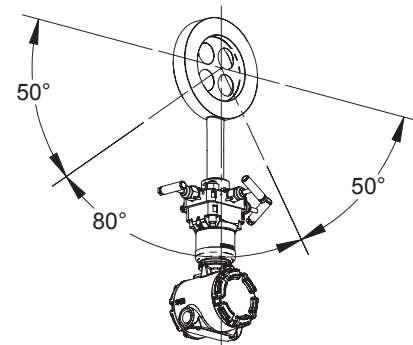
Flowmeter Orientation

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

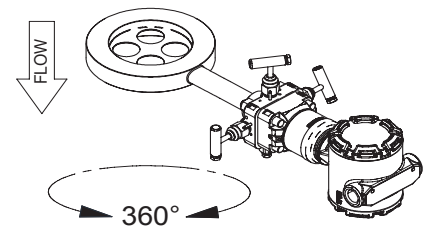
Gas (Horizontal)



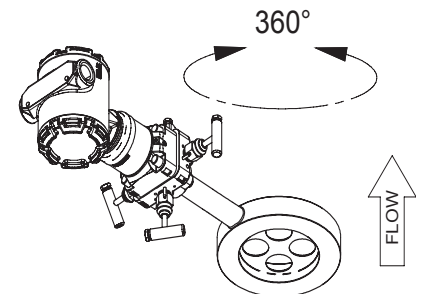
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



PRODUCT CERTIFICATIONS

Approved Manufacturing Locations

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

European Directive Information

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

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

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

Models 3051S_CA4; 3051S_CD2, 3, 4, 5; (also with P9 option)
Pressure Transmitters — QS Certificate of Assessment - EC No. PED-H-20, Module H Conformity Assessment
All other Model 3051S Pressure Transmitters — Sound Engineering Practice
Transmitter Attachments: Diaphragm Seal - Process Flange - Manifold — Sound Engineering Practice
Primary Elements, Flowmeter
— See appropriate Primary Element QIG

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

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

Ordinary Location Certification for FM

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

Hazardous Locations Certifications

North American Certifications

FM Approvals

- E5** Explosion-proof for Class I, Division 1, Groups B, C, and D; dust-ignition proof for Class II and Class III, Division 1, Groups E, F, and G; hazardous locations; enclosure Type 4X, conduit seal not required when installed according to Rosemount drawing 03151-1003.

- I5** Intrinsically Safe for use in Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1; Class I, Zone 0 AEx ia IIC when connected in accordance with Rosemount drawing 03151-1006; Non-incendive for Class I, Division 2, Groups A, B, C, and D Enclosure Type 4X
For entity parameters see control drawing 03151-1006.

Canadian Standards Association (CSA)

- E6** Explosion-proof for Class I, Division 1, Groups B, C, and D; Dust-Ignition-Proof for Class II and Class III, Division 1, Groups E, F, and G; suitable for Class I, Division 2, Groups A, B, C, and D, when installed per Rosemount drawing 03151-1013, CSA Enclosure Type 4X; conduit seal not required.
- I6** Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D when connected in accordance with Rosemount drawings 03151-1016;
For entity parameters see control drawing 03151-1016.

European Certifications



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

TABLE 8. Input Parameters

Loop / Power	Groups
U _i = 30 V	HART / FOUNDATION Fieldbus/ Remote Display / SIS
U _i = 17.5 V	FISCO
I _i = 300 mA	HART / FOUNDATION Fieldbus/ Remote Display / SIS
I _i = 380 mA	FISCO
P _i = 1.0 W	HART / Remote Display / SIS
P _i = 1.3 W	FOUNDATION Fieldbus
P _i = 5.32 W	FISCO
C _i = 30 nF	SuperModule™
C _i = 11.4 nF	HART / SIS
C _i = 0	FOUNDATION Fieldbus / Remote Display / FISCO
L _i = 0	HART / FOUNDATION Fieldbus/ SIS / FISCO
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 SuperModules respectively), is not capable of withstanding the 500V test as defined in Clause 6.4.12 of EN 50020. This must be considered during installation.
- The terminal pins of the Types 3051 S-T and 3051 S-C must be protected to IP20 minimum.

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


Special conditions for safe use (x)

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

ND ATEX Dust
Certificate No.: BAS01ATEX1374X  II 1 D
 $T_{105\text{ °C}} (-20\text{ °C} \leq T_{\text{amb}} \leq 35\text{ °C})$
 $V_{\text{max}} = 42.4\text{ volts max}$
 $A = 24\text{ mA}$
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 milliampere, DC) are not exceeded. All connections to other apparatus or associated apparatus shall have control over this voltage and current equivalent to a category "ib" circuit according to EN 50020.
2. Cable entries must be used which maintain the ingress protection of the enclosure to at least IP66.
3. Unused cable entries must be filled with suitable blanking plugs which maintain the ingress protection of the enclosure to at least IP66.
4. Cable entries and blanking plugs must be suitable for the ambient range of the apparatus and capable of withstanding a 7J impact test.
5. The 3051S must be securely screwed in place to maintain the ingress protection of the enclosure.

E1 ATEX Flameproof
Certificate No.: KEMA00ATEX2143X  II 1/2 G
EEx d IIC T6 ($-50\text{ °C} \leq T_{\text{amb}} \leq 65\text{ °C}$)
EEx d IIC T5 ($-50\text{ °C} \leq T_{\text{amb}} \leq 80\text{ °C}$)
 $V_{\text{max}} = 42.4\text{ V}$
CE 1180

Special conditions for safe use (x)

This device contains a thin wall diaphragm. Installation, maintenance and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime. The Model 3051S pressure transmitter must include a Series 300S housing integrally mounted to a Series Model 3051S Sensor module as per Rosemount drawing 03151-1023.

Australian Certifications

E7 SAA Explosion-proof and DIP
Certification No.: AUS Ex 3798X
Ex d IIC T6 ($T_a = 60\text{ °C}$) IP66
DIP A21 TA T6 ($T_a = 60\text{ °C}$) IP66

Special conditions for safe use (x)

1. It is a condition of manufacture that each transmitter module shall be pressure tested in accordance with clause 4.3 of AS 2380.2 at minimum pressure of 1450 kPa. As the model 300S housing passed tests at 4 times the reference pressures (400 kPa for single and 3800 kPa for dual compartment housing) and are not of welded construction, they may be exempted from the routing pressure test of clause 4.3 of AS 2380.2.
2. It is a condition of manufacture that each transmitter module and housing combination shall be subjected to a routine high voltage test in accordance with clause 6.2 of AS 2380.1, with the following variation. The test voltage applied to each single or dual compartment housing shall not be less than 500 V, 47 to 62 Hz, for a period of not less than one minute, with a breakdown current of less than 5 mA.
3. It is a condition of safe use that each housing shall be connected to external circuits via suitable conduit or Standards Australia certified cable glands. Where only one entry is used for connection to external circuits, the unused entry shall be closed by means of the blanking plug supplied by the equipment manufacturer or by a suitable Standards Australia certified blanking plug.
4. It is a condition of safe use that a dielectric strength test shall be applied whenever the terminal block is changed or replaced in either the dual compartment or single compartment housings. The breakdown current shall be less than 5 mA, when 500 V, 47 to 62 Hz, is applied for one minute. Note: if tested with an optional T1 transient protector terminal block fitted, the protection will operate and hence there will be no current indicated.
5. It is a condition of safe use that each transmitter module shall be used with a Model 300S housing, in order to comply with flameproof requirements.
6. It is a condition of safe use that each model 300S housing fitted with a transmitter module shall be marked with the same certification marking code information. Should the housing be replaced after initial supply to another model 300S housing, the replacement housing shall have the same certification marking code information as the housing it replaces.

IECEX Certifications

- I7** IECEx Intrinsic Safety
Certificate No.: IECExBAS04.0017X
Ex ia IIC T5 ($T_a = -60\text{ °C to }40\text{ °C}$) -Hart/SIS/Remote Meter
Ex ia IIC T4 ($T_a = -60\text{ °C to }70\text{ °C}$) -Hart/SIS/Remote Meter
Ex ia IIC T4 ($T_a = -60\text{ °C to }70\text{ °C}$) -Foundation Fieldbus
Ex ia IIC T4 ($T_a = -60\text{ °C to }40\text{ °C}$) -FISCO
IP66

TABLE 9. Input Parameters

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

Special conditions for safe use (x)

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

- N7** IECEx Type n
Certificate No.: IECExBAS04.0018X
Ex nC IIC T5 ($T_a = -40\text{ °C to }70\text{ °C}$)
 $U_i = 45\text{ Vdc MAX}$
IP66

Special conditions for safe use (x)

The apparatus is not capable of withstanding the 500 V insulation test required by Clause 8 of IEC 79-15: 1987.

