

**PSS 1-8A7 A**

**Model 84F Flanged and Male NPT Intelligent Vortex Flowmeters with HART<sup>®</sup> Communication Protocol**



The Foxboro<sup>®</sup> brand Model 84F flanged and male NPT vortex flowmeters are part of a family of intelligent, high performance vortex flowmeters<sup>(1)</sup>. The flowmeters transmit 4 to 20 mA or digital multidrop and a pulse output signal, as applicable, using HART<sup>®</sup> communication protocol for remote configuration, calibration, and monitoring. An on-board LCD indicator with pushbuttons is also offered for local configuration.

**FEATURES**

- ▶ Liquid, gas, or steam applications.
- ▶ Best in class accuracy:
  - $\pm 0.5\%$  of reading in liquids.
  - $\pm 1.0\%$  of reading in gas and steam.
- ▶ Flanged body designs: 3/4 to 12 in (DN15 to DN300).
- ▶ High pressure options up to Class 1500 and PN160.
- ▶ Male NPT (National Pipe Thread) design is available for direct replacement of turbine, magnetic flow, and orifice meters.
- ▶ *DirectSense*<sup>™</sup> technology with lifetime sensor warranty.
- ▶ Widest rangeability in class
- ▶ Low power versions available for use in battery or solar power applications.
- ▶ ActiveTuning<sup>™</sup> algorithm:
  - Real time Reynolds number ( $R_D$ ) low flow correction down to  $R_D$  of 5000.
  - Compensation for piping effects.
  - Adaptive filtering and signal conditioning.
- ▶ HART communication protocol, 4 to 20 mA, and pulse outputs.
- ▶ Pulse output provides raw or scaled frequency, or total.
- ▶ CE marked; complies with EMC European Union and PED Directives, and NAMUR NE 21 interference immunity requirement.
- ▶ A free-to-use, flow sizing tool is available on the internet at [www.FlowExpertPro.com](http://www.FlowExpertPro.com).

1. For information on other flowmeters in the Model 84 family, refer to PSS 1-8A3 A (Style A Models 84F and 84W), PSS 1-8A5 A (Style A Model 84S), and PSS 1-8A6 A (Low Power Style A Models 84F, 84W, and 84S).

## WIDE VARIETY OF APPLICATIONS

The Foxboro brand Model 84F sets the example for industry standards whether the application requires accuracy for totalizing and batching; utility metering of fluids in the process industries; fuel, air, steam, or gas metering for the measurement of energy in any high use application; or stability and repeatability for process control.

The low power versions of these flowmeters differ from other 84 Series Vortex flowmeters in that the supply current is fixed at a constant 10 mA, and remain in operation down to a minimum voltage of 10V dc. They are intended for use with battery power with any form of recharging technology such as solar arrays or alternators.

The Model 84F Vortex flowmeter is also offered with male NPT end connections. The new threaded end connections allow you to easily replace existing turbine, magnetic flow, and orifice meters.

## COMPLIANCE WITH EUROPEAN UNION DIRECTIVES

- ▶ Complies with Electromagnetic Compatibility Requirements of EMC Directive 2004/108/EC by conforming to the following EN and IEC Standards: EN 61326-1 and IEC 61000-4-2 through 61000-4-6.
- ▶ Complies with NAMUR NE 21 Interference Immunity Requirement (EMC).
- ▶ Complies with Pressure Equipment Directive (PED) 97/23/EC.
- ▶ Complies with all applicable European Union Directives (CE Logo marked on product).

## PATENTED *DIRECTSENSE* TECHNOLOGY ENSURES BEST PERFORMANCE AND RELIABILITY

This patented family of vortex flowmeters has the high accuracy and rangeability of positive displacement and turbine flowmeters without the mechanical complexity and high cost. It utilizes patented *DirectSense* technology to eliminate routine problems encountered with other vortex meters.

*DirectSense* technology measures pressure pulses from vortex shedding directly, without losses due to mechanical linkages. The benefits of *DirectSense* technology include:

- ▶ Provides best-in-class performance.
- ▶ Increased measurement sensitivity for wider rangeability.
- ▶ Greater immunity to pipe vibration.
- ▶ High reliability backed by lifetime sensor warranty.
- ▶ Replaceable sensor without recalibrating.

Because these vortex flowmeters have no moving parts, they are very durable and reliable. The simplicity of design ensures low initial cost, low operating and maintenance costs, which contribute to an overall lower cost of ownership.

## SIMPLIFIED START-UP

No primary device calculations or mechanical calibrations are required. The flowmeter is easily installed and configured. Simply wire it to a proper power source, an I/O module, or controller, and it is ready to measure flow.

The flowmeter is shipped preconfigured with flow data supplied by the customer. Generically preconfigured flowmeters can be used as shipped, but for more precise application, the flowmeter should be configured to specific process usage. The configurator allows selection of the fluid type and provides general default configurations when process conditions are not available.

## ActiveTuning ALGORITHM

### Reynolds Number

Patented algorithm improves accuracy performance down to an  $R_D$  of 5000.

### Compensations for Piping Effects

When it is not possible to provide the recommended pipe diameters of unobstructed straight pipe upstream of the flowmeter, the 84 Series can be configured to compensate for most of the common non-ideal upstream conditions, such as elbows and reducers. Straight runs as short as 5-pipe diameters can be configured to achieve full accuracy.

### Adaptive Filtering and Signal Conditioning

A patented, adaptive filtering algorithm provides real-time, dynamic frequency filters that follow the vortex shedding frequency. This results in unsurpassed low-flow measurement capability and vibration immunity. This is incorporated with a digital smoothing algorithm that conditions the raw vortex signal to virtually eliminate dropped or added pulses, further enhancing low-flow performance.

### Tunable for Specific Operating Conditions

Configurable parameters for Low Flow Cut-in and damping allow tuning for specific flow conditions.

## COMPACT, EFFICIENT, AND DURABLE DESIGN

The flowmeter mounts between ANSI or DIN EN 1092-1 raised face flanges. See MODEL CODE section for end connections offered with each line size. Other flange face surfaces can be used as a custom design.

The electronics housing is of explosionproof and flameproof construction and provides environmental protection to the enclosed electronics. It is offered integrally mounted to the flowtube, or can be mounted remotely.

The flowmeter's simple, modular design requires minimum maintenance. Common, field replaceable parts are used, including the sensor assembly and amplifier. The amplifier can be replaced without

interrupting the flow in the pipe, and sensor can be replaced without process shutdown when an isolation valve is installed. Since a single device is used for multiprocess-fluid applications, ordering is simplified and spare part needs minimized.

## USABLE IN HAZARDOUS AREA LOCATIONS

These flowmeters meet numerous agency requirements for hazardous locations.

