Product Data Sheet
00813-0100-4860, Rev BF
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Rosemount™ 8600 Utility™ Vortex Flowmeter

The Rosemount 8600 Vortex delivers superior reliability for general purpose applications:

- Rosemount reliability — The Rosemount 8600 Vortex improves reliability over traditional flow metering technology.
- Vibration immunity — Mass balancing of the sensor system, and Adaptive Digital Signal Processing (ADSP) provide vibration immunity.
- Simplified troubleshooting — Device Diagnostics enable field verification of Meter Electronics and meter verification.

Rosemount 8600 MultiVariable™ Vortex reduces installation costs, simplifies installation, and improves performance in saturated steam

Multivariable vortex design

Incorporates temperature sensor into the vortex meter using the shedder bar as a thermowell, which keeps the temperature sensor isolated from process for easy verification and replacement.

Temperature compensated capability for saturated steam

Calculates density from measured process temperature and uses the calculated density to provide a temperature compensated mass flow.

Increased performance in saturated steam

Performance in saturated steam is improved because the electronics will be compensating for changes in the process temperature.

Reduces installed costs

MultiVariable vortex eliminates the need for an external thermowell and temperature sensor.

Output options

Able to map independent variables to analog output, pulse output, or HART® burst variables.

Available with flow computer for additional functionality

Integrate the Multivariable vortex with a pressure transmitter for full pressure and temperature compensation of superheated steam and various gases.

The benefits include:

- Remote communications
- Heat calculations
- Remote totalization
- Peak demand calculation
- Data logging capabilities

Remote mount electronics

Also available with remote mounted electronics up to 75 ft. (23 m).

For more information on the Rosemount Flow Computer, see the Rosemount Flow Computer Product Data Sheet.

Contents

Product specifications

The following specifications are for the Rosemount 8600, except where otherwise noted.

Functional specifications

Process fluids

Liquid, gas, and steam applications. Fluids must be homogeneous and single-phase.

Line sizes

Flanged style

1, 1½, 2, 3, 4, 6, and 8 inches (DN 25, 40, 50, 80, 100, 150, and 200)

Pipe schedules

Process piping Schedules 10, 40, 80, and 160.

Note
The appropriate bore diameter of the process piping must be entered using ProLink III, TREX, or AMS Device Manager. Meters will be shipped from the factory at the Schedule 40 default value unless otherwise specified.

Measurable flow rates

Capable of processing signals from flow applications which meet the sizing requirements below.

To determine the appropriate flowmeter size for an application, process conditions must be within the Reynolds number and velocity limitations for the desired line size provided in Table 1, Table 2, and Table 3.

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

The Reynolds number equation is shown below:

$$R_D = \frac{VD\rho}{\mu_{C\rho}}$$

where:

Density = ρ

Viscosity = $\mu_{C\rho}$

Pipe inside diameter = D

Flow velocity = V

Table 1: Minimum Measurable Meter Reynolds Numbers

Meter sizes (Inches/DN)	Reynolds number limitations
1 through 4/25 through 100	5000 minimum
6 through 8/150 through 200	

Table 2: Minimum Measurable Meter Velocities

	Feet per second	Meters per second
Liquids	$\sqrt{36/\rho}$	$\sqrt{54/\rho}$
Gases	$\sqrt{36/\rho}$	$\sqrt{54/\rho}$

Note
Velocities are referenced to schedule 40 pipe.

The ρ is the process fluid density at flowing conditions in lb/ft^3 for ft/s and kg/m^3 for m/s.

Table 3: Maximum Measurable Meter Velocities (use the smaller of the two values)

	Feet per second	Meters per second
Liquids	$\sqrt{90,000/\rho}$ or 25	$\sqrt{134,000/\rho}$ or 7.6
Gases	$\sqrt{90,000/\rho}$ or 250	$\sqrt{134,000/\rho}$ or 76

Note
Velocities are referenced to schedule 40 pipe.

The ρ is the process fluid density at flowing conditions in lb/ft^3 for ft/s and kg/m^3 for m/s.

Process temperature limits

Standard

–58 to 482 °F (–50 to 250 °C)

Output signals

4–20 mA with HART® protocol superimposed on the analog mA signal

Available with HART 5 (default) or HART 7 (optional)

Optional scalable pulse output

0 to 10000 Hz; transistor switch closure with adjustable scaling via HART communications; capable of switching up to 30 Vdc, 120 mA maximum.

Analog output adjustment

Engineering units and lower and upper range values are user-selected. Output is automatically scaled to provide 4 mA at the selected lower range value, and 20 mA at the selected upper range value. No frequency input is required to adjust the range values.

Scalable frequency adjustment

The scalable pulse output can be set to a specific velocity, volume, or mass (i.e. 1 pulse = 1 lb). The scalable pulse output can also be scaled to a specific rate of volume, mass, or velocity (i.e. 100 Hz = 500 lb/hr).

Ambient temperature limits

Operating

- –58 to 185 °F (–50 to 85 °C)
- –40 to 185 °F (–40 to 85 °C) for flowmeters with local indicator
- LCD contrast may be affected below –4 °F (–20 °C)

Storage

- –58 to 250 °F (–50 to 121 °C)
- –50 to 185 °F (–46 to 85 °C) for flowmeters with local indicator

Pressure limits

Flange style meter

Rated for ASME B16.5 (ANSI) Class 150, 300, EN 1092-1 PN 16 and 40.

Power supply

HART® analog

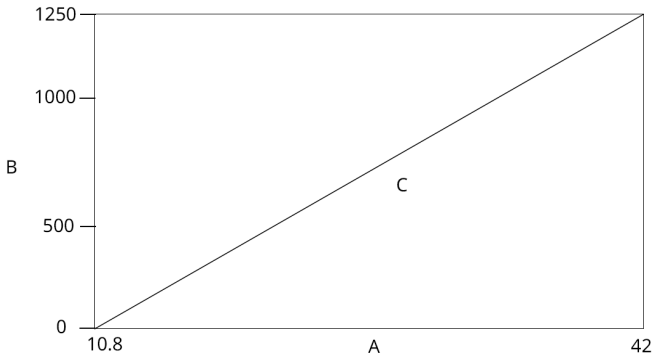
External power supply required. Flowmeter operates on 10.8 to 42 Vdc terminal voltage (with 250-ohm minimum load required for HART communications, 16.8 Vdc power supply is required).