Combinations of Certifications

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

- K1** Combination of E1, I1, N1, and ND
- K5** Combination of E5 and I5
- K6** Combination of E6 and I6
- K7** Combination of E7, I7, and N7
- KA** Combination of E1, I1, E6, and I6
- KB** Combination of E5, I5, I6 and E6
- KC** Combination of E5, E1, I5 and I1
- KD** Combination of E5, I5, E6, I6, E1, and I1

DIMENSIONAL DRAWINGS

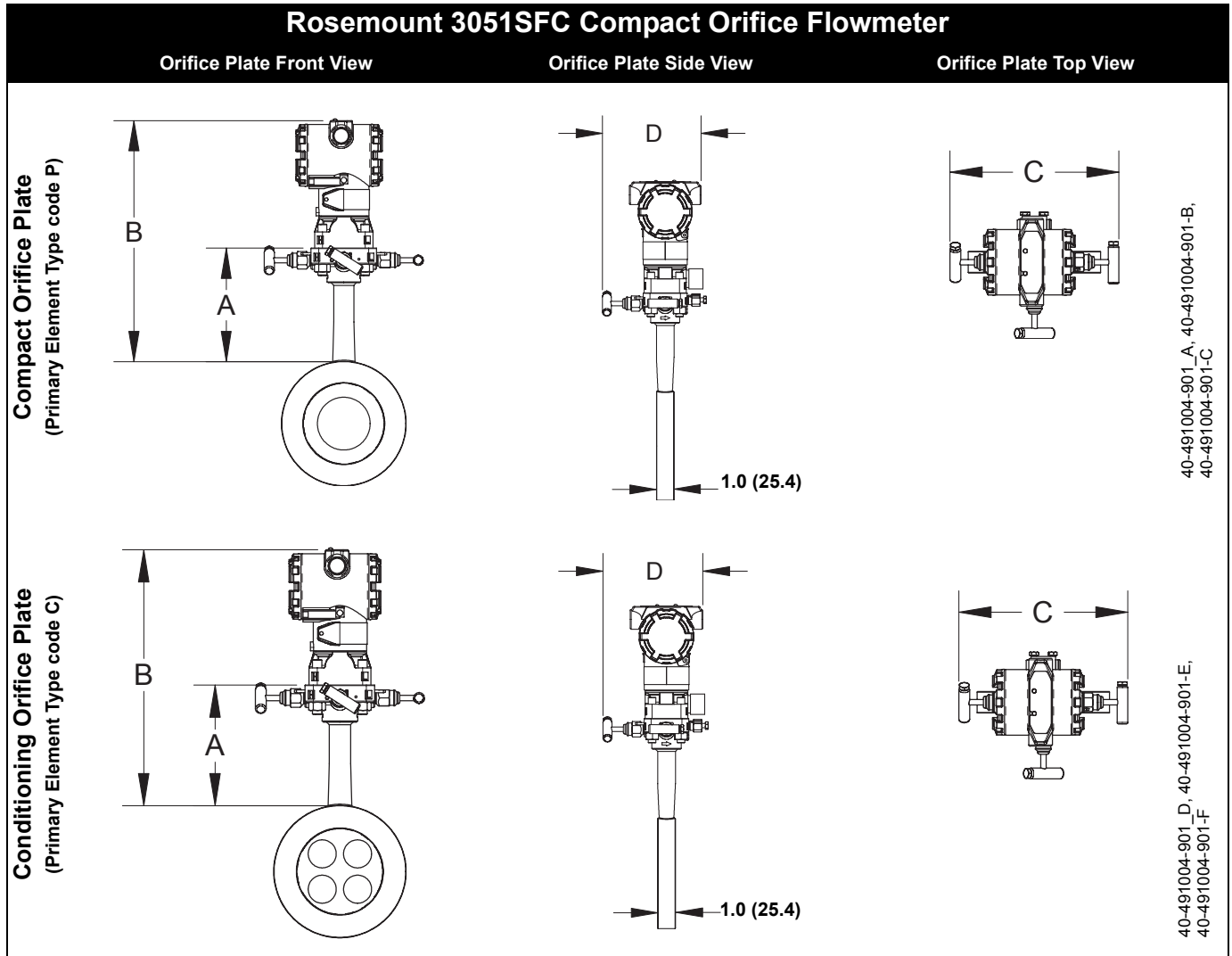


TABLE 10. Dimensional Drawings⁽¹⁾

Plate Type	A	B	Transmitter Height	C	D
Type P	see chart below	Transmitter Height + A	7.75 (197)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open
Type C	see chart below	Transmitter Height + A	7.75 (197)	7.75 (197) - closed 8.25 (210) - open	6.00 (152) - closed 6.25 (159) - open

TABLE 11. Flange Rating (dimension A)⁽¹⁾

Flange Rating	Line Size							
	0.5 ⁽²⁾	1 ⁽²⁾	1.5 ⁽²⁾	2	3	4	6	8
150# (PN 16)	2.350 (59.69)	2.365 (60.07)	2.490 (63.25)	2.240 (56.90)	2.300 (58.42)	2.540 (64.52)	3.800 (95.52)	3.800 (96.52)
300# (PN 40)	2.225 (56.52)	2.050 (52.07)	1.930 (49.02)	1.990 (50.55)	1.925 (48.90)	2.040 (51.82)	3.050 (77.74)	3.050 (77.47)
600# (PN 100)	2.225 (56.52)	2.050 (52.07)	1.930 (49.02)	1.990 (50.55)	1.925 (48.90)	1.665 (42.29)	2.300 (58.42)	2.300 (58.42)

(1) Measurement is in inches (millimeters).

(2) Plate type option P only.

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

ORDERING INFORMATION

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

Model	Product Description		
3051SFC	Compact Orifice Flowmeter		
Code	Measurement Type		
D	Differential Pressure		
Code	Primary Element Type		
C	Conditioning Orifice Plate		
P	Orifice Plate		
Code	Material Type		
S	316 Stainless Steel (SST)		
Code	Line Size		
005 ⁽¹⁾	1/2-in. (15 mm)		
010 ⁽¹⁾	1-in. (25 mm)		
015 ⁽¹⁾	1 1/2-in. (40 mm)		
020	2-in. (50 mm)		
030	3-in. (80 mm)		
040	4-in. (100 mm)		
060	6-in. (150 mm)		
080	8-in. (200 mm)		
Code	Primary Element Style		
N	Square Edged		
Code	Beta Ratio		
040	0.40 Beta Ratio (β)		
065 ⁽²⁾	0.65 Beta Ratio (β)		
Code	Temperature Measurement		
R	Remote Thermowell and RTD		
0	No Temperature Sensor		
9	Special		
Code	Electronics Connection Platform		
3	Direct-mount, 3-valve integral manifold, SST		
7	Remote-mount, 1/4-in. NPT connections		
Code	Differential Pressure Range		
1A ⁽³⁾	0 to 25 in H ₂ O (0 to 62.2 mbar)		
2A	0 to 250 in H ₂ O (0 to 623 mbar)		
3A	0 to 1000 in H ₂ O (0 to 2.5 bar)		
Code	Output Protocol		
A	4–20 mA with digital signal based on <i>HART</i> protocol		
B ⁽⁴⁾	4–20 mA Safety Certified with digital signal based on <i>HART</i> protocol (requires <i>PlantWeb</i> housing)		
F	<i>FOUNDATION</i> fieldbus: AI block, Link Master, Input Selector Block (requires <i>PlantWeb</i> housing)		
Code	Electronics Housing Style	Material	Conduit Entry Size
1A	<i>PlantWeb</i> Housing	Aluminum	1/2-14 NPT
1B	<i>PlantWeb</i> Housing	Aluminum	M20 x 1.5 (CM20)
1C	<i>PlantWeb</i> Housing	Aluminum	G ¹ / ₂
1J	<i>PlantWeb</i> Housing	316L SST	1/2-14 NPT
1K	<i>PlantWeb</i> Housing	316L SST	M20 x 1.5 (CM20)
1L	<i>PlantWeb</i> Housing	316L SST	G ¹ / ₂
2A	Junction Box Housing	Aluminum	1/2-14 NPT
2B	Junction Box Housing	Aluminum	M20 x 1.5 (CM20)
2C	Junction Box Housing	Aluminum	G ¹ / ₂
2E	Junction Box housing with output for remote display and interface	Aluminum	1/2-14 NPT
2F	Junction Box housing with output for remote display and interface	Aluminum	M20 x 1.5 (CM20)
2G	Junction Box housing with output for remote display and interface	Aluminum	G ¹ / ₂