## MEASUREMENT INTEGRATION

These flowmeters provide efficient integration of measurements into HART process control schemes. They operate by using a bidirectional digital signal superimposed on the 4 to 20 mA current signal (standard power -T and -U versions), or on the fixed 10 mA supply current (low power -L and -M versions). They are also offered with or without a pulse output. Remote communication of digital values plus status and configuration information can be achieved via HART communication protocol.

Configurators used with the HART versions are:

- ▶ The HART Communicator. Users having a HART Communicator for other devices can have them upgraded with Foxboro software to accommodate these flowmeters.
- ▶ The Local Digital Indicator/Configurator with pushbuttons.
- ▶ A PC-based configurator.

With HART, digital multidropping is permitted. This is the connection of several transmitters to a single communications line. Up to fifteen transmitters can be connected on a single twisted pair of wires or over leased telephone lines.

## REMOTE MOUNTED ELECTRONICS HOUSING

Remote mounting is offered to allow access to the amplifier and other housing electronics when the measurement is not in an easily accessible location. The remote housing is supported by a bracket, which in turn mounts to a surface or to a nominal

2-in or DN50 pipe. This housing can be located up to a cable length of 50 ft (15.2 m) from the flowtube without loss of low level signal.

### LOCAL DIGITAL INDICATOR/CONFIGURATOR

This is a full feature, 16-character digital indicator and configurator. Total flow and/or the instantaneous flow rate may be displayed in user-selected flow units. The display may be configured for either flow or total, or to toggle between them. Four pushbuttons on the indicator are used to configure the flowmeter.

### ISOLATION VALVE

An isolation valve allows the sensor to be removed or replaced without interrupting the flow in the pipe.

### FlowExpertPro™ PROGRAM

The FlowExpertPro program is a tool primarily used to size Foxboro brand flowmeters. It also ensures that the user has selected the proper flowmeter type for this application. This meter selection tool is provided to all users on a free web site, without the need for registration. In addition to flowmeter selection and sizing, the FlowExpertPro program includes the following features:

- ▶ Incorporates a large library of the physical properties of typical process fluids.
- ▶ Displays results in tabular or graphic format.
- ▶ Allows user to save, print, or E-mail results.
- ▶ Provides reference to applicable flowmeter PSSs and other related flowmeter documentation.

The program calculates minimum and maximum flow rates, rangeability, pressure loss, and Reynolds Number, using established flow equations. It also allows for material and flange selection, and provides ANSI or DIN flange recommendations for predicted flow pressure and temperature. You are invited to visit [www.FlowExpertPro.com](http://www.FlowExpertPro.com) to access this tool, or contact Invensys for further information and technical support.

### DUAL MEASUREMENT FLOWMETER

Dual measurement feature, available in 84F Flanged flowmeters, provides redundant sensors and electronics. Two electronics housings and sensors are mounted to a common flowmeter body assembly. Should one transmitter fail, the redundant measurement avoids the necessity of shutting down the process. The failed transmitter can then be replaced at some later noncritical time. Applications include Safety Shutdown Systems (independent of Process Measurement Network), Safety Backup for critical flow loops, Comparative Verification of Measurement for high accuracy precision loops, or just for dual communications paths with the same primary element. See Figure 1.

Figure 1. Dual Measurement Flowmeter



OPERATING CONDITIONS

Influence	Factory Calibration Conditions (a)	Operating Limits (b)
Process Fluid	Clear Water	Liquid, Gas, and Steam
Process Temperature ▶ Std. Temp. Version/Fluorolube Fill ▶ Std. Temp. Version/Silicone Fill ▶ High Temp. Version/Unfilled (c)	▶ 70° to 85°F (20° to 30°C) ▶ 70° to 85°F (20° to 30°C) ▶ 70° to 85°F (20° to 30°C)	▶ 0° and +200°F (-20° and +90°C) ▶ 0° and +400°F (-20° and +200°C) ▶ 400° and 800°F (200° and 430°C)
Ambient Temperature (Housing) ▶ with Indicator/Configurator ▶ without Indicator/Configurator	▶ 70° to 85°F (20° to 30°C) ▶ 70° to 85°F (20° to 30°C)	▶ 0° and +176°F (-20° and +80°C) (d) ▶ -40° and +176°F (-40° and +80°C) (d)
Relative Humidity	50 to 90%	0 and 100%
Supply Voltage	24 ± 0.5 V dc	15.5 and 42 V dc (see Figure 3) 10 and 42 V dc for Low Power version (e)

- a. The factory calibration conditions assume: ANSI Schedule 160 process piping for 2-, 3-, and 4-inch line sizes using Class 1500 flanges, 6-inch (152.4 mm) and 8-inch (203.2 mm) line sizes using Class 900 and Class 1500 flanges, and DN150 and DN200 line sizes using PN160 flanges; all other line sizes and pressure options assume ANSI Schedule 40 process piping; flanges bored to interfacing pipe I.D.; piping and flowmeter body bores aligned to within 2% of meter bore; gaskets to be 0.125 in (3.18 mm) thick and not protruding into pipeline; a minimum of thirty pipe diameters of straight pipe upstream and five pipe diameters downstream of flowmeter; clear water is free from air or particles.
- b. Limits are based on nonflashing, noncavitating conditions. A minimum positive back pressure is required for proper operation to avoid these effects.
- c. Model 84F (Style B) requires the E or G option for upper operating limit above 700°F (370°C).
- d. The 176°F (80°C) temperature is extended to 185°F (85°C) with certain electrical approvals or certifications. Refer to ELECTRICAL SAFETY SPECIFICATIONS table.
- e. Supply current is fixed at a constant 10 mA and remains in operation down to a minimum terminal voltage of 10 V dc. See Power Supply Requirements (Low Power Versions) note in the FUNCTIONAL SPECIFICATIONS section.

**PERFORMANCE SPECIFICATIONS**

*Under calibrated operating conditions unless otherwise stated*

**Factory Calibrated Flow Ranges**

Nominal Meter Size	Nominal Mean K-Factor in Pulses/ft <sup>3</sup> (Pulses/L) (a)	Factory-Calibrated Flow Range for Water (b)		
		Range in US gpm	Range in L/s	Range Reynolds Number (R <sub>D</sub> )
3/4 in (DN15)	5,580 (197)	6.9 to 34	0.43 to 2.1	30,000 to 150,000
1 in (DN25)	2,250 (79.5)	8.9 to 56	0.56 to 3.5	30,000 to 190,000
1 1/2 in (DN40)	570 (20.1)	14 to 140	0.88 to 8.7	30,000 to 300,000
2 in (DN50)	258 (9.11)	18 to 230	1.1 to 15	30,000 to 380,000
2 in (DN50) Class 1500	389 (13.74)	16 to 203	1 to 12.8	30,000 to 380,000
3 in (DN80)	78.7 (2.78)	34 to 500	2.1 to 32	38,000 to 570,000
3 in (DN80) Class 1500	103 (3.64)	32 to 475	2 to 30	38,000 to 570,000
4 in (DN100)	34.8 (1.23)	59 to 890	3.7 to 56	50,000 to 750,000
4 in (DN100) Class 1500	47.29 (1.67)	55 to 818	3.4 to 51.6	50,000 to 750,000
6 in (DN150)	10.00 (0.353)	140 to 2,000	8.5 to 130	76,000 to 1,100,000
6 in (DN150) Class 900, Class 1500, PN160	13.68 (0.483)	125 to 1,812	7.9 to 114.3	76,000 to 1,100,000
8 in (DN200)	4.26 (0.150)	240 to 3,600	15 to 220	100,000 to 1,500,000
8 in (DN200) Class 900, Class 1500, PN160	5.98 (0.211)	216 to 3,244	13.6 to 204.6	100,000 to 1,500,000
10 in (DN250)	2.19 (0.0773)	395 to 5,768	24.9 to 363.9	130,000 to 1,900,000
12 in (DN300)	1.32 (0.0466)	578 to 8,305	36.4 to 524.0	160,000 to 2,300,000