Power consumption

One watt maximum

Load limitations (HART analog)

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



A. Power supply (Volts)
B. Load (Ohms)
C. Operating region

Note
HART communication requires a minimum loop resistance of 250 ohms.

Optional LCD display

The optional LCD display is capable of displaying:

- Primary Variable
- Velocity Flow
- Volumetric Flow
- Mass Flow
- Percent of Range
- Analog Output
- Totalizer
- Shedding Frequency
- Pulse Output Frequency (if applicable)
- Electronics Temperature
- Process Temperature (MTA Option Only)
- Calculated Process Density (MTA Option Only)

Note
If more than one item is selected, the display will scroll through all items selected.

Enclosure rating

Type 4X; IP66

Permanent pressure loss

The approximate permanent pressure loss (PPL) from the Rosemount 8600 Flowmeter is calculated for each application in the Vortex sizing software available from your local Rosemount representative. The PPL is determined using the equation:

$$PPL = \frac{A \times \rho_f \times Q^2}{D^4}$$

where:

PPL = Permanent Pressure loss (psi or kPa)

ρ_f = Density at operating conditions (lb/ft^3 or kg/m^3)

Q = Actual volumetric flow rate (Gas = ft^3/min or m^3/hr; Liquid = gal/min or l/min)

D = Flowmeter bore diameter (in. or mm)

A = Constant depending on meter style, fluid type, and flow units. Determined per Table 4:

Table 4: Determining the PPL

Meter style	English units		SI units	
	A_{Liquid}	A_{Gas}	A_{Liquid}	A_{Gas}
8600 F	3.4 3 10^{-5}	1.9 3 10^{-3}	0.425	118

Minimum upstream pressure (liquids)

Flow metering conditions that would allow cavitation, the release of vapor from a liquid, must be avoided. This flow condition can be avoided by remaining within the proper flow range of the meter and by following appropriate system design.

For some liquid applications, incorporation of a back pressure valve should be considered. To prevent cavitation, the minimum upstream pressure must be:

$P = 2.9*\triangle P + 1.3*p_v$ or $P = 2.9*\triangle P + p_v + 0.5$ psia (3.45 kPa) (use the smaller of the two results)

P = Line pressure five pipe diameters downstream of the meter (psia or kPa abs)

$\triangle P$ = Pressure loss across the meter (psi or kPa)

p_v = Liquid vapor pressure at operating conditions (psia or kPa abs)

Failure mode alarm

HART® analog

If self-diagnostics detect a gross flowmeter failure, the analog signal will be driven to the following values:

Signal	Value
Low	3.75
High	21.75
NAMUR Low	3.60
NAMUR High	22.6

High or low alarm signal is user-selectable through the fail mode alarm jumper on the electronics. NAMUR-compliant alarm limits are available through the C4 or CN option. Alarm type is also field configurable.

Saturation output values

When the operating flow is outside the range points, the analog output continues to track the operating flow until reaching the saturation value listed below. The output does not exceed the listed saturation value regardless of the operating flow.

The NAMUR-compliant saturation values are available through the C4 or CN option. Saturation type is field configurable.

Saturation	Value
Low	3.9
High	20.8
NAMUR Low	3.8
NAMUR High	20.5

Damping

Flow Damping is adjustable between 0.2 and 255 seconds.

Process Temperature Damping adjustable between 0.4 and 32.0 seconds (MTA option only).

Response time

Three vortex shedding cycles or 300 ms, whichever is greater, maximum required to reach 63.2% of actual input with the minimum damping (0.2 seconds).

Turn-on time

HART® analog

Less than four (4) seconds plus the response time to rated accuracy from power up (less than 7 seconds with the MTA Option).

Transient protection

The optional transient terminal block prevents damage to the flowmeter from transients induced by lightning, welding, heavy electrical equipment, or switch gears. The transient protection electronics are located in the terminal block.

The transient terminal block meets the following specifications:

- IEEE C62.41 - 2002 Category B
- 3 kA crest (8 3 20 µs)
- 6 kV crest (1.2 3 50 µs)
- 6 kV/0.5 kA (0.5 µs, 100 kHz, ring wave)

Security lockout

When the security lockout jumper is enabled, the electronics will not allow you to modify parameters that affect flowmeter output.

Output testing

Current source

Flowmeter may be commanded to set the current to a specified value between 4 and 20 mA.

Frequency source

Flowmeter may be commanded to set the frequency to a specified value between 0 and 10000 Hz.

Low flow cutoff

Adjustable over entire flow range. If it is below a selected value, output is driven to 4 mA and zero pulse output frequency.

Humidity limits

Operates in 0–95% relative humidity under noncondensing conditions (tested to IEC 60770, Section 6.2.11).

Overrange capability

HART® analog

Analog signal output continues to 105 percent of span, then remains constant with increasing flow. The digital and pulse outputs will continue to indicate flow up to the upper sensor limit of the flowmeter and a maximum pulse output frequency of 10400 Hz.

Flow calibration

Meter bodies are flow-calibrated and assigned a unique calibration factor (K-factor) at the factory. The calibration factor is entered into the electronics, enabling interchangeability of electronics and/or sensors without calculations or compromise in accuracy of the calibrated meter body.

Typical flow velocities and rates

Table 5 through Table 9 show typical flow ranges for some common process fluids with default filter settings.

Note
Consult your Emerson Flow representative to obtain a computer sizing program that describes in greater detail the flow range for an application.