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

2J	Junction Box Housing	316L SST	1/2-14 NPT
2M	Junction Box housing with output for remote display and interface	316L SST	1/2-14 NPT
Code	Electronics Performance Class		
3	Ultra for Flow: up to 0.75% flow rate accuracy, 14:1 flow turndown, 10-year stability, limited 12-year warranty		
1	Ultra: up to 0.85% flow rate accuracy, 8:1 flow turndown, 10-year stability, limited 12-year warranty		
2	Classic: up to 1.05% flow rate accuracy, 8:1 flow turndown, 5-year stability		
Code	Options		
Installation Accessories			
G	DIN alignment ring (PN 16)		
H	DIN alignment ring (PN 40, PN 100)		
Remote Adapters			
E	Flange adapters 316 SST (1/2-in. NPT)		
High Temperature Applications			
T	Graphite valve packing (Tmax = 850 °F)		
Flow Calibration			
WC ⁽⁵⁾	Discharge coefficient verification (3 point)		
WD ⁽⁵⁾	Discharge coefficient verification (full 10 point)		
Hydrostatic 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 certification		
QC7	Inspection and performance certification		
Transmitter Calibration Certification			
Q4	Calibration data certificate for transmitter		
QP	Calibration certification and tamper evident seal		
Material Traceability Certification			
Q8	Material certification per ISO 10474 3.1.B and EN 10204 3.1.B		
Quality Safety Certification			
QS	Quality certification for safety		
Code Conformance			
J2	ANSI B31.1		
J3	ANSI B31.3		
J4	ANSI B31.8		
J5 ⁽⁶⁾	NACE MR-0175 / ISO 15156		
Country Certification			
J1	Canadian Registration		
Product Certifications			
E1	ATEX Flameproof		
I1	ATEX Intrinsically Safe		
N1	ATEX Type N		
IA	ATEX Fisco Intrinsically Safe		
K1	ATEX Flameproof, Intrinsically Safe, Type n, Dust		
ND	ATEX Dust		
E5	FM Explosion-proof		
I5	FM Intrinsic Safety, non-incendive		
K5	FM Explosion-proof, Intrinsic Safety, non-incendive		
E6	CSA Explosion-proof		
I6	CSA Intrinsic Safety, non-incendive		
K6	CSA Explosion-proof, Intrinsically Safe, Division 2		
E7	SAA Flameproof, Dust Ignition Proof		
I7	SAA Intrinsic Safety		
K7	SAA Flameproof, SAA Intrinsic Safety, and Type N		
N7	SAA Type n		

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

Rosemount 3051SFC Compact Orifice Flowmeter Ordering Information

KA	ATEX and CSA Flameproof and Intrinsic Safety (combination of E1, I1, E6, and I6)
KB	FM and CSA Explosion-proof, Intrinsically Safe, Division 2
KC	FM and ATEX Explosion-proof, Intrinsically Safe, Non-incendive

Alternative Transmitter Material of Construction

L1 ⁽³⁾	Inert Sensor Fill Fluid (not available with Differential Pressure range code 1A)
L2	Graphite-filled Teflon® (PTFE) o-ring
LA ⁽³⁾	Inert sensor fill fluid and graphite-filled Teflon (PTFE) o-ring

Display

M5	<i>PlantWeb</i> LCD display (requires <i>PlantWeb</i> housing)
M7	Remote mount LCD display and interface, <i>PlantWeb</i> housing, no cable, SST bracket
M8	Remote mount LCD display and interface, <i>PlantWeb</i> housing, 50 foot cable, SST bracket ⁽⁷⁾
M9	Remote mount LCD display and interface, <i>PlantWeb</i> housing, 100 foot cable, SST bracket ⁽⁷⁾

Terminal Blocks

T1	Transient terminal block
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Manifold for Remote Mount Option

F2	3-Valve Manifold, SST
F6	5-Valve Manifold, SST

PlantWeb Control Anywhere Software

A01	Regulatory control suite: PID, arith, signal char, integ, etc. (requires <i>PlantWeb</i> housing and <i>FOUNDATION</i> fieldbus)
-----	--

PlantWeb Advanced Diagnostic Software

D01	Diagnostics suite: Plugged Impulse Line and SPM diagnostics (requires <i>PlantWeb</i> housing and <i>FOUNDATION</i> fieldbus)
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Alarm Limits

C4 ⁽⁷⁾	NAMUR alarm and saturation signal levels, high alarm
C5 ⁽⁷⁾	NAMUR alarm and saturation signal levels, low alarm
C6 ⁽⁷⁾	Custom alarm and saturation signal levels, high alarm
C7 ⁽⁷⁾	Custom alarm and saturation signal levels, low alarm
C8 ⁽⁷⁾	Low alarm (standard Rosemount alarm and saturation signal levels)

Special Transmitter Configuration (Hardware)

D1 ⁽⁷⁾	Hardware Adjustment (zero, span, security)
D4	External ground screw
DA ⁽⁷⁾	Hardware adjustment (zero, span, security) and external ground screw

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

(2) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for primary element type C.

(3) Not available with Electronics Performance Class Code 3.

(4) Requires Hardware Adjustments option code D1. Not available with scaled variable configuration.

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

(6) Materials of Construction comply with recommendations per NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.

(7) Not available with *FOUNDATION* fieldbus protocol.

Rosemount 3095MFC Compact Orifice Mass Flowmeter

SPECIFICATIONS

Performance

System Reference Accuracy

Percent (%) of mass flow rate

TABLE 12. 3095MFC Compact Orifice Mass Flowmeter

Type	Beta	Mass Flow Accuracy (8:1 flow turndown)
3095MFCC	0.4	±0.70%
	0.65	±0.90%
3095MFCCP ⁽¹⁾⁽²⁾	0.4	±2.00%
	0.65 ⁽³⁾	
3095MFCCP ⁽⁴⁾	0.4	±1.40%
	0.65 ⁽³⁾	

(1) Line sizes 1/2 to 1 1/2-in. (12.7 to 38.1 mm).

(2) Discharge Coefficient Uncertainty for 1/2-in. units with Beta = 0.65 is +2.25%. Contact the factory for mass flow accuracy.

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

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

Repeatability

±0.1%

Line Sizes

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

Output

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

Performance Statement Assumptions

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

Sizing

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

Turndown

8:1 flow turndown

Optional Performance Class Specification

Ultra for Flow (Code U3): up to 0.75% mass flow rate accuracy, 10:1 turndown, 10-year stability, limited 12-year warranty

Functional

Service

- Liquid
- Gas
- Steam

Power Supply

4–20 mA option

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

Process Temperature Limits

Direct Mount Electronics

- 450 °F (232 °C)

Remote Mount Electronics

- 850 °F (454 °C) – Stainless Steel

Electronics Temperature Limits

Ambient

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

Storage

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

Pressure Limits⁽¹⁾

Direct Mount Electronics

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

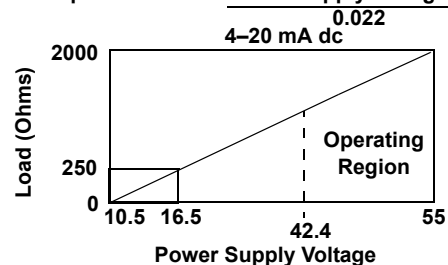
Static Pressure Limits

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

Load Limitations

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

$$\text{Max. Loop Resistance} = \frac{\text{Power Supply Voltage} - 11.0}{0.022}$$



For CSA approval, power supply must not exceed 42.4 V dc. HART communication requires a minimum loop resistance of 250 ohms.

(1) Static pressure selection may effect pressure limitations.

Overpressure Limits

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

Humidity Limits

- 0–100% relative humidity

Inert Sensor Fill Fluid

- Not available with Static Pressure range codes B and D
- Not available with Differential Pressure range code 1

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

HART 4–20mA (output code A)

- If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 3.75 mA or above 21.7 mA to alert the user. High or low alarm signal is user-selectable by internal jumper.)

Physical

Temperature Measurement ⁽¹⁾

Remote RTD

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

Thermowell

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

NOTE

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

Electronic Connections for Remote Mount

- 1/2–14 NPT, G 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

Manifold Head/Valves

- 316 SST

Flange Studs and Nuts

- Customer supplied
- Available as a spare part

Transmitter Connection Studs and Nuts

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

Gasket and O-rings

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

NOTE

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

Transmitter Connections

Remote Mount

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

Orifice Type

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

Process Connections

Mounts between the following flange configurations

ASME B16.5 (ANSI):

DIN:

- | | |
|-------------|----------------------------------|
| • Class 150 | • PN16 (option code G required) |
| • Class 300 | • PN40 (option code H required) |
| • Class 600 | • PN100 (option code H required) |

ANSI alignment ring is included as standard when ordering

(1)

Bore Sizes (d)

For 3095MFCC, Beta (β) is calculated by $2 \times d / \text{pipe size}$.

TABLE 13. $\beta = 0.4^{(1)(2)}$

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

TABLE 14. $\beta = 0.65^{(1)(2)}$

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

(1) Measurement is in inches (millimeters)

(2) Tolerance = ± 0.002 -in.

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

Weight

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

(1) Measurement in lb (kg).