- a. The K-factor is the relationship between input (volumetric flow rate) and the output (pulse rate). Reference K-factor is the arithmetic mean value of K-factor over a designated flow rate range (reference conditions). The mean K-factor is derived as:  

$$\text{Mean K-factor} = (K_{\text{MAX}} + K_{\text{MIN}}) / 2$$
 where KMAX is the maximum K-factor and KMIN is the minimum K-factor over the calibrated flow range.
- b. Factory calibrated Reynolds Number range applies to standard temperature sensor without isolation valve. Other sensor selections and manifold selections may alter the calibration range. For sizing tools and specific calibration ranges, visit [www.FlowExpertPro.com](http://www.FlowExpertPro.com).

**Accuracy for Liquids**

Accuracy within the calibrated range is as follows:

- ▶ Above 30,000  $R_D$ ;  $\pm 0.5\%$ <sup>(2)</sup>
- ▶ Between 20,000 and 30,000  $R_D$ ;  $\pm 1.0\%$
- ▶ Between 5,000 and 20,000  $R_D$ ;  $\pm 2.0\%$

See Figure 2.

**Accuracy for Gases and Steam**

Accuracy within the calibrated range is as follows:

- ▶ Above 20,000  $R_D$ ;  $\pm 1.0\%$ <sup>(3)</sup>
- ▶ Between 5,000 and 20,000  $R_D$ ;  $\pm 2.0\%$

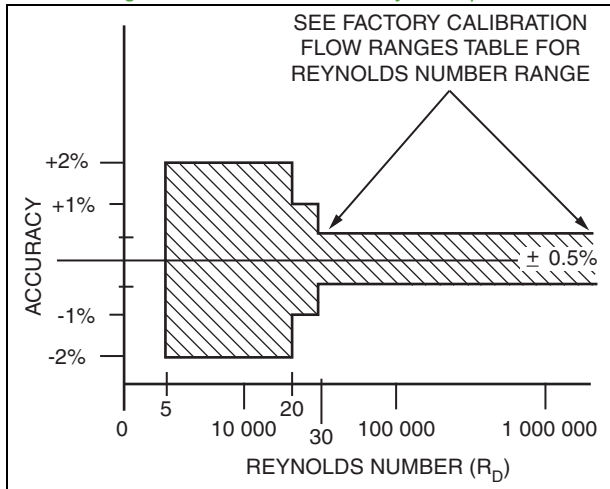
**NOTE**

To achieve the fluid accuracies listed here, the flowing density and viscosity must be entered in the database configuration. To determine accuracy for specific applications and use other sizing tools, visit [www.FlowExpertPro.com](http://www.FlowExpertPro.com).

**Supply Voltage Effect (Within Stated Limits)**

- ▶ With Pulse Output: No effect on accuracy
- ▶ With Analog Output: Less than 0.005% per volt
- ▶ With Digital Output: No effect on accuracy

Figure 2. Flowmeter Accuracy for Liquids



**Ambient Temperature Effect (Amplifier only)**

- ▶ With Pulse Output:  $\pm 0.01\%$  of reading from  $-40^\circ$  to  $+176^\circ\text{F}$  ( $-40^\circ$  to  $+80^\circ\text{C}$ )<sup>(4)</sup>
- ▶ With Analog Output: For  $50^\circ\text{F}$  ( $28^\circ\text{C}$ ) change in ambient temperature within operative limits.
  - Zero (4 mA):  $\pm 0.02\%$  of span maximum
  - Span (16 mA):  $\pm 0.1\%$  of span maximum
- ▶ With Digital Output:  $\pm 0.01\%$  of reading from  $-40^\circ$  to  $+176^\circ\text{F}$  ( $-40^\circ$  to  $+80^\circ\text{C}$ )<sup>(4)</sup>

**Relative Humidity Effect**

No effect if covers and conduit seals are properly installed.

**EMI and RFI Effects**

The flowmeters meet the EMI and RFI requirements of EN 61326-1.

**Vibration Effect**

Vibration can affect the flow measurement output of a vortex flowmeter in the form of added pulses, but with the built-in Tuning functions and Low Flow Cut-in adjustability, these effects can be minimized. Invensys has tested this meter with vibrations up to 3 “g” of acceleration with no physical damage, no shift in calibration after the test, and no loss of communications throughout the test.

2. For male NPT Vortex flowmeters (Option -V), accuracy is  $\pm 1.0\%$  for Reynolds numbers above 30,000.

3. For male NPT Vortex flowmeters (Option -V), accuracy is  $\pm 1.5\%$  for Reynolds numbers above 20,000.

4. The  $176^\circ\text{F}$  ( $80^\circ\text{C}$ ) temperature may be extended to  $185^\circ\text{F}$  ( $85^\circ\text{C}$ ). Refer to ELECTRICAL SAFETY SPECIFICATIONS table further in the document.

### Position Effect (Filled Pipe Conditions)

For most applications, the flowmeter can be mounted in a pipeline which may run in any direction from the vertical (flow in upward direction) to the horizontal. Measurement of liquid and gas streams is not affected by the pipeline orientation or the flowmeter orientation in the pipeline.

For saturated steam, the recommended flowmeter position is in a horizontal pipe with the electronics housing located below the pipeline.

For superheated steam, the electronics housing may be left or right or below the pipeline. The flowmeter should be insulated to maintain superheat conditions within the flowmeter, as well as insulating the electronics away from the rising heat. The electronics temperature should not exceed 176°F (80°C) under any conditions.

Refer to RECOMMENDED MOUNTING ARRANGEMENTS section for further information.

### Switching and Indirect Lightning Transients

The transmitter can withstand a transient surge up to 2000 V common mode or 1000 V normal mode without permanent damage. Transmitter complies with ANSI/IEEE C62.41-1980 and IEC Std. 61000-4-5.

- ▶ Complies with Electromagnetic Compatibility requirements of European EMC Directive 2004/108/EC by conforming to the following EN and IEC standards: EN 61326-1 and IEC 61000-4-2 through 61000-4-6.