Table 5 is a reference of pipe velocities that can be measured for the standard Rosemount 8600. It does not consider density limitations, as described in Table 2 and Table 3. Velocities are referenced in Schedule 40 pipe.

Table 5: Typical pipe velocity ranges for Rosemount 8600

Process line size		Liquid (water) velocity ranges		Gas (air) velocity ranges	
(Inches/ DN)	Vortex meter	(ft/s)	(m/s)	(ft/s)	(m/s)
1/ 25	8600F010	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
1½ / 40	8600F015	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
2/ 50	8600F020	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
3/ 80	8600F030	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
4/ 100	8600F040	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
6/ 150	8600F060	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2
8/ 200	8600F080	0.70 to 25.0	0.21 to 7.6	6.50 to 250.0	1.98 to 76.2

Table 6 is a reference of flow rates that can be measured for the standard Rosemount 8600. It does not consider density limitations, as described in Table 2 and Table 3.

Table 6: Water Flow Rate Limits for the Rosemount 8600

Process line size	Vortex meter	Minimum and maximum measurable water flow rates(1)	
(Inches/ DN)		Gallons/Minute	Cubic Meters/Hour
1/ 25	8600F010	2.96 to 67.3	0.67 to 15.3
1½ / 40	8600F015	4.83 to 158	1.10 to 35.9
2/ 50	8600F020	7.96 to 261	1.81 to 59.4
3/ 80	8600F030	17.5 to 576	4.00 to 130
4/ 100	8600F040	30.2 to 992	6.86 to 225
6/ 150	8600F060	68.5 to 2251	15.6 to 511
8/ 200	8600F080	119 to 3898	27.0 to 885

(1) *Conditions: 77 °F (25 °C) and 14.7 psia (1.01 bar absolute)*

Table 7: Air Flow Rate Limits at 59 °F (15 °C)

Process pressure	Flow rate limits	Minimum and maximum air flow rates for line sizes 1-in./DN 25 through 2-in./DN 50					
		1-in./DN 25		1½-in./DN 40		2-in./DN 50	
		Rosemount 8600		Rosemount 8600		Rosemount 8600	
		ACFM	ACMH	ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max	79.2	134	212	360	349	593
	min	9.71	16.5	18.4	31.2	30.3	51.5
50 psig (3.45 bar G)	max	79.2	134	212	360	349	593
	min	3.72	6.32	8.76	14.9	14.5	24.6

Table 7: Air Flow Rate Limits at 59 °F (15 °C) *(continued)*

Process pressure	Flow rate limits	Minimum and maximum air flow rates for line sizes 1-in./DN 25 through 2-in./DN 50					
		1-in./DN 25		1½-in./DN 40		2-in./DN 50	
		Rosemount 8600		Rosemount 8600		Rosemount 8600	
		ACFM	ACMH	ACFM	ACMH	ACFM	ACMH
100 psig (6.89 bar G)	max	79.2	134	212	360	349	593
	min	2.80	4.75	6.58	11.2	10.8	18.3
150 psig (10.3 bar G)	max	79.2	134	212	360	349	593
	min	2.34	3.98	5.51	9.36	9.09	15.4
200 psig (13.8 bar G)	max	79.2	134	212	360	349	593
	min	2.34	3.98	5.51	9.36	9.09	15.4
300 psig (20.7 bar G)	max	79.2	134	198	337	326	554
	min	2.34	3.98	5.51	9.36	9.09	15.4
400 psig (27.6 bar G)	max	73.0	124	172	293	284	483
	min	2.34	3.98	5.51	9.36	9.09	15.4
500 psig (34.5 bar G)	max	66.0	112	154	262	254	432
	min	2.34	3.98	5.51	9.36	9.09	15.4

Table 8: Air Flow Rate Limits at 59 °F (15 °C)

Process pressure	Flow rate limits	Minimum and maximum air flow ratesfor line sizes 3-in./DN 80 through 4-in./DN 100			
		3-in./DN 80		4-in./DN 100	
		Rosemount 8600		Rosemount 8600	
		ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max	770	1308	1326	2253
	min	66.8	114	115	195
50 psig (3.45 bar G)	max	770	1308	1326	2253
	min	31.8	54.1	54.8	93.2
100 psig (6.89 bar G)	max	770	1308	1326	2253
	min	23.9	40.6	41.1	69.8
150 psig (10.3 bar G)	max	770	1308	1326	2253
	min	20.0	34.0	34.5	58.6
200 psig (13.8 bar G)	max	770	1308	1326	2253
	min	20.0	34.0	34.5	58.6
300 psig (20.7 bar G)	max	718	1220	1237	2102
	min	20.0	34.0	34.5	58.6
400 psig (27.6 bar G)	max	625	1062	1076	1828
	min	20.0	34.0	34.5	58.6
500 psig (34.5 bar G)	max	560	951	964	1638
	min	20.0	34.0	34.5	58.6

Table 9: Air Flow Rate Limits at 59 °F (15 °C)

Process pressure	Flow rate limits	Minimum and maximum air flow rates for line sizes 6-in./DN 150 through 8-in./DN 200			
		6-in./DN 150		8-in./DN 200	
		Rosemount 8600		Rosemount 8600	
		ACFM	ACMH	ACFM	ACMH
0 psig (0 bar G)	max	3009	5112	5211	8853
	min	261	443	452	768
50 psig (3.45 bar G)	max	3009	5112	5211	8853
	min	124	211	215	365
100 psig (6.89 bar G)	max	3009	5112	5211	8853
	min	93.3	159	162	276
150 psig (10.3 bar G)	max	3009	5112	5211	8853
	min	78.2	133	135	229
200 psig (13.8 bar G)	max	3009	5112	5211	8853
	min	78.2	133	135	229
300 psig (20.7 bar G)	max	2807	4769	4862	8260
	min	78.2	133	135	229
400 psig (27.6 bar G)	max	2442	4149	4228	7183
	min	78.2	133	136	229
500 psig (34.5 bar G)	max	2188	3717	3789	6437
	min	78.2	133	136	229