Installation Considerations

Straight Run Requirements

TABLE 15. 3095MFCC Straight Pipe Requirements⁽¹⁾

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

TABLE 16. 3095MFCP Straight Pipe Requirements⁽¹⁾⁽²⁾⁽³⁾

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

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

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

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

Pipe Orientation

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

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

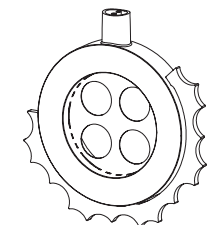
(1) D = Direct mount acceptable (recommended)

R = Remote mount acceptable

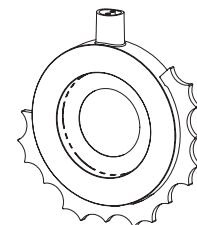
NR = Not recommended

Pipe Centering

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



3095MFCCD
Conditioning Orifice



3095MFCDP
Compact Orifice

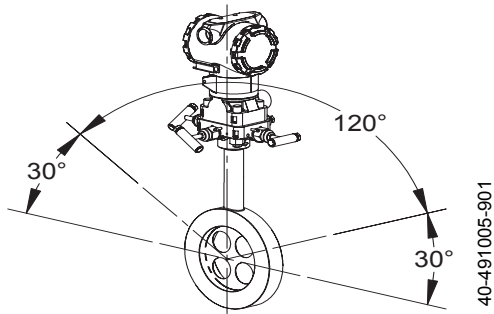
Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

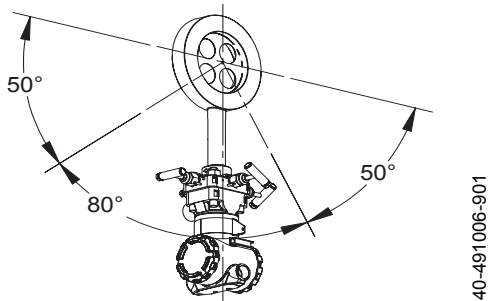
Flowmeter Orientation

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

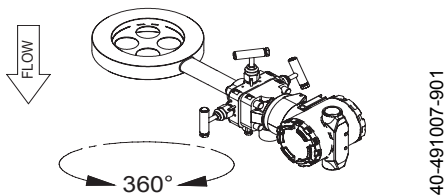
Gas (Horizontal)



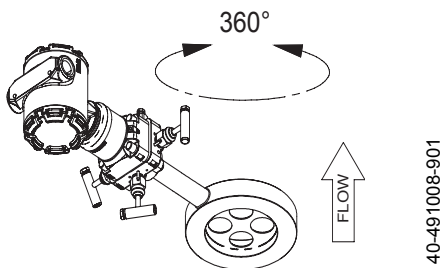
Liquid and Steam (Horizontal)



Gas (Vertical)



Liquid (Vertical)



PRODUCT CERTIFICATIONS

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

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

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

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

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

Transmitter Attachments: Process Flange - Manifold —
Sound Engineering Practice

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

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

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 17. Connection Parameters (Power/Signal Terminals)

$U_i = 30\text{V}$
$I_i = 200\text{mA}$
$P_i = 1.0\text{W}$
$C_i = 0.012\ \mu\text{F}$
$L_i = 0$

TABLE 18. Temperature Sensor Connection Parameters

$U_o = 30\text{V}$
$I_o = 19\text{mA}$
$P_o = 140\text{mW}$
$C_i = 0.002\ \mu\text{F}$
$L_i = 0$

TABLE 19. Temp Sensor Terminals Connection Parameters

$C_o = 0.066\ \mu\text{F}$	Gas Group IIC
$C_o = 0.560\ \mu\text{F}$	Gas Group IIB
$C_o = 1.82\ \mu\text{F}$	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


TABLE 19. Temp Sensor Terminals Connection Parameters

$L_o/R_o = 247\ \mu\text{H}/\text{ohm}$	Gas Group IIC
$L_o/R_o = 633\ \mu\text{H}/\text{ohm}$	Gas Group IIB
$L_o/R_o = 633\ \mu\text{H}/\text{ohm}$	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)

Special Conditions for Safe Use

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

E1 ATEX Flameproof


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

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
 $V = 55\text{Vdc MAX}$
 $I = 23\text{mA MAX}$
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

DIMENSIONAL DRAWINGS

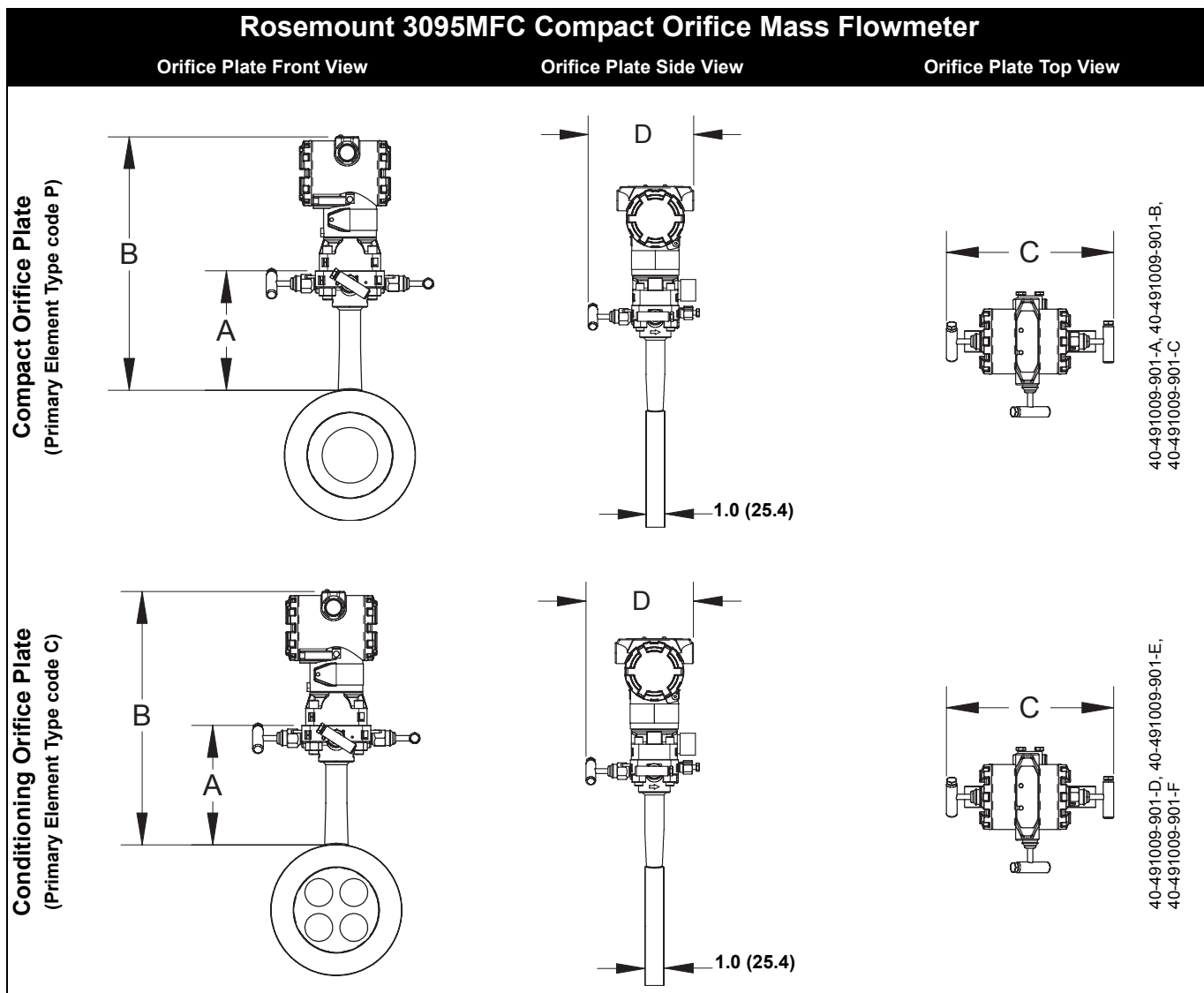


TABLE 20. Dimensional Drawings⁽¹⁾

Plate Type	A	B	Transmitter Height	C	D
Type P	see chart below	Transmitter Height + A	6.25-in. (159 mm)	7.75 (197) - closed 8.25 (210) - open	6.00-in. (152 mm) - closed 6.25-in. (159 mm) - open
Type C	see chart below	Transmitter Height + A	6.25-in. (159 mm)	7.75 (197) - closed 8.25 (210) - open	6.00-in. (152 mm) - closed 6.25-in. (159 mm) - open

TABLE 21. Flange Rating (dimension A)

Flange Rating	Line Size							
	0.5 ⁽²⁾	1 ⁽²⁾	1.5 ⁽²⁾	2	3	4	6	8
150# (PN 16)	2.350 (59.69)	2.365 (60.07)	2.490 (63.25)	2.240 (56.90)	2.300 (58.42)	2.540 (64.52)	3.800 (95.52)	3.800 (96.52)
300# (PN 40)	2.225 (56.52)	2.050 (52.07)	1.930 (49.02)	1.990 (50.55)	1.925 (48.90)	2.040 (51.82)	3.050 (77.74)	3.050 (77.47)
600# (PN 100)	2.225 (56.52)	2.050 (52.07)	1.930 (49.02)	1.990 (50.55)	1.925 (48.90)	1.665 (42.29)	2.300 (58.42)	2.300 (58.42)

(1) Measurement is in inches (millimeters).