### RFI Effect

The output error is less than 0.1% of span for radio frequencies from 27 to 1000 MHz and field intensity of 15 V/m when the transmitter is properly installed with shielded conduit and grounding, and housing covers are in place. (Per IEC Std. 61000-4-3).

## FUNCTIONAL SPECIFICATIONS

### Remote Digital Communication

Remote digital communication is through a HART Communicator or PC-based configurator at a communication rate of 1200 baud, and a rated communication distance of 6000 ft (1800 m). Remote digital communication is also through an I/A Series System.

### Local Communication/Configuration

In addition to remote communications, a local digital indicator/configurator with pushbuttons is also available for local interrogation and configuration.

### Communication Format

- ▶ Analog 4 to 20 mA with HART superimposed
- ▶ HART communications with fixed mA output

Table 1. Remote Communication Parameters

Parameter	HART Analog or Digital Multidrop Mode
Remote Configurator/Communicator	HART Communicator or PC-Based Configurator
Communication Rate	1200 baud
Communication Distance (Rated)	6000 ft (1800 m)
Flow/Total Measurement Update	5 times/s
Raw Pulse Measurement Update	Vortex Shedding Frequency



**Write Protect Jumper**

A write protect jumper provides additional security by allowing the user to prevent the local indicator (configurator) and remote configurator from writing to the electronics. This write protection capability meets the security requirements of ISA-584.01-1986.

**Password Protection**

This is provided in the local display/configurator mode to assure operating security. A second level of protection is provided for configuration security.

**On-Line Diagnostics**

Flowmeter uses many internal diagnostic functions including hardware checks, and internal code and database validation. Error checking and diagnostic codes are also embedded in the communications protocol. These diagnostics are performed at startup and as continuous background checks.

**Offline Diagnostics (Self-Test)**

The configurators allow self-tests to be initiated to validate the transmitter electronics. This test uses an internally generated frequency signal.

**Power Supply Requirements (Standard Power Versions)**

**Supply Current**

- ▶ Digital Mode: 10 mA dc nominal
- ▶ Analog Mode: 22 mA dc maximum
- ▶ Pulse Output: 20 mA dc maximum

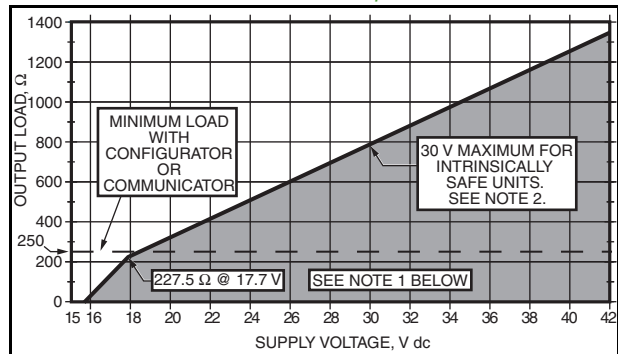
**Supply Voltage**

15.5 to 42 V dc, depending on electrical safety approvals and certifications. Refer to Figure 3.

**NOTE**

When operating at ambient temperatures below -20°F (-29°C), it is important to maintain a minimum loop voltage of 15.75 V dc to maintain remote configurator communications capability.

*Figure 3. Supply Voltage vs Output Load for 4 to 20 mA Output*



**NOTE**

1. The transmitter will function with an output load less than 250 Ω provided that a PC-based configurator or HART Communicator is not connected to it. Connecting a PC-based configurator or HART Communicator while operating in this area may cause output disturbances and/or communication problems.
2. With intrinsically safe certifications with a 24 V dc supply, an active barrier is required.

**Power Supply Requirements (Low Power Versions)**

**Supply Current**

10 mA dc nominal

**Supply Voltage Limits**

10 and 42 V dc

**NOTE**

For proper operation, 10 V dc must be maintained at the flowmeter terminals. For HART communications, a 250 Ω load resistor must be included in the power supply loop and a supply voltage of 12.5 V dc must be maintained. See installation MI for typical installation topologies.

## Output Damping

Damping smooths the flow rate output, and optimizes the flowmeter's response time to the control system. Damping is an exponential filter, 90% recovery time to an 80% input step, with a selectable time constant; it can be set between 0 and 32 seconds. An eight second damping factor will pass 64% of the step change in this time period. Damping applies to all outputs except the Raw Pulse Output where no damping is applied to the direct vortex shedding frequency.

## Response Time (Without Damping)

### Analog Mode

0.5 second or the vortex shedding period for frequencies less than 2 Hz.

### Digital Mode

0.5 second or the vortex shedding period for frequencies less than 2 Hz.

### Pulse Output

- ▶ Raw Pulse: Vortex shedding frequency
- ▶ Rate or Total Pulse: 0.25 s or the vortex shedding period for frequencies less than 2 Hz.

## Outputs

These flowmeters with full-featured electronics can support the following outputs:

- ▶ HART Version -T: Digital and 4 to 20 mA output, with a pulse output
- ▶ HART Version -U: Digital and 4 to 20 mA output
- ▶ HART Version -L: Digital output with a pulse output
- ▶ HART Version -M: Digital output without a pulse output

### Analog Output

Flow rate available as a 4 to 20 mA signal with the 20 mA value being set by the configured full range flow rate.

## Digital Output

Digital information is superimposed on a 4 to 20 mA signal (standard power versions) or the power supply loop (low power versions) at 1200 baud (see Table 1). For low power versions, output is fixed at 10 mA.

## Pulse Output

The pulse output can be configured with the full-function electronics: raw pulse, rate pulse, and total pulse.

- ▶ Raw Pulse: This is the vortex shedding frequency directly passed through providing an instantaneous, nondampened frequency output.
- ▶ Rate Pulse: The frequency of this output is a 50% duty cycle pulse output with a frequency range of 0 to 10, 0 to 100, or 0 to 1000 Hz, proportional to zero flow to the full range flow rate/upper range value (URV).
- ▶ Total Pulse: The frequency of this output is also a 50% duty cycle pulse output that is configured to provide a pulse when a determined volumetric/totalized unit has flowed through the meter.

## Pulse Output Specifications

The pulse output is an externally powered 2-wire transistor switch type output. This output can be configured using any applicable configuration device to select any one of three types of pulse outputs: raw pulse, rate pulse, and total pulse. The following specifications apply to all three types of outputs:

- ▶ Isolated 2-Wire Transistor Switch
- ▶ Applied Voltage: 5 to 30 V dc
- ▶ Maximum "ON" State Voltage Drop: 1.0 V dc
- ▶ Maximum "ON" State Current: 20 mA
- ▶ Reverse polarity protected
- ▶ Short circuit protected
- ▶ Connectable to pull up or pull down counters.

## Output Combinations (4 to 20 mA Outputs)

Flowmeter wired as a 2-wire device without pulse output, and as a 4-wire device with pulse output.