Note

The Rosemount 8600 measures the volumetric flow under operating conditions (i.e. the actual volume at the operating pressure and temperature—acfm or acmh), as shown above. However, gas volumes are strongly dependent on pressure and temperature. Therefore, gas quantities are typically stated in standard or normal conditions (for example: SCFM or NCMH). (Standard conditions are typically 59 °F (15 °C) and 14.7 psia. Normal conditions are typically 32 °F (0 °C) and 1 bar abs.) The flow rate limits in standard conditions are found using the equations below:

Standard Flow Rate = Actual Flow Rate X Density Ratio

Density Ratio = Density at Actual (Operating) Conditions/Density at Standard Conditions

Table 10: Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 1-in./DN 25 through 2-in./DN 50					
		1-in./DN 25		1½-in./DN 40		2-in./DN 50	
		Rosemount 8600		Rosemount 8600		Rosemount 8600	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1.03 bar G)	max	342	155	917	416	1511	685
	min	34.8	15.8	82.0	37.2	135	61.2
25 psig (1.72 bar G)	max	449	203	1204	546	1983	899
	min	39.9	18.1	93.9	42.6	155	70.2
50 psig (3.45 bar G)	max	711	322	1904	864	3138	1423
	min	50.1	22.7	118	53.4	195	88.3

Table 10: Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%) *(continued)*

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 1-in./DN 25 through 2-in./DN 50					
		1-in./DN 25		1½-in./DN 40		2-in./DN 50	
		Rosemount 8600		Rosemount 8600		Rosemount 8600	
		lb/hr	kg/hr	lb/hr	kg/hr	lb/hr	kg/hr
100 psig (6.89 bar G)	max	1221	554	3270	1483	5389	2444
	min	65.7	29.8	155	70.1	255	116
150 psig (10.3 bar G)	max	1724	782	4616	2094	7609	3451
	min	78.1	35.4	184	83.2	303	137
200 psig (13.8 bar G)	max	2225	1009	5956	2702	9818	4453
	min	88.7	40.2	209	94.5	344	156
300 psig (20.7 bar G)	max	3229	1464	8644	3921	14248	6463
	min	107	48.5	252	114	415	189
400 psig (27.6 bar G)	max	4244	1925	11362	5154	18727	8494
	min	125	56.7	295	134	487	221
500 psig (34.5 bar G)	max	5277	2393	14126	6407	23284	10561
	min	156	70.7	367	167	605	274

Table 11: Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 3-in./DN 80 through 4-in./DN 100			
		3-in./DN 80		4-in./DN 100	
		Rosemount 8600		Rosemount 8600	
		lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1.03 bar G)	max	3330	1510	5734	2601
	min	298	135	513	233
25 psig (1.72 bar G)	max	4370	1982	7526	3414
	min	341	155	587	267
50 psig (3.45 bar G)	max	6914	3136	11905	5400
	min	429	195	739	335
100 psig (6.89 bar G)	max	11874	5386	20448	9275
	min	562	255	968	439
150 psig (10.3 bar G)	max	16763	7603	28866	13093
	min	668	303	1150	522
200 psig (13.8 bar G)	max	21630	9811	37247	16895
	min	759	344	1307	593
300 psig (20.7 bar G)	max	31389	14237	54052	24517
	min	914	415	1574	714
400 psig (27.6 bar G)	max	41258	18714	71047	32226
	min	1073	487	1847	838

Table 11: Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%) *(continued)*

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 3-in./DN 80 through 4-in./DN 100			
		3-in./DN 80		4-in./DN 100	
		Rosemount 8600		Rosemount 8600	
		lb/hr	kg/hr	lb/hr	kg/hr
500 psig (34.5 bar G)	max	51297	23267	88334	40068
	min	1334	605	2297	1042

Table 12: Saturated Steam Flow Rate Limits (Assumes Steam Quality is 100%)

Process pressure	Flow rate limits	Minimum and maximum saturated steam flow rates for line sizes 6-in./DN 150 through 8-in./DN 200			
		6-in./DN 150		8-in./DN 200	
		Rosemount 8600		Rosemount 8600	
		lb/hr	kg/hr	lb/hr	kg/hr
15 psig (1.03 bar G)	max	13013	5903	22534	10221
	min	1163	528	2015	914
25 psig (1.72 bar G)	max	17080	7747	29575	13415
	min	1333	605	2308	1047
50 psig (3.45 bar G)	max	27019	12255	46787	21222
	min	1676	760	2903	1317
100 psig (6.89 bar G)	max	46405	21049	80356	36449
	min	2197	996	3804	1725
150 psig (10.3 bar G)	max	65611	29761	113440	51455
	min	2610	1184	4520	2050
200 psig (13.8 bar G)	max	84530	38342	146375	66395
	min	2965	1345	5134	2329
300 psig (20.7 bar G)	max	122666	55640	212411	96348
	min	3572	1620	6185	2805
400 psig (27.6 bar G)	max	161236	73135	279200	126643
	min	4192	1901	7259	3293
500 psig (34.5 bar G)	max	200468	90931	347134	157457
	min	5212	2364	9025	4094

Performance specifications

The following performance specifications are for all Rosemount models, except where otherwise noted. Digital performance specifications applicable to Digital HART® output.

Flow accuracy

Includes linearity, hysteresis, and repeatability.

Liquids - for Reynolds numbers over 20,000

Digital and pulse output

±0.75% of rate

Analog output

Same as pulse output plus an additional 0.025% of span

Gas and steam—for Reynolds numbers over 15,000

Digital and pulse output

±1% of rate

Analog output

Same as pulse output plus an additional 0.025% of span.

Note
As the meter maximum velocity exceeds 125 ft./sec (38 m/sec), the accuracy error band will increase linearly to ±1.5% up to 250 ft./sec (76 m/sec).

Note
As the meter Reynolds numbers decrease below the stated limit to 10,000, the accuracy error band will increase linearly to ±3.0%. For Reynolds numbers down to 5,000, the accuracy error band will increase linearly from ±3.0% to ±10.0%.