(2) Plate type option P only.

ORDERING INFORMATION

Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Model	Product Description	
3095MFC	Compact Orifice Mass Flowmeter	
Code	Primary Element Type	
C	Conditioning Orifice Plate	
P	Orifice Plate	
Code	Material Type	
S	316 Stainless Steel (SST)	
Code	Line Size	
005 ⁽¹⁾	1/2-in. (15 mm)	
010 ⁽¹⁾	1-in. (25 mm)	
015 ⁽¹⁾	1 1/2-in. (40 mm)	
020	2-in. (50 mm)	
030	3-in. (80 mm)	
040	4-in. (100 mm)	
060	6-in. (150 mm)	
080	8-in. (200 mm)	
Code	Primary Element Style	
N	Square Edged	
Code	Beta Ratio	
040	0.40 Beta Ratio (β)	
065 ⁽²⁾	0.65 Beta Ratio (β)	
Code	Temperature Measurement	
R	Remote Thermowell and RTD	
0	No Temperature Sensor	
9	Special	
Code	Electronics Connection Platform	
3	Direct-mount, 3-valve integral manifold, SST	
7	Remote-mount, 1/4-in. NPT connections	
Code	Differential Pressure Range	
1 ⁽³⁾ ⁽⁴⁾	0 to 25 in H ₂ O (0 to 62.2 mbar)	
2	0 to 250 in H ₂ O (0 to 623 mbar)	
3	0 to 1000 in H ₂ O (0 to 2.5 bar)	
Code	Static Pressure Range	
B	0 – 8 to 0 – 800 psia (0 –55.16 to 0 – 5515.8 kPa)	
C	0 – 8 to 0 – 800 psig (0 –55.16 to 0 – 5515.8 kPa)	
D	0 – 36.2 to 0 – 3626 psia (0 –250 to 0 – 25000 kPa)	
E	0 – 36.2 to 0 – 3626 psig (0 –250 to 0 – 25000 kPa)	
Code	Output Protocol	
A	4–20 mA with digital signal based on <i>HART</i> protocol	
V	<i>FOUNDATION</i> fieldbus	
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	G 1/2
1J	SST	1/2-14 NPT
1K	SST	M20 x 1.5 (CM20)
1L	SST	G 1/2

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Code	Options
Performance Class	
U3 ⁽⁶⁾	Ultra for Flow: up to 0.75% mass flow rate accuracy, up to 10:1 turndown, 10-year stability, limited 12-year warranty
PlantWeb Control Anywhere Software	
A01	Regulatory control suite: PID, arith, signal char, integ.etc.
Installation Accessories	
G	DIN alignment ring (PN 16)
H	DIN alignment ring (PN 40, PN 100)
Remote Adapters	
E	Flange adapters 316 SST (1/2-in. NPT)
High Temperature Applications	
T	Graphite valve packing (Tmax = 850 °F)
Flow Calibration	
WC ⁽⁶⁾	Discharge coefficient verification (3 point)
WD ⁽⁶⁾	Discharge coefficient verification (full 10 point)
Hydrostatic 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 certification
QC7	Inspection and performance certification
Transmitter Calibration Certification	
Q4	Calibration data certificate for transmitter
Material Traceability Certification	
Q8	Material certification per ISO 10474 3.1.B and EN 10204 3.1.B
Code Conformance	
J2	ANSI B31.1
J3	ANSI B31.3
J4	ANSI B31.8
J5 ⁽⁷⁾	NACE MR-0175 / ISO 15156
Country Certification	
J1	Canadian Registration
Product Certifications	
E1	ATEX Flameproof
I1	ATEX Intrinsically Safe
N1	ATEX Type N
K1	ATEX Flameproof, Intrinsically Safe, Type n
ND	ATEX Dust
E5	FM Explosion proof
I5	FM Intrinsically Safe, non-incendive
K5	FM Explosion-proof, Intrinsically Safe, Non-Incendive
E6	CSA Explosion proof
I6	CSA Intrinsically Safe, Division 2
K6	CSA Explosion-proof, Intrinsically Safe, Division 2
K7	SAA Flame-proof and Intrinsic Safety Approvals (combination of I7, N7, and E7)
E4	JIS Flame-proof Certification

Rosemount 3095MFC Compact Orifice Mass Flowmeter Ordering Information

Alternative Transmitter Material of Construction

L1⁽³⁾ (8) Inert Sensor Fill Fluid

Display

M5 Integral mount LCD display

Terminal Blocks

T1 Transient Protection

Manifold for Remote Mount Option

F2 3-Valve Manifold, SST

F6 5-Valve Manifold, SST

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

- (1) Not available for Primary Element Type code C.
- (2) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for primary element type C.
- (3) Not available with Options Performance Class Code code U3: Ultra for Flow.
- (4) Not available with Static Pressure codes D and E.
- (5) Not available with Differential Pressure Range code 1A. Not available with Option code L1.
- (6) Not available with Primary Element Type code P.
- (7) Materials of Construction comply with recommendations per 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.
- (8) Not available with Static Pressure range codes B and D or Differential Pressure range code 1.

Rosemount 405 Compact Orifice Primary Element

SPECIFICATIONS

Performance

Discharge Coefficient Uncertainty

TABLE 22. 405 Compact Orifice Flowmeter

Type	Beta	Discharge Coefficient Uncertainty
Conditioning	0.4	±0.50%
	0.65	±0.75%
Standard (1)(2)	0.4	±1.75%
	0.65	±1.75%
Standard (3)	0.4	±1.25%
	0.65	±1.25%

(1) Line sizes 1/2 to 1 1/2-in. (12.7 to 38.1 mm).

(2) Discharge Coefficient Uncertainty for 1/2-in. units with Beta = 0.65 is ±2.25%.

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

Line Sizes

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

Sizing

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

Functional

Service

- Liquid
- Gas
- Vapor

Operating Process Temperature Limits

Standard (direct/remote mount):

- -40 to 450 °F (-40 to 232 °C)

Extended (remote mount only with option code T):

- -148 to 850 °F (-100 to 454 °C)

Maximum Working Pressure

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

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

Material of Construction

Body/Plate

- 316 SST

Manifold Head/Valves

- 316 SST

Flange Studs and Nuts

- Customer supplied
- Available as a spare part

Transmitter Connection Studs and Nuts

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

Gasket and O-rings

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

NOTE

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

Transmitter Connections

Direct Mount

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

Remote Mount

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

Orifice Plate Type

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

Process Connections

Mounts between the following flange configurations:

- | | |
|--------------------|----------------------------------|
| ASME B16.5 (ANSI): | DIN: |
| • Class 150 | • PN16 (option code G required) |
| • Class 300 | • PN40 (option code H required) |
| • Class 600 | • PN100 (option code H required) |

ANSI alignment ring is included as standard when ordering.

Bore Sizes (d)

For 405C, Beta (β) is calculated by $2 \times d / \text{pipe size}$.

TABLE 23. $\beta = 0.4^{(1)(2)}$

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

TABLE 24. $\beta = 0.65^{(1)(2)}$

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

- (1) Measurement is in inches (millimeters)
- (2) Tolerance = ± 0.002 -in.
- (3) Beta (β) = 0.60 (15.24 mm) for 2-in. line size only.

Weight

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

- (1) Measurement in lb (kg).

Installation Consideration

Straight Pipe Requirement

Use the appropriate lengths of straight pipe upstream and downstream of the 405 to minimize the effects of moderate flow disturbances in the pipe. Table 25 and Table 26 lists recommended lengths of straight pipe per ISO 5167.

TABLE 25. 405C Straight Pipe Requirements⁽¹⁾

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

TABLE 26. 405P Straight Pipe Requirements⁽¹⁾⁽²⁾⁽³⁾

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

- (1) Consult an Emerson Process Management representative if disturbance is not listed.
- (2) Recommended lengths represented in pipe diameters per ISO 5167.
- (3) Refer to ISO 5167 for recommended lengths when using flow straighteners.

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

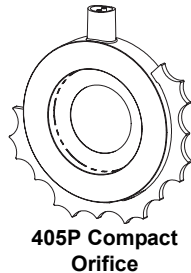
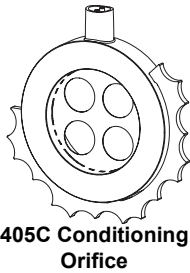
Pipe Orientation

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

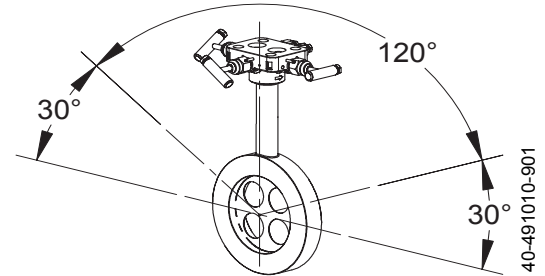
Improper centering of any orifice type device can cause an error of up to ±5% in small line sizes. A centering mechanism (centering ring) independent of flange rating comes standard with the 405 Compact Orifice Series.