**Flowmeter Ranges**

Flowmeter is shipped with flow range specified in the sales order or with a default flow range equal to the meter capacity. It can be reranged by the user keeping the same flow rate units, choosing new flowrate units from a built-in menu-selectable list, or entering custom flow rate units. Table 2 is included for reference only. To determine flow velocity limits and use other sizing tools, visit [www.FlowExpertPro.com](http://www.FlowExpertPro.com).

**Nominal Flow Velocity Limits**

These limits can be calculated using Table 2. In the table,  $\rho_f$  is the fluid density at flowing conditions in lb/ft<sup>3</sup> for U.S. customary units, or in kg/m<sup>3</sup> for SI units. The specifications apply for most applications, but can deviate slightly for some combinations of density and line size.

**Table 2. Nominal Flow Velocity Limits**

Range Limit	Standard Temperature Range		Extended Temperature Range	
	ft/s	m/s	ft/s	m/s
Lower (a)	$2.5/\sqrt{\rho_f}$	$3.0/\sqrt{\rho_f}$	$5.0/\sqrt{\rho_f}$	$6.0/\sqrt{\rho_f}$
Upper	$250/\sqrt{\rho_f}$	$300/\sqrt{\rho_f}$	$250/\sqrt{\rho_f}$	$300/\sqrt{\rho_f}$

a. Values given for lower range velocity limit are at the lowest LFCI setting.

**Reference K-Factor**

The reference K-factor is a coefficient that specifies the flowmeter calibration and is expressed as pulses per unit volume, where pulses/unit volume =pulses per second divided by volume flow per second.

The reference K-factor is the arithmetic mean value of K over the factory-calibrated flow range. It is determined at the factory by actual flow calibration with water by comparison to a master flowmeter calibration, or by actual static weight. Both calibrations are traceable to NIST. The reference K-factor is entered in the flowmeter database and stamped on the data plate. Once established, this K-factor is available to gas, liquid, or steam.

**Flowing K-Factor**

The flowing K-factor is computed from the K-reference expressed in specified flowing units, and can be corrected for the following:

- ▶ Process Temperature
- ▶ Mating Pipe
- ▶ Upstream Disturbances

**Process Temperature Correction**

The flowmeter computes a corrected K-factor at the specific process temperature entered by the user.

**Process Temperature Effect on K-Factor**

There is an effect on the reference K-factor due to a diameter change of the flowtube bore with temperature. The effect is -0.3% of flow rate per 100°F (55°C) increase in temperature. These flowmeters will automatically recompute a flowing K-factor when process temperature is entered in the database fluid definition.

**K-Factor Bias**

Provisions are made in the configuration menu to bias the flowmeter K-factor by a percent (%) value. Flowing K-factor value will be automatically recalculated when the % bias is entered.

**Static Pressure Limits**

**Minimum Static Pressure**

The minimum static pressure is that pressure which is sufficient to prevent flashing and meet the pressure drop requirements to attain maximum flow rate. For sizing tools, visit [www.FlowExpertPro.com](http://www.FlowExpertPro.com).

**Maximum Static Pressure**

3750 psig (258.6 bar) (25855 kPa) or that imposed by flange rating.

To determine the pressure drop for Model 84 Vortex flowmeters and use other sizing tools, visit [www.FlowExpertPro.com](http://www.FlowExpertPro.com).

### Minimum Back Pressure (Volatile Liquids or Low Pressure Conditions)

Any condition that tends to contribute to the release of vapor from the liquid (flashing, which may also induce cavitation) shall be avoided by proper system design and operation of the flowmeter within the rated flow rate range. Location of flowmeter should consider the need for using a back-pressure valve, or for increasing inlet pressure. To avoid flashing and to ensure stable vortex generation, the minimum back pressure should be:

$$P_G = (3)(\Delta P) + (1.25)(p_v) - (p_{atm})$$

where

- $P_G$  = Gauge pressure in kPa or psi five pipe diameters downstream of the flowmeter
- $\Delta P$  = Pressure loss in psi or kPa
- $p_v$  = Vapor pressure at line conditions in psi or kPa absolute
- $p_{atm}$  = Atmospheric pressure in psi or kPa absolute

### Flange Pressure-Temperature Ratings

See MI 019-202 and MI 019-211 for ANSI and DIN flange pressure-temperature ratings. These ratings are also embedded in the FlowExpertPro sizing tool. See Figure 6 for pressure-temperature limits when isolation valves are used. Also note the temperature limit when fluorolube fill (200°F/90°C) or silicone fill (400°F/200°C) is used, or when no fill (800°F/430°C) is used with extended temperature applications.

### Functional Block Diagrams

Figure 4. HART 4 to 20 mA Topology

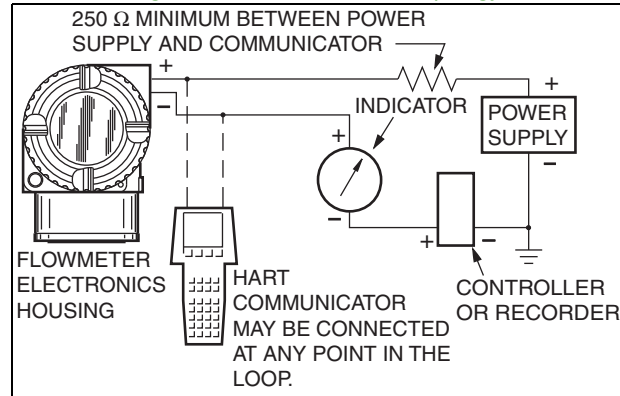
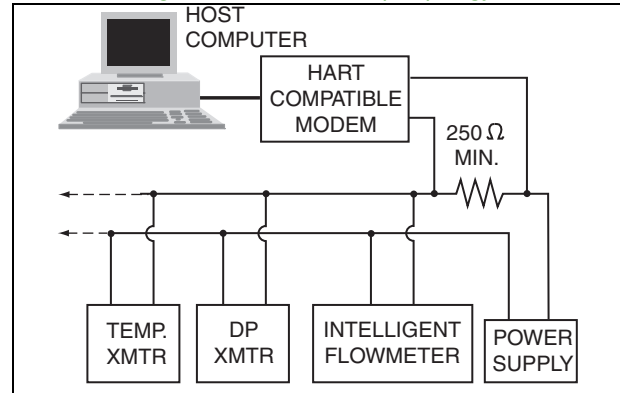


Figure 5. HART Multidrop Topology



### Isolation Valves

Flowmeters equipped with an isolation valve have Pressure-Temperature limits as shown in Figure 6.