Process Temperature Accuracy

2.2 °F (1.2 °C)

Note
For remote mount installations, add ±0.018 °F/ft. (±0.03 °C/m) of uncertainty to the temperature measurement.

Mass flow accuracy for temperature compensated mass flow

Digital and Pulse Output

±2.0% of rate (Nominal)

Nominal conditions include temperature variation in saturation and superheat at 150 psig (10 bar-g) and above.

For pressure below 150 psig (10 bar-g), add 0.08% of uncertainty for every 15 psi (1 bar) below 150 psig (10 bar-g).

Analog output

Same as pulse output plus an additional 0.025% of span

Repeatability

± 0.2% of actual flow rate

Stability

± 0.2% of rate over one year

Process temperature effect

Automatic K-factor correction with user-entered process temperature.

Table 13 indicates the percent change in K-factor per 100 °F (55.5 °C) in process temperature from reference temperature of 77 °F (25 °C).

Table 13: Process Temperature Effect

Percent change in K-Factor per 100 °F (55.5 °C)	
< 77 °F (25 °C)	+ 0.23
> 77 °F (25 °C)	- 0.27

Ambient temperature effect

Digital and pulse outputs

No effect

Analog output

±0.1% of span from –58 to 185 °F (–50 to 85 °C)

Vibration effect

An output with no process flow may be detected if sufficiently high vibration is present.

The meter design will minimize this effect and the factory settings for signal processing are selected to eliminate these errors for most applications.

If an output error at zero flow is still detected, it can be eliminated by adjusting the low flow cutoff, trigger level, or low-pass filter.

As the process begins to flow through the meter, most vibration effects are quickly overcome by the flow signal.

Vibration specifications

Integral aluminum housings and remote aluminum housings

At or near the minimum liquid flow rate in a normal pipe mounted installation, the maximum vibration should be 0.087-in. (2.21 mm) double amplitude displacement or 1 g acceleration, whichever is smaller. At or near the minimum gas flow rate in a normal pipe mounted installation, the maximum vibration should be 0.043-in. (1.09 mm) double amplitude displacement or ½ g acceleration, whichever is smaller.

Mounting position effect

Meter will meet accuracy specifications when mounted in horizontal, vertical, or inclined pipelines. Best practice for mounting in a horizontal pipe is to orient the shedder bar in the horizontal plane. This will prevent solids in liquid applications and liquid in gas/steam applications from disrupting the shedding frequency.

EMI/RFI effect

Meets EMC requirements to EU Directive 2004/108/EC.

HART® analog

Output error less than ±0.025% of span with twisted pair from 80-1000 MHz for radiated field strength of 10 V/m; 1.4 - 2.0 GHz for radiated field strength of 3 V/m; 2.0 - 2.7 GHz for radiated field strength of 1 V/m. Tested per EN61326.

HART digital

No effect on the values that are being given if using HART digital signal.

Tested per EN61326.

Magnetic-field interference

HART analog

Output error less than ±0.025% of span at 30 A/m (rms). Tested per EN61326.

Series mode noise rejection

HART analog

Output error less than ±0.025% of span at 1 V rms, 60 Hz.

Common mode noise rejection

HART analog

Output error less than ±0.025% of span at 30 V rms, 60 Hz.

Power supply effect

HART analog

Less than 0.005% of span per volt

Physical specifications

Electrical connections

½ –14 NPT or M20 3 1.5 conduit threads; screw terminals provided for 4–20 mA and pulse output connections; communicator connections permanently fixed to terminal block.

Non-wetted materials

Housing

Low-copper aluminum (Type 4X, IP66)

Paint

Polyurethane

Cover O-rings

Buna-N

Temperature sensor (MTA option)

Type-N Thermocouple

Process-wetted materials

Meter body and flanges

CF-8M cast stainless steel.

Sensor material

CF-3M cast stainless steel.

Gasket

Graphite with 316 stainless steel insert

Process connections

Mounts between the following flange configurations:

- ASME B16.5 (ANSI): Class 150, 300

- EN 1092-1 PN16, 40 Type B1

Mounting

Integral (standard)

Electronics are mounted on meter body.

Remote (optional)

Electronics may be mounted remote from the meter body. Interconnecting coaxial cable available in nonadjustable 10, 20, and 30 ft (3.0, 6.1, and 9.1 m) lengths. Consult factory for non-standard lengths up to 75 ft (22.9 m). Remote mounting hardware includes a pipe mount bracket with one u-bolt.

Temperature limitations for integral mounting

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

Pipe length requirements

The vortex meter may be installed with a minimum of ten diameters (D) of straight pipe length upstream and five diameters (D) of straight pipe length downstream.

Rated Accuracy is based on the number of pipe diameter from an upstream disturbance. No K-factor correction is required if the meter is installed with 35 D upstream and 10 D downstream.

Tagging

The flowmeter will be tagged at no charge. All tags are stainless steel. The standard tag is permanently attached to the flowmeter. Character height is 1/16-in. (1.6 mm). A wired-on tag is available on request. Wire on tags can contain five lines with up to 28 characters per line.

Flow calibration information

Flowmeter calibration and configuration information is provided with every flowmeter. For a certified copy of flow calibration data, Option Q4 must be ordered in the model number.

Product certifications

For detailed approval certification information and installation drawings, please see document number 00825-VA00-0011: Rosemount 8600 Series Vortex Flowmeter Approval Document.