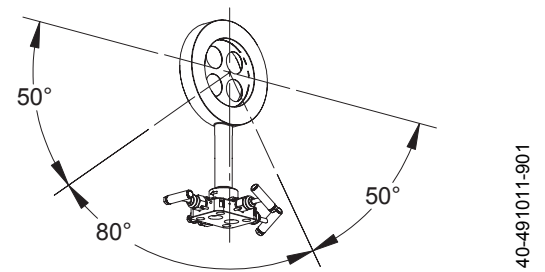
Flowmeter Orientation

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

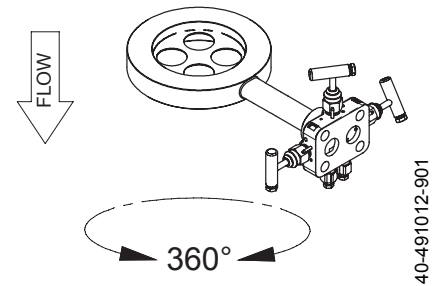
Gas (Horizontal)



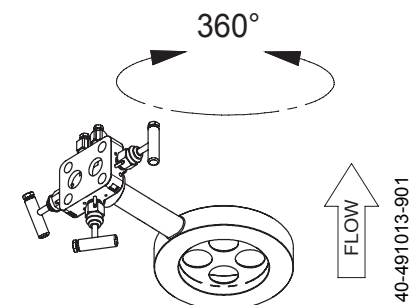
Liquid and Steam (Horizontal)



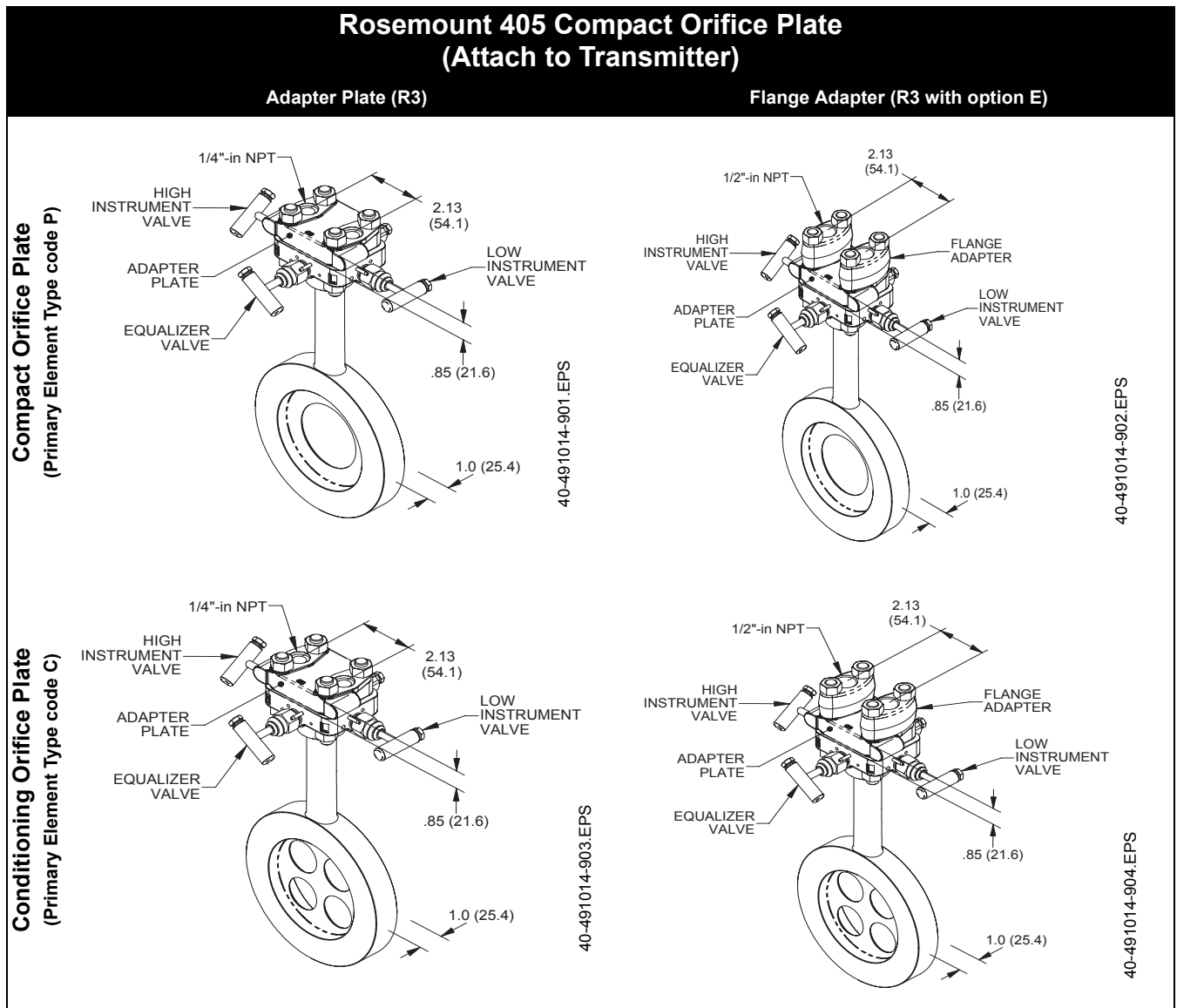
Gas (Vertical)

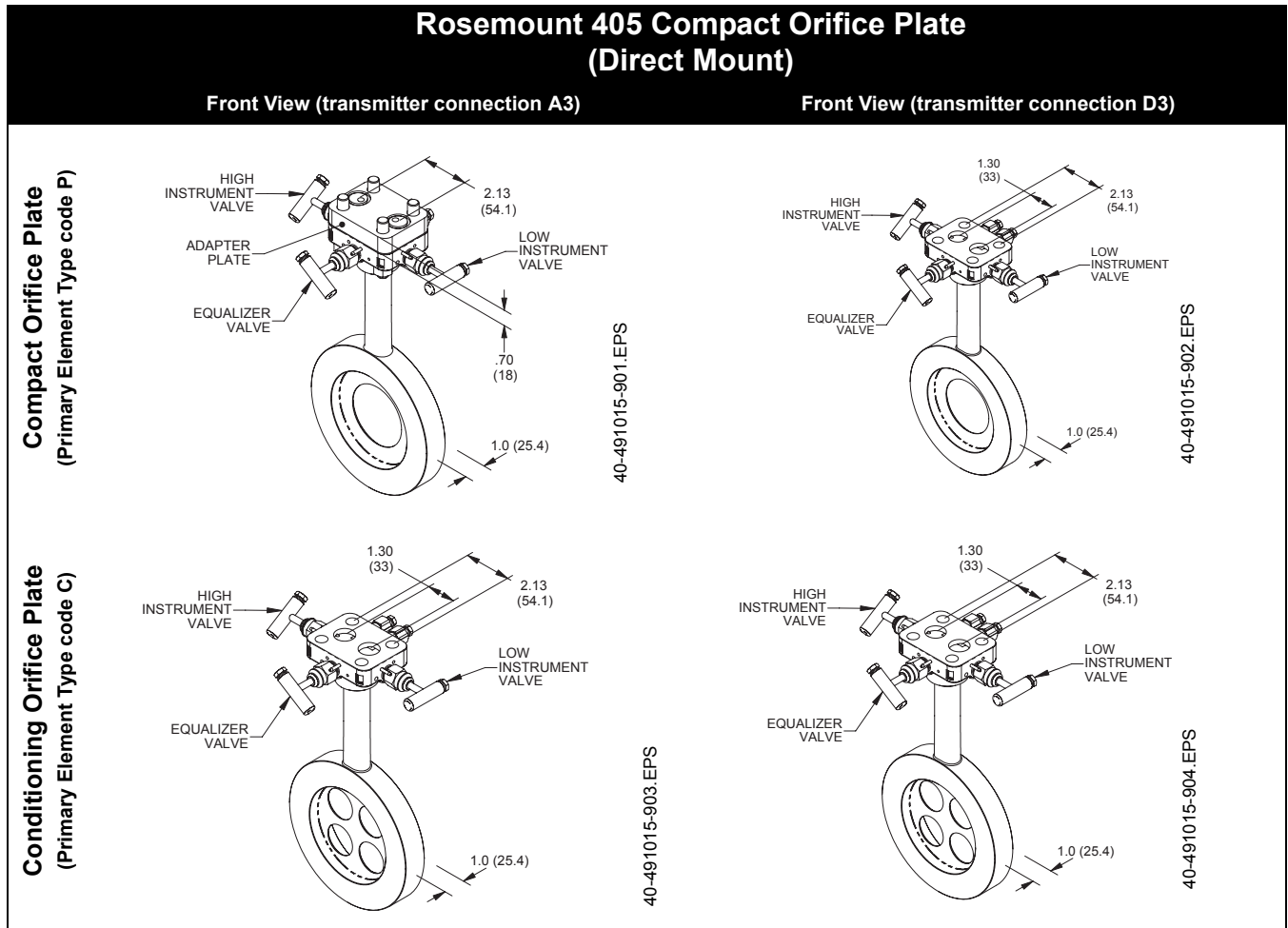


Liquid (Vertical)