The temperature range of your flowmeter is found within the model number on the data label as follows:

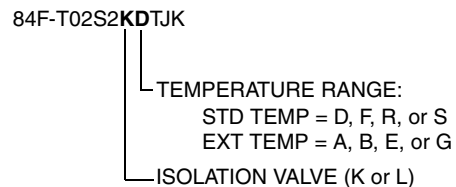
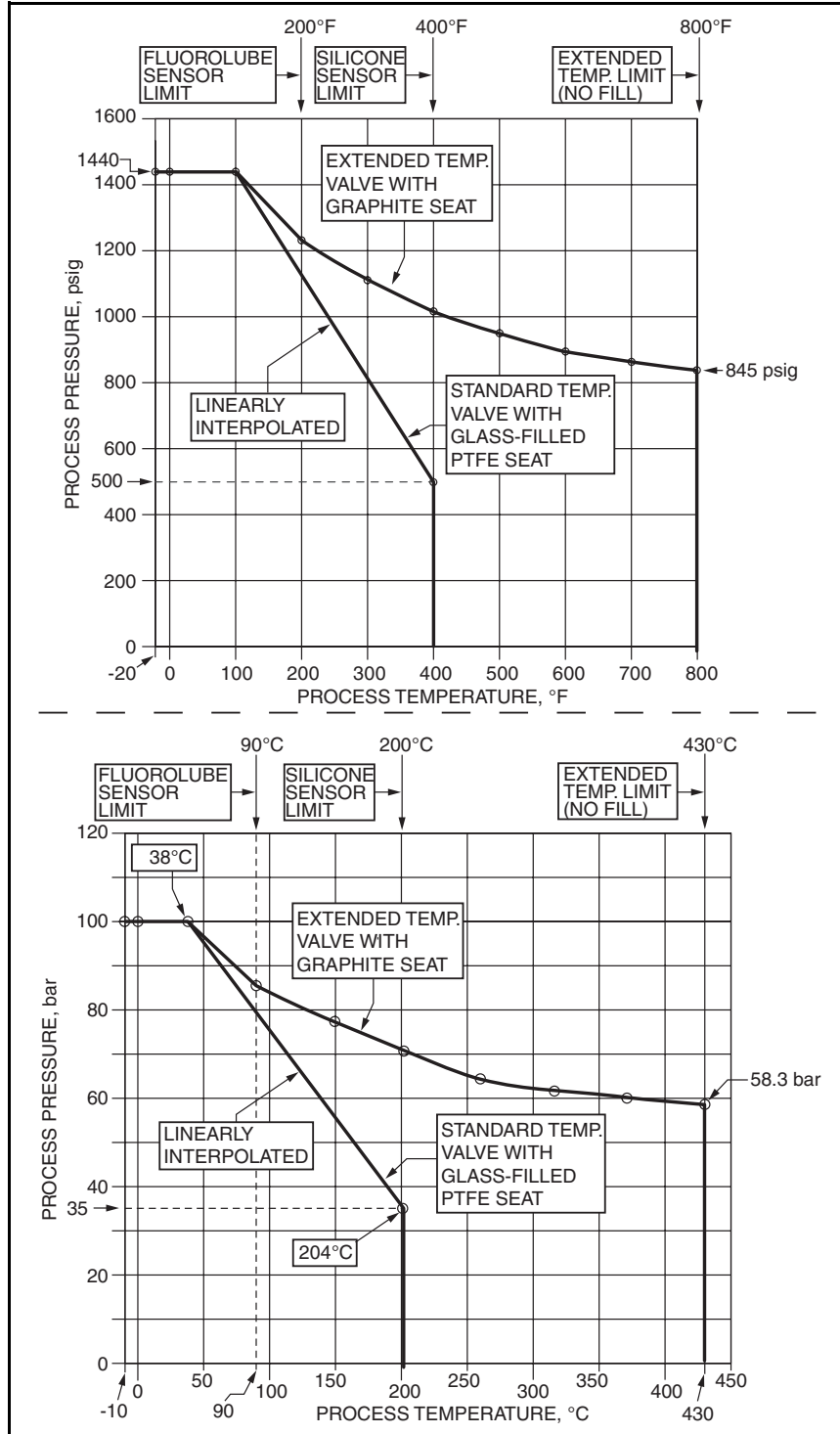


Figure 6. Pressure-Temperature Limits with Isolation Valves; U.S. Customary and Metric Units



PHYSICAL SPECIFICATIONS

Process-Wetted Parts

Table 3. Flanged Flowmeter

Line Sizes	Body/Shepherd Bar	Flange
3/4 to 4 inch (Codes 3Q to 04)	Cast 316 SS, CF8M	316 SS per ASTM A182 Grade F316/F316L Carbon steel per ASTM A105
	Cast Duplex SS per ASTM A995 Grade 4A, CD3MN	Duplex SS per ASTM A182 Grade F51
	Cast nickel alloy, CX2MW (a)	Nickel alloy N06022 (a)
6 to 8 inch (Codes 06 to 08)	Cast 316 SS, CF8M	304 SS per ASTM A182 Grade F304/F304L Carbon steel per ASTM A105
	Cast Duplex SS per ASTM A995 Grade 4A, CD3MN	Duplex SS per ASTM A182 Grade F51
	Cast nickel alloy, CX2MW (a)	Nickel alloy N06022 (a)
10 and 12 inch (Codes 10 and 12)	Fabricated 304 SS per ASTM 312	304 SS per ASTM A182 Grade F304/F304L Carbon steel per ASTM A105
	Fabricated Duplex SS per ASTM A790	Duplex SS per ASTM A182 Grade F51
	Fabricated nickel alloy UNS N06022 (a) per ASTM B622	Nickel alloy N06022 (a) per ASTM B462

a. Equivalent to Hastelloy® C-22. Hastelloy is a registered trademark of Haynes International, Inc.

Table 4. Male NPT Flowmeter

Line Sizes	Body/Shepherd Bar	NPT Connection
1 inch (Code 01)	Cast 316 SS, CF8M	Cast 316 SS, CF8M, integrally cast to body
2 inch (Code 02)	Cast 316 SS, CF8M	316 SS

Table 5. Gaskets and Flow Dam (Sensor Seals)

Sensor Type	Gasket Material	Flow Dam Material
Standard Temperature Sensor	PTFE	PTFE
High Temperature Sensor	316 SS	316 SS/grafoil
	Nickel alloy CW2M (a)	Nickel alloy CW2M/grafoil (a)

a. Nickel alloy CW2M is equivalent to Hastelloy® C-4C.

### Dual Measurement Manifold (Flanged Vortex Flowmeters Only)

Made from CF8M stainless steel, the pressure and temperature rating of the dual manifold is the same as the flowmeter body.