Dimensional drawings

Figure 1: Flanged-Style Flowmeter—Line Sizes 1- through 8-in. (25 through 200 mm)

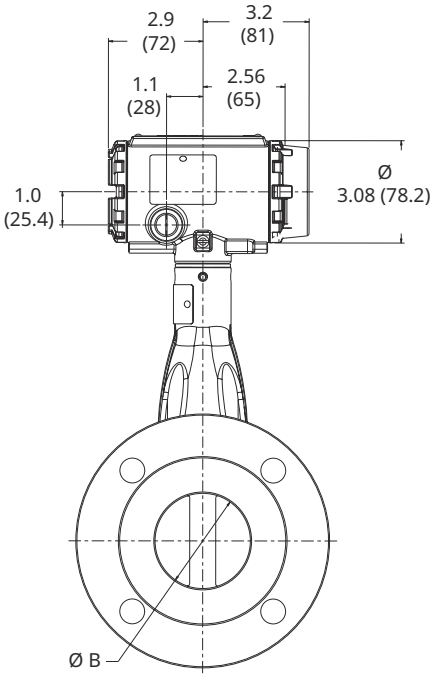


Diagram illustrated without MTA Option

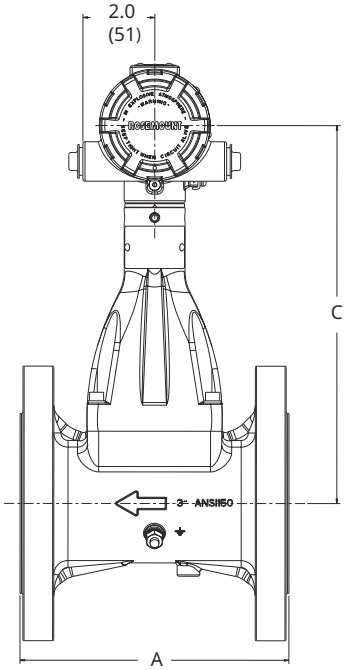
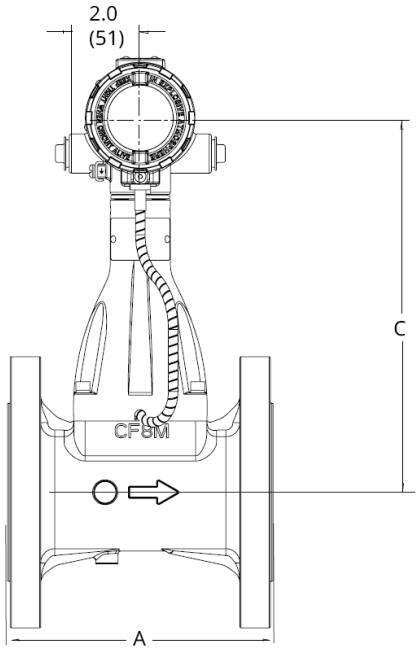


Diagram illustrated with MTA Option



Note
Dimensions are in inches (millimeters).

See Table 14, Table 15 and Table 16 for the values of A, Ø B and C.

Table 14: Flanged-Style Flowmeter—Line Sizes 1- through 2-in. (25 through 50 mm)

Nominal size in. (mm)	Flange rating	Face-to-face A in. (mm)	Diameter Ø B in. (mm)	C in. (mm)	Weight(1) lb (kg)
1 (25)	ANSI 150	5.9 (150)	0.95 (24.1)	9.6 (244)	13 (5.9)
	ANSI 300	6.7 (170)	0.95 (24.1)	9.6 (244)	15.4 (7.0)
	PN 16/40	6.1 (156)	0.95 (24.1)	9.6 (244)	14.8 (6.7)
1 ½ (40)	ANSI 150	5.9 (150)	1.49 (37.8)	8.1 (250)	15.7 (7.1)
	ANSI 300	7.1 (180)	1.49 (37.8)	8.1 (250)	21.4 (9.7)
	PN 16/40	7.1 (180)	1.49 (37.8)	8.1 (250)	18.7 (8.5)
2 (50)	ANSI 150	6.7 (170)	1.92 (48.8)	10 (254)	20.5 (9.3)
	ANSI 300	7.1 (180)	1.92 (48.8)	10 (254)	24.5 (11.1)
	PN 16/40	6.7 (170)	1.92 (48.8)	10 (254)	22.7 (10.3)

(1) *Add 0.2 lb (0.1 kg) for display option.*

Table 15: Flanged-Style Flowmeter—Line Sizes 3- to 6-in. (80 mm to 150 mm)

Nominal size in. (mm)	Flange rating	Face-to-face A in. (mm)	Diameter Ø B in. (mm)	C in. (mm)	Weight(1) lb (kg)
3 (80)	ANSI 150	7.5 (190)	2.87 (72.9)	10.7 (271)	33.1 (15.0)
	ANSI 300	8.8 (224)	2.87 (72.9)	10.6 (268)	41.4 (18.8)
	PN 16/40	7.9 (200)	2.87 (72.9)	10.6 (268)	34.4 (15.6)
4 (100)	ANSI 150	7.5 (190)	3.79 (96.3)	11.1 (281)	42.8 (19.6)
	ANSI 300	8.7 (220)	3.79 (96.3)	11.1 (281)	63.1 (28.6)
	PN 16	7.5 (190)	3.79 (96.3)	11.1 (281)	42.8 (19.6)
	PN 40	8.7 (220)	3.79 (96.3)	11.1 (281)	43.4 (19.7)
6 (150)	ANSI 150	9.8 (250)	5.7 (144.8)	12.1 (307)	69.9 (31.7)
	ANSI 300	10.6 (270)	5.7 (144.8)	12.1 (307)	161.8 (73.4)
	PN 16	9.8 (250)	5.7 (144.8)	12.1 (307)	69.9 (31.7)
	PN 40	10.6 (270)	5.7 (144.8)	12.1 (307)	130.5 (59.2)