DIMENSIONAL DRAWINGS





NOTE

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

ORDERING INFORMATION

Rosemount 405 Compact Orifice Primary Element Ordering Information

Model	Product Description
405	Compact Primary Element
Code	Primary Element Type
C	Conditioning Orifice Plate
P	Orifice Plate
Code	Material Type
S	316 Stainless Steel (SST)
Code	Line Size
005 ⁽¹⁾	1/2-in. (15 mm)
010 ⁽¹⁾	1-in. (25 mm)
015 ⁽¹⁾	1 1/2-in. (40 mm)
020	2-in. (50 mm)
030	3-in. (80 mm)
040	4-in. (100 mm)
060	6-in. (150 mm)
080	8-in. (200 mm)
Code	Primary Element Style
N	Square Edged
Code	Beta Ratio
040	0.40 Beta Ratio (β)
065 ⁽²⁾	0.65 Beta Ratio (β)
Code	Transmitter Connection
D3	<i>Coplanar</i> , Direct mount, 3-valve integral manifold, SST
R3	Remote-mount, 1/4-in. NPT connections
A3	Traditional, Direct mount, 3-valve integral manifold with adapter plate, SST
Code	Options
Installation Accessories	
G	DIN alignment ring (PN 16)
H	DIN alignment ring (PN 40, PN 100)
Adapters	
E	Flange adapters 316 SST (1/2-in. NPT)
High Temperature Applications	
T	Graphite valve packing (Tmax = 850 °F)
Flow Calibration	
WC ⁽³⁾	Discharge coefficient verification (3 point)
WD ⁽³⁾	Discharge coefficient verification (full 10 point)
Special Cleaning	
P2	Cleaning for special processes
PA	Cleaning per ASTM G93 Level D (section 11.4)
Continued on Next Page	

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

Rosemount 405 Compact Orifice Primary Element Ordering Information

Special Inspection

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

Material Traceability Certification

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

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

Country Certification

J1	Canadian Registration
----	-----------------------

Typical Model Number: 405 C S 040 N 040 D3

- (1) Not available for Primary Element Type code C.
- (2) For 2-in. (50.8 mm) line sizes the Beta Ratio is 0.6 for primary element type C.
- (3) Not available with Primary Element Type code P.
- (4) Materials of Construction comply with recommendations per 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.

Configuration Data Sheet (CDS)

DP FLOW CDS

Complete this form to define a custom flow configuration for DP Flowmeters. Unless specified, the flowmeter will be shipped with the default values identified by the H symbol.

For technical assistance in filling out this CDS, call a Rosemount representative.

NOTE

Any missing information will be processed with the indicated default values.

* = Required Item

★ = Default

Customer Information

Customer:	Contact Name:
Customer Phone:	Customer Fax:
Customer Approval Sign-Off:	Customer PO:

Calculation Approval

Check this box if a calculation for approval prior to manufacturing is required

Application and Configuration Data Sheet (Required with Order)

Tag:

Model No ⁽¹⁾

* **Select fluid type** Liquid Gas Steam

* **Fluid name**⁽²⁾

Flowmeter Information (optional)

* Failure Mode Alarm Direction (select one) Alarm High★ Alarm Low

Software Tag: _____ (8 characters)

Descriptor: _____ (16 characters)

Message: _____
 _____ (32 characters)

Date: Day ___ (numeric) Month ___ (numeric) Year ___ (numeric)

(1) A complete model number is required before Rosemount Inc. can process the order.

(2) If the Fluid is not located in Table 27 on page 33, the "Fluid Data Sheet (FDS)" on page 34 must be completed.

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S.O.:	LI
CHAMP:	DATE:
	ADMIN:

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

* = Required Item

★ = Default

Primary Element Information

* Select Differential Producer (Select One)

Annubar

- 485 Annubar/ 3095MFA Mass ProBar, 3051SFA ProBar
- 285 Annubar
- Annubar Diamond II + / Mass Probar
- Long Radius Wall Taps, ASME
- Long Radius Wall Taps, ISO
- ISA 1932, ISO

Venturi

- Nozzle, ISO
- Rough Cast/Fabricated Inlet, ASME
- Round Cast Inlet, ISO
- Machined Inlet, ASME
- Machined Inlet, ISO
- Welded Inlet, ISO

Other (All options require a discharge coefficient value)

- Calibrated Orifice: Flange, Corner, or D & D/2 Taps.

Discharge coefficient: _____

- Calibrated Orifice: 2¹/₂ D & 8D Taps

Discharge coefficient: _____

- Calibrating Nozzle

Discharge coefficient: _____

- Calibrating Venturi

Discharge coefficient: _____

- Area Averaging Meter

Discharge coefficient: _____

- V-Cone®

Discharge coefficient: _____

Diameter (d) _____

Orifice

- 3051SFP, 3095MFP, 1195
- 405C, 405P, 3051SFC, 3095MFC
- 1595 Conditioning Orifice
- 2¹/₂D & 8D Taps, ASME
- Corner Taps, ASME
- Corner Taps, ISO
- D & D/2 Taps, ASME
- D & D/2 Taps, ISO
- D & D/2 Taps, ISO 99 Amendment 1
- Flange Taps, AGA
- Flange Taps, ASME
- Flange Taps, ISO
- Flange Taps, ISO 99 Amendment 1
- Small Bore, Flange Taps, ASME

inch★

millimeters

at _____

°F

°C

68 °F★

ODF _____

ODT _____

Special Annubar dimension (required if customer supplies mounting hardware).

Pipe Information

* Orientation / Flow Direction: Vertical Up Vertical Down Horizontal

* Line Size / Schedule: _____ Body I.D. (D): _____

Materials of Construction

* Pipe Material Carbon Steel 304 SST 316 SST Hastelloy Other _____

* Primary Element Material 316 SST Hastelloy Other _____ (Please verify material availability)

Operating Conditions

	4 mA value	Minimum	Normal	Maximum	Full Scale:20 mA flow rate (design to P and T)	Design
Flow Rate	0	*(1)	*	*		
Pressure (P)	—	*(1)	*	*(1)	*(2)	
Temperature (T)	—	*(1)	*	*(1)	*	

RTD Mode

Normal Mode ★ (Requires a RTD to be connected. If the RTD is disconnected or fails, the 3095MV output goes to alarm value)

Fixed Temperature Mode: Specify the fixed temperature value _____ °F °C

Backup Mode (Uses the connected RTD for temperature measurement. If the RTD is disconnected or fails, the transmitter uses a fixed temperature value as a backup. This will not cause the mA output to go to alarm value and can potentially cause inaccurate flow measurement.) Fixed temperature value to be used as backup _____ °F °C

* = Required Item

★ = Default

Base Conditions

Standard Base (P=14.696 psia / 101.325 kPa abs, T= 60 °F (15.56 °C))

Normal Base (P=14.696 psia / 101.325 kPa abs, T= 32 °F (0 °C))

Standard Base for Natural Gas (AGA) (P=14.73 psia, T= 60°F (15.56 °C))

User Defined: P= _____ Units: _____ T= _____ Units = _____

Compressibility at Base: _____ OR Density at Base: _____

(1) Operating ranges for pressure and temperature are needed for transmitter configuration.

(2) Required to verify that the product selection meets design criteria.

TABLE 27. Rosemount Fluids Database⁽¹⁾

Acetic Acid	Divinyl Ether	Methane	n-Hexane	1-Heptanol
Acetone	Ethane	Methanol	n-Octane	1-Heptene
Acetonitrile	Ethanol	Methyl Acrylate	n-Pentane	1-Hexene
Acetylene	Ethylamine	Methyl Ethyl Ketone	Oxygen	1-Hexadecanol
Acrylonitrile	Ethylbenzene	Methyl Vinyl Ether	Pentafluorothane	1-Octanol
Air	Ethylene	m-Chloronitrobenzene	Phenol	1-Octene
Allyl Alcohol	Ethylene	Neon	Propadiene	1-Nonanol
Ammonia	GlycolEthylene	Neopentane	Pyrene	1-Pentadecanol
Argon	Oxide	Nitric Acid	Propylene	1-Pentanol
Benzene	Fluorene	Nitric Oxide	Styrene	1-Pentene
Benzaldehyde	Furan	Nitrobenzene	Sulfur Dioxide	1-Undecanol
Benzyl Alcohol	Helium-4	m-Dichlorobenzene	Propane	1-Nonanal
Biphenyl	Hydrazine	Nitroethane	Toluene	1,2,4- Trichlorobenzene
Carbon Dioxide	Hydrogen	Nitrogen	Trichloroethylene	1,1,2- Trichloroethane
Carbon Monoxide	Hydrogen Chloride	Nitromethane	Vinyl Acetate	1,1,2,2- Tetrafluoroethane
Carbon Tetrachloride	Hydrogen Cyanide	Nitrous Oxide	Vinyl Chloride	1,2-Butadiene
Chlorine	Hydrogen Peroxide	n-Butane	Vinyl Cyclohexane	1,3-Butadiene
Chlorotrifluoroethylene	Hydrogen Sulfide	n-Butanol	Water	1,3,5- Trichlorobenzene
Chloroprene	Isobutane	n-Butyraldehyde	1-Butene	1,4-Dioxane
Cycloheptane	Isobutene	n-Butyronitrile	1-Decene	1,4-Hexadiene
Cyclohexane	Isobutyl benzene	n-Decane	1-Decanal	2-Methyl-1-Pentene
Cyclopentane	Isopentane	n-Dodecane	1-Decanol	2,2-Dimethylbutane
Cyclopentene	Isoprene	n-Heptadecane	1-Dodecene	
Cyclopropane	Isopropanol	n-Heptane	1-Dodecanol	

(1) This list is subject to change without notice. Steam per ASME Steam tables. All other fluids per AIChE.