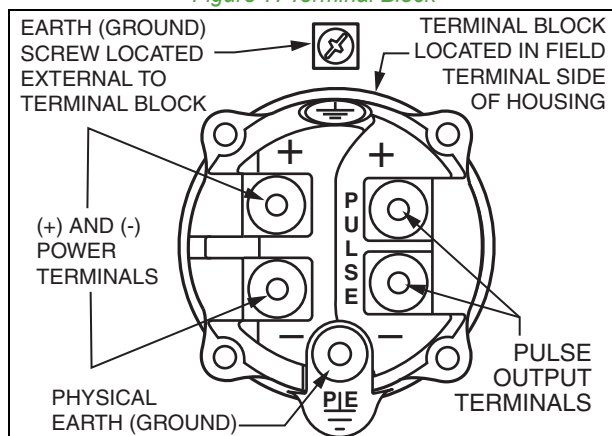
### Flowmeter Mounting

The flowmeter can be located in a pipeline which may run in any direction from the vertical (upward flow) to the horizontal. The electronics housing can also be rotated 270° (in 90° increments) with respect to the body. A vertical pipeline is preferred for batch operations to provide improved full line assurance. See "RECOMMENDED MOUNTING ARRANGEMENTS" on page 23.

### Electrical Connections

Field wires enter through 1/2 NPT or M20 conduit threaded entrances on either side of the electronics housing. Wires terminate under screw terminals and washers on terminal block (see Figure 7) in the field terminal compartment. Unused entrance is plugged to insure moisture and RFI/EMI protection.

Figure 7. Terminal Block



### Electronics Housing and Housing Covers

A two compartment housing separates the electronics from the field connections. Housing and covers are low copper, die-cast aluminum alloy with an epoxy finish. Buna-N O-ring seals are used to seal the housing covers, housing neck, and terminal block.

### Electronics Module

Printed wiring assemblies (PWAs) are conformally coated for moisture and dust protection.

### Environmental Protection

The electronics housing has the dusttight and weatherproof rating of IP66 as defined by IEC 60529, and provides the environmental and corrosion resistant protection rating of NEMA 4X.

### Isolation Valve

(If applicable; see MODEL CODE for selection options.)

- ▶ Valve Body: Grade CF8M stainless steel
- ▶ Valve Ball: 316 SS
- ▶ Valve Seats:
  - Standard Temperature: Glass-Filled PTFE
  - Extended Temperature: Graphite
- ▶ Stem Seal: The valve stem seal meets the external leakage requirements for fire safety per API Standard 607.
- ▶ Valve Handle: Use adjustable wrench.
- ▶ Seat Leakage:
  - Standard Temperature  
Class IV – Less than 5 mL/h per MSS-SPG1.
  - High Temperature  
Class IV per ANSI/FCI-70.2
- ▶ Flow Velocity Limits: See "Nominal Flow Velocity Limits" on page 11.
- ▶ Applications: Recommended for use with clean liquids, saturated steam, and all gases.
- ▶ Limitations: Not recommended for use with superheated steam without insulation, or liquids with suspended solids.

- ▶ Mounting: See MI 019-202 and MI 019-211 for installation guidelines.
- ▶ Pressure/Temperature Rating: Both standard and extended (high) temperature isolation valves have a maximum pressure rating of 1440 psi at 100°F (100 bar at 38°C). The standard temperature valve with PTFE seats is further limited to a maximum pressure of 500 psi at 400°F (35 bar at 204°C). The extended temperature valve has an ANSI Class 600 temperature and pressure rating. See Figure 6.

**Data Plate**

Stainless steel data plate encircles and is secured to the lower part of the electronics housing. Includes conventional Model and operating data, including the factory calibration factor (K-factor). If additional tag data space is required, an optional Stainless Steel Customer Tag is offered.

**NACE Certification**

The Model 84F (Style B) flowmeters have been designed to meet the requirements of NACE Standard MR-0175-2003 for use in H<sub>2</sub>S Sour Oilfield environments. The design and process wetted materials also comply with NACE Standard MR-0103-2007 for use in corrosive petroleum refining environments. A NACE compliance certificate is available by selecting the -Q option.

**Dimensions**

Refer to DIMENSIONS – NOMINAL section for general outline data. For more dimensional details, refer to the following Dimensional Prints (DPs).

Model	Configuration	Dimensional Print
84F	Single Measurement	DP 019-125
84F	Dual Measurement	DP 019-126

**Approximate Weight**

Refer to Table 6. Weights shown are approximate and are meant as a guide to the user.

- ▶ Standard temperature flowmeter weights are listed for integrally mounted electronics housings. There is a slight weight difference for high temperature flowmeters (adds about 1 lb (0.5 kg)), and for remote mounted housings (housing replaced by connector head assembly/junction box). The electronics housing itself weighs about 4 lbs (2 kg) and varies slightly depending on whether indicator/configurator, and/or extended housing covers are used.
- ▶ For single measurement flowmeters, add approximately 2 lb (1 kg) if an isolation valve is used.
- ▶ For dual measurement flowmeters (applicable to 84F flanged flowmeters only):
  - Add approximately 9 lb (4 kg) when a manifold without isolation valves is used.
  - Add approximately 15 lb (7 kg) when a manifold with two isolation valves is used.



Table 6. Approximate Weight - Model 84F Flanged

Nominal Line Size	Flange	Material	Weight, lb (kg)
0.75 in	Class 150	316 SS	10.4 (4.71)
0.75 in	Class 150	Duplex SS	10.2 (4.62)
0.75 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	10.8 (4.90)
0.75 in	Class 1500	316 SS	19.3 (8.75)
0.75 in	Class 1500	Duplex SS	18.8 (8.53)
0.75 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	20.5 (9.30)
1 in	Class 150	316 SS	12.2 (5.53)
1 in	Class 150	Duplex SS	12.0 (5.44)
1 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	12.8 (5.81)
1 in	Class 1500	316 SS	24.3 (11.02)
1 in	Class 1500	Duplex SS	23.6 (10.70)
1 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	25.9 (11.75)
1.5 in	Class 150	316 SS	16.7 (7.57)
1.5 in	Class 150	Duplex SS	16.3 (7.39)
1.5 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	17.7 (8.03)
1.5 in	Class 1500	316 SS	34.5 (15.65)
1.5 in	Class 1500	Duplex SS	33.4 (15.15)
1.5 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	36.9 (16.74)
2 in	Class 150	316 SS	20.9 (9.48)
2 in	Class 150	Duplex SS	20.4 (9.25)
2 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	22.2 (10.07)
2 in	Class 1500	316 SS	54.2 (24.58)
2 in	Class 1500	Duplex SS	52.5 (23.81)
2 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	58.2 (26.40)
3 in	Class 150	316 SS	43.0 (19.50)
3 in	Class 150	Duplex SS	41.7 (18.91)
3 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	46.2 (20.96)
3 in	Class 1500	316 SS	109.7 (49.76)
3 in	Class 1500	Duplex SS	106.1(48.13)
3 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	118.4 (53.71)
4 in	Class 150	316 SS	46.4 (21.05)
4 in	Class 150	Duplex SS	45.0 (20.41)
4 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	49.9 (22.63)
4 in	Class 1500	316 SS	155.9 (70.72)
4 in	Class 1500	Duplex SS	150.7 (68.36)
4 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	168.4 (76.38)