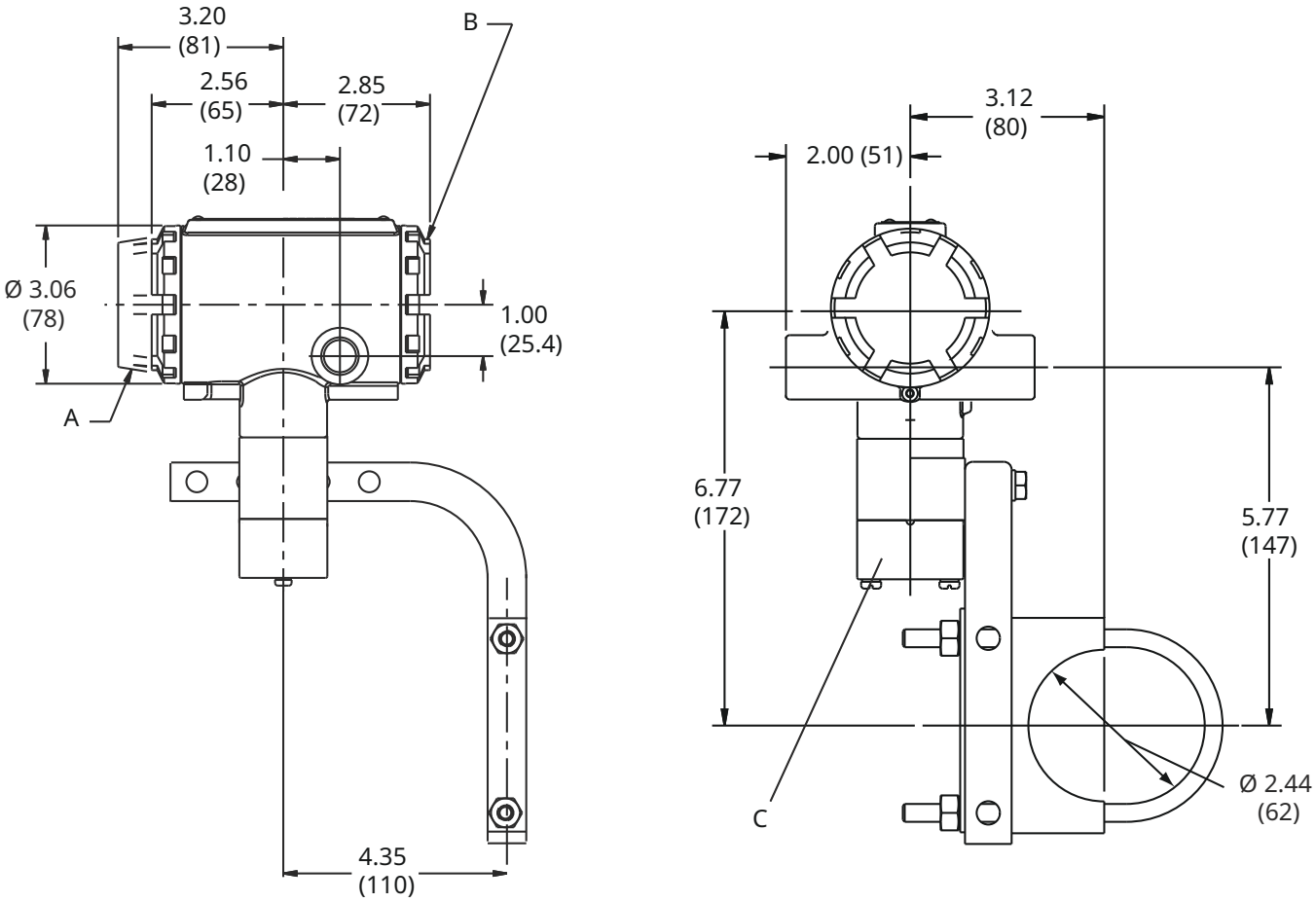
(1) *Add 0.2 lb (0.1 kg) for display option.*

Table 16: Flanged-Style Flowmeter—Line Size 8-in. (200 mm)

Nominal size in. (mm)	Flange rating	Face-to-face A in. (mm)	Diameter Ø B in. (mm)	C in. (mm)	Weight(1) lb (kg)
8 (200)	ANSI 150	9.8 (250)	7.55 (191.8)	13.1 (332)	104.9 (47.6)
	ANSI 300	11.4 (290)	7.55 (191.8)	13.1 (332)	161.8 (73.4)
	PN 16	9.8 (250)	7.55 (191.8)	13.1 (332)	104.9 (47.6)
	PN 40	12.2 (310)	7.55 (191.8)	13.1 (332)	130.5 (59.2)

(1) *Add 0.2 lb (0.1 kg) for display option.*

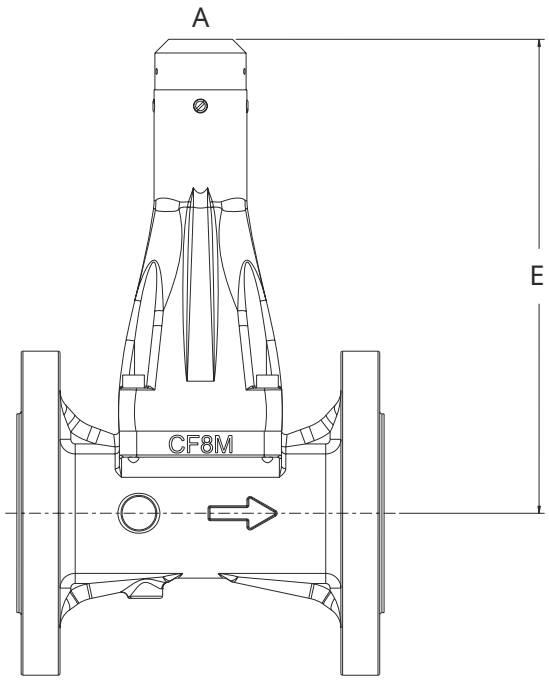
Figure 2: Remote Mount Transmitters



A. Display option
B. Terminal cover
C. ½-14 NPT (for remote cable conduit)

Note
Consult factory for SST installation. Dimensions are in inches (millimeters).

Figure 3: Flanged Style Remote Mount Flowmeters—Line Sizes 1- to 8-in. (25 mm to 200 mm)



A. ½-14 NPT (for remote cable conduit)

Note
Dimensions are in inches (millimeters).