Drawing/Notes

Fluid Data Sheet (FDS)

For custom fluid not in the Rosemount Fluid Database

For technical assistance in filling out this CDS, call an Emerson Process Management representative. Complete this form to define a custom fluid. The H symbol identifies the default value.

NOTE

This form is not required if using the Rosemount Fluid Database.

* = Required Item
= Default

Customer Information

Customer:	Contact Name:
Customer Phone:	Customer Fax:
	Customer PO:

Fluid Properties

Custom Liquid– Complete Table	Liquid
Custom Gas– Complete Table	Gas
Custom Natural Gas– Complete Table	Natural Gas

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S.O.:	LI
CHAMP:	DATE:
	ADMIN:

TABLE 28. Custom Liquid Worksheet

* = Required Item
 = Default

Mass Liquid Density and Viscosity Information

1. Fill in the following operating temperatures

- a) _____ min
- b) _____ [$^{1/3}(\text{max} - \text{min})$] + min
- c) _____ [$^{2/3}(\text{max} - \text{min})$] + min
- d) _____ max

2. Transfer the values from the above section to the numbered lines below.

- 3. Check one Density box, then enter the values for each temperature and the standard density.
- 4. Check one Viscosity box, then enter values for each temperature. (At least one viscosity value is required).

Density

- Density in lbs/CuFt
- Density in kg/CuM

Viscosity

- Viscosity in centipoise
- Viscosity in lbs/ft sec
- Viscosity in pascal sec

Temperature

- a) _____ min
- b) _____ [$^{1/3}(\text{max} - \text{min})$] + min
- c) _____ [$^{2/3}(\text{max} - \text{min})$] + min
- d) _____ max

Temperature

- a) _____ min.
- b) _____ [$^{1/3}(\text{max} - \text{min})$] + min
- c) _____ [$^{2/3}(\text{max} - \text{min})$] + min
- d) _____ max

Base density: _____
 (at base reference conditions specified)

Volumetric Liquid Density and Viscosity Information

* Density at Flow: _____ Units: lb/ft³ Kg/m³ Other:

OR

Specific Gravity at Flow: _____

* Viscosity at Flow: _____ Units: Centipoise Other:

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

TABLE 29. Custom Gas Worksheet

* = Required Item
= Default

Mass Gas Compressibility and Viscosity Information

1. Fill in the following operating pressures and operating temperatures

Operating Pressures

- 1) _____ min
- 2) _____ [$^{1/3}$ (max - min))] + min
- 3) _____ [$^{2/3}$ (max - min))] + min
- 4) _____ max

Operating Temperatures

- 5) _____ min
- 6) _____ [$^{1/2}$ (max - min))] + min
- 7) _____ max
- 8) _____ [$^{1/3}$ (max - min))] + min
- 9) _____ [$^{2/3}$ (max - min))] + min

2. Transfer the values from the above section to the numbered lines below

- 3. Check one Density/Compressibility box, then enter the 12 values for each pressure/temperature range.
- 4. Check one Viscosity box, then enter values for each temperature. (At least one viscosity value is required).
- 5. Enter values for molecular weight, isentropic exponent, and standard density (or standard compressibility).

Density

Density in lbs/CuFt

Density in kg/CuM

Compressibility

Pressure

Temperature

- | | |
|----------|----------|
| 1) _____ | 5) _____ |
| 2) _____ | 5) _____ |
| 3) _____ | 5) _____ |
| 4) _____ | 5) _____ |
| 1) _____ | 6) _____ |
| 2) _____ | 6) _____ |
| 3) _____ | 6) _____ |
| 4) _____ | 6) _____ |
| 1) _____ | 7) _____ |
| 2) _____ | 7) _____ |
| 3) _____ | 7) _____ |
| 4) _____ | 7) _____ |

Viscosity

Viscosity in centipoise

Viscosity in lbs/ft sec

Viscosity in pascal sec

Temperature

- 5) _____
- 8) _____
- 9) _____
- 7) _____

Molecular Weight: _____

Isentropic Exponent: _____ 1.4

Standard density/compressibility: _____

Volumetric Gas Compressibility and Viscosity Information

* Density at Flow: _____ Units: lb/ft³ Kg/m³ Other: _____

OR

M.W. / Specific Gravity at Flow: _____

Compressibility at Flow: _____

Compressibility at Base: _____

* Viscosity at Flow: _____ Units: Centipoise Other: Isentropic Exponent (K): _____ 1.4

TABLE 30. Natural Gas Worksheet

NOTE

The minimum requirement for the Volumetric options is highlighted gray on page 37.

Compressibility Factor Information

Choose desired characterization method and only enter values for that method.

Detail Characterization Method (AGA8 1992)		Mole	Valid Range
CH ₄	Methane mole percent	_____ %	0 – 100 percent
N ₂	Nitrogen mole percent	_____ %	0 – 100 percent
CO ₂	Carbon Dioxide mole percent	_____ %	0 – 100 percent
C ₂ H ₆	Ethane mole percent	_____ %	0 – 100 percent
C ₃ H ₈	Propane mole percent	_____ %	0 – 12 percent
H ₂ O	Water mole percent	_____ %	0 – Dew point
H ₂ S	Hydrogen Sulfide mole percent	_____ %	0 – 100 percent
H ₂	Hydrogen mole percent	_____ %	0 – 100 percent
CO	Carbon monoxide mole percent	_____ %	0 – 3.0 percent
O ₂	Oxygen mole percent	_____ %	0 – 21 percent
C ₄ H ₁₀	i-Butane mole percent	_____ %	0 – 6 percent ⁽¹⁾
C ₄ H ₁₀	n-Butane mole percent	_____ %	0 – 6 percent ⁽¹⁾
C ₅ H ₁₂	i-Pentane mole percent	_____ %	0 – 4 percent ⁽²⁾
C ₅ H ₁₂	n-Pentane mole percent	_____ %	0 – 4 percent
C ₆ H ₁₄	n-Hexane mole percent	_____ %	0 – Dew Point
C ₇ H ₁₈	n-Heptane mole percent	_____ %	0 – Dew Point
C ₈ H ₁₈	n-Octane mole percent	_____ %	0 – Dew Point
C ₉ H ₂₀	n-Nonane mole percent	_____ %	0 – Dew Point
C ₁₀ H ₂₂	n-Decane mole percent	_____ %	0 – Dew Point
He	Helium mole percent	_____ %	0 – 3.0percent
Ar	Argon mole percent	_____ %	0 – 1.0 percent

Gross Characterization Method, Option Code 1 (AGA8 Gr-Hv-CO ₂)		Mole	Valid Range
Specific Gravity at 14.73 psia and 60 °F		_____	0.554 – 0.87
Volumetric gross heating value at base conditions		_____ BTU/SCF	477 – 1150 BTU/SCF
Carbon Dioxide mole percent		_____ %	0 – 30 percent
Hydrogen mole percent		_____ %	0 – 10 percent
Carbon Monoxide mole percent		_____ %	0 – 3.0 percent

Gross Characterization Method, Option Code 2 (AGA8 Gr-CO ₂ -N ₂)		Mole	Valid Range
Specific Gravity at 14.73 psia and 60 °F		_____ %	0.554 – 0.87
Carbon Dioxide mole percent		_____ %	0 – 30 percent
Nitrogen mole percent		_____ %	0 – 50 percent
Hydrogen mole percent		_____ %	0 – 10 percent
Carbon Monoxide mole percent		_____ %	0 – 3.0 percent

(1) The summaries of i-Butane and n-Butane cannot exceed 6 percent.

(2) The summaries of i-Pentane and n-Pentane cannot exceed 4 percent.

Rosemount Compact Orifice Flowmeter Series

Product Data Sheet
00813-0100-4810, Rev EA
April 2005

Notes

Notes

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