Table 17: Remote Mount, Flanged Style Sensor Flowmeter Dimensions

Nominal size in. (mm)	E flange style in. (mm)
1 (25)	8.3 (210)
1½ (40)	8.5 (216)
2 (50)	8.7 (220)
3 (80)	9.3 (237) - ANSI150/PN16 9.1 (234) - ANSI300/PN40
4 (100)	9.7 (247)
6 (150)	10.8 (273)
8 (200)	11.7 (298)

Ordering information

The standard offering represents the most common models and options. These options should be selected for best delivery. The expanded offering is subject to additional delivery lead time.

Required model components

Model

Code	Description
8600D	Vortex Flowmeter

Meter style

Code	Description
F	Flanged style

Line size

Code	Description
010	1-in. (25 mm)
015	1½-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)

Wetted materials

Code	Description
S	CF-8M cast stainless/CF-3M and Graphite Gasket

Note
Material of construction is 316/316L.

Flange or alignment ring size

Code	Description
A1	ASME B16.5 (ANSI) RF Class 150
A3	ASME B16.5 (ANSI) RF Class 300
K1[(1)]	EN 1092-1 PN 16 Type B1

Code	Description
K3	EN 1092-1 PN 40 Type B1

(1) *On 1-in. (25 mm) to 3-in. (80 mm) line sizes, the dimensions for PN16 and PN40 flanges are identical and therefore, all flanges are marked PN40.*

Sensor process temperature range

Code	Description
N	Standard: -58 to 482 °F (-50 to 250 °C)

Conduit entry and housing material

Code	Description
1	½ -14 NPT – Aluminum Housing
2	M20 3 1.5 – Aluminum Housing

Transmitter output

Code	Description
D	4-20 mA digital electronics (HART® protocol)
P	4-20 mA digital electronics (HART protocol) with scaled pulse

Calibration

Code	Description
1	7 Point Flow Calibration

Options

MultiVariable options

Code	Description
MTA	MultiVariable output with Integral Temperature Sensor

Hazardous locations certifications

Code	Description
E3	NEPSI Flameproof
I3	NEPSI Intrinsic Safety
N3	NEPSI Increased Safety - Ex ec
K3	NEPSI Flameproof, Intrinsic Safety, Increased Safety - Ex ec, Dust
E1	ATEX Flameproof
I1	ATEX Intrinsic Safety
N1	ATEX Type n

Code	Description
ND	ATEX Dust
K1	ATEX Flameproof, Intrinsic Safety, Type n, Dust
E7	IECEx Flameproof
I7	IECEx Intrinsic Safety
N7	IECEx Type n
NF	IECEx Dust
K7	IECEx Flameproof, Intrinsic Safety, Type n, and Dust
E6	CSA (C/US) Explosion-proof, Dust Ignition-Proof, and Division 2
I6	CSA (C/US) Intrinsically Safe
K6	CSA (C/US) Explosion-proof, Dust Ignition-Proof, Intrinsically Safe, and Division 2
E2	INMETRO Flameproof
I2	INMETRO Intrinsic Safety
K2	INMETRO Flameproof, Intrinsic Safety
E8	Technical Regulations Customs Union (EAC) Flameproof, and Dust
I8	Technical Regulations Customs Union (EAC) Intrinsic Safety, and Dust
N8	Technical Regulations Customs Union (EAC) Type n, and Dust
K8	Technical Regulations Customs Union (EAC) Flameproof, Intrinsic Safety, Type n, and Dust
E4	TIIS Flameproof
E9	KTL (Korean) Flameproof
EW	PESO (India) Flameproof
IW	PESO (India) Intrinsically Safe
KW	PESO (India) Flameproof, Intrinsically Safe

Display type

Code	Description
M5	LCD display

Other options

Code	Description
PD	Pressure Equipment Directive (PED)

Remote electronics

Code	Description
R10	Remote electronics with 10 ft. (3.0 m) cable
R20	Remote electronics with 20 ft. (6.1 m) cable
R30	Remote electronics with 30 ft. (9.1 m) cable
R33	Remote electronics with 33 ft. (10 m) cable
R50	Remote electronics with 50 ft. (15.2 m) cable

Code	Description
R75	Remote electronics with 75 ft. (22.9 m) cable
RXX(1)	Remote electronics with customer-specified cable length (up to 75 ft. (23 m) maximum)
A10	Armored remote electronics with 10 ft. (3.0 m) cable
A20	Armored remote electronics with 20 ft. (6.1 m) cable
A33	Armored remote electronics with 33 ft. (10.1 m) cable
A50	Armored remote electronics with 50 ft. (15.2 m) cable
A75	Armored remote electronics with 75 ft. (22.9 m) cable

(1) *XX is a customer specified length in feet.*

Transient protection

Code	Description
T1	Transient protection terminal block

Alarm mode

Code	Description
C4	NAMUR alarm and saturation values, high alarm
CN	NAMUR alarm and saturation values, low alarm

Ground screw assembly

Code	Description
V5	External ground screw assembly

Advanced PlantWeb™ Diagnostics

Code	Description
DS1	Internal Flow Simulation

Special cleaning feature

Code	Description
P3	General special cleaning

Safety certifications

Code	Description
SI	Safety Certification of 4-20 mA Outputs per IEC 61508

HART® Revisions Configuration

Code	Description
HR7	HART Revision 7

Certification options

Code	Description
Q4	Calibration data sheet per ISO 10474 3.1B and EN 10204 3.1
Q8	Material traceability certification per ISO 10474 3.1B and EN 10204 3.1
QBR	India Boiler Regulation (IBR)

MC certification

Code	Description
CM	China Metrology Cert
RM	Russian Metrology Cert

Quick Start Guide (QSG) language options (default is English)

Code	Description
YF	French
YG	German
YI	Italian
YM	Chinese (Mandarin)
YP	Portuguese
YR	Russian
YS	Spanish

Typical Model Number: **8600 F 020 S A1 N 1 D 1 M5**

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For more information: **Emerson.com/global**

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