Table 6. Approximate Weight - Model 84F Flanged (Continued)

Nominal Line Size	Flange	Material	Weight, lb (kg)
6 in	Class 150	316 SS	77.6 (35.2)
6 in	Class 150	Duplex SS	75.1 (34.0)
6 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	83.6 (37.92)
6 in	Class 150	CS	81.1 (36.78)
6 in	Class 600	316 SS	178.1 (77.92)
6 in	Class 600	Duplex SS	175.5 (79.6)
6 in	Class 600	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	204.0 (92.53)
6 in	Class 600	CS	186.5 (84.59)
6 in	Class 1500	316 SS	357.0 (161.93)
6 in	Class 1500	Duplex SS	344.9 (156.44)
6 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	386.1 (175.13)
6 in	Class 1500	CS	349.0 (158.3)
8 in	Class 150	316 SS	127.3 (57.74)
8 in	Class 150	Duplex SS	123.1 (55.83)
8 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	137.4 (62.32)
8 in	Class 150	CS	125.1(56.74)
8 in	Class 600	316 SS	289.4 (131.26)
8 in	Class 600	Duplex SS	279.6 (126.82)
8 in	Class 600	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	312.9 (141.92)
8 in	Class 600	CS	283.3 (128.5)
8 in	Class 1500	316 SS	657.2 (298.1)
8 in	Class 1500	Duplex SS	634.7 (287.89)
8 in	Class 1500	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	711.1 (322.54)
8 in	Class 1500	CS	642.5 (291.43)
10 in	Class 150	316 SS	160.0 (72.57)
10 in	Class 150	Duplex SS	154.7 (70.17)
10 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	172.9 (78.42)
10 in	Class 600	316 SS	476.2 (216.0)
10 in	Class 600	Duplex SS	460.0 (208.65)
10 in	Class 600	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	515.2 (233.69)
12 in	Class 150	316 SS	252.4 (114.48)
12 in	Class 150	Duplex SS	243.8 (110.58)
12 in	Class 150	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	272.8 (123.73)
12 in	Class 600	316 SS	540.4 (245.12)
12 in	Class 600	Duplex SS	521.9 (236.72)
12 in	Class 600	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	584.7 (265.21)
DN15	PN40	316 SS	12.3 (5.58)
DN15	PN40	Duplex SS	12.1 (5.49)

Table 6. Approximate Weight - Model 84F Flanged (Continued)

Nominal Line Size	Flange	Material	Weight, lb (kg)
DN15	PN40	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	12.9 (5.85)
DN15	PN100	316 SS	16.2 (7.35)
DN15	PN100	Duplex SS	15.8 (7.17)
DN15	PN100	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	17.1 (7.76)
DN25	PN40	316 SS	13.4 (6.08)
DN25	PN40	Duplex SS	13.1 (5.94)
DN25	PN40	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	14.1 (6.40)
DN25	PN160	316 SS	19.1 (8.66)
DN25	PN160	Duplex SS	18.6 (8.44)
DN25	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	20.3 (9.21)
DN40	PN40	316 SS	17.9 (8.12)
DN40	PN40	Duplex SS	17.5 (7.94)
DN40	PN40	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	19.0 (8.62)
DN40	PN160	316 SS	28.2 (12.79)
DN40	PN160	Duplex SS	27.4 (12.43)
DN40	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	30.1 (13.65)
DN50	PN40	316 SS	21.7 (9.84)
DN50	PN40	Duplex SS	21.2 (9.62)
DN50	PN40	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	23.1 (10.48)
DN50	PN160	316 SS	38.4 (17.42)
DN50	PN160	Duplex SS	37.3 (16.92)
DN50	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	41.2 (18.69)
DN80	PN40	316 SS	33.3 (15.10)
DN80	PN40	Duplex SS	32.3 (14.65)
DN80	PN40	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	35.6 (16.15)
DN80	PN160	316 SS	58.6 (26.58)
DN80	PN160	Duplex SS	56.7 (25.72)
DN80	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	63.0 (28.58)
DN100	PN40	316 SS	44.4 (20.14)
DN100	PN40	Duplex SS	43.1 (19.55)
DN100	PN40	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	47.7 (21.64)
DN100	PN160	316 SS	81.2 (36.83)
DN100	PN160	Duplex SS	78.6 (35.65)
DN100	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	87.5 (39.69)
DN150	PN16	316 SS	61.5 (27.89)
DN150	PN16	Duplex SS	59.5 (26.98)
DN150	PN16	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	66.1 (29.98)
DN150	PN16	CS	60.5 (27.44)

Table 6. Approximate Weight - Model 84F Flanged (Continued)

Nominal Line Size	Flange	Material	Weight, lb (kg)
DN150	PN160	316 SS	195.8 (88.81)
DN150	PN160	Duplex SS	189.2 (85.81)
DN150	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	211.6 (95.98)
DN150	PN160	CS	191.7 (86.95)
DN200	PN16	316 SS	94.8 (43)
DN200	PN16	Duplex SS	88.2 (40)
DN200	PN16	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	102.2 (46.35)
DN200	PN16	CS	93.4 (42.36)
DN200	PN160	316 SS	356.7 (161.79)
DN200	PN160	Duplex SS	344.6 (156.3)
DN200	PN160	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	385.8 (174.99)
DN200	PN160	CS	349.3 (158.43)
DN250	PN16	316 SS	143.6 (65.13)
DN250	PN16	Duplex SS	138.8 (62.95)
DN250	PN16	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	155.1 (70.35)
DN250	PN100	316 SS	421.6 (191.23)
DN250	PN100	Duplex SS	407.2 (184.70)
DN250	PN100	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	456.0 (206.83)
DN300	PN16	316 SS	204.4 (92.71)
DN300	PN16	Duplex SS	197.5 (89.58)
DN300	PN16	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	220.9 (100.19)
DN300	PN100	316 SS	618.0 (280.32)
DN300	PN100	Duplex SS	596.9 (270.74)
DN300	PN100	Nickel alloy CX2MW (equivalent to Hastelloy® C-22)	668.7 (303.31)

Table 7. Approximate Weight - Model 84F Male NPT

Nominal Line Size	Equivalent to Flange	Material	Weight, lb (kg)
1 in	Class 1500	316 SS	8.4 (3.8)
2 in	Class 900	316 SS	10.40 (4.7)

Table 8. Flanged Flowmeter Body Internal Dimensions for Schedule 80 Bore (a)

ANSI/DIN Nominal Line Size		Bore (ID)	
in	mm	in	mm
0.75	15	0.74	18.8
1.00	25	0.96	24.3
1.50	40	1.50	38.1
2.00	50	1.94	49.2
3.00	80	2.87	72.9
4.00	100	3.83	97.2
6.00	150	5.76	146.3
8.00	200	7.63	193.7
10.00	250	9.56	242.9
12.00	300	11.38	288.9

- a. Dimensions are for following flange offerings:
- 3/4"-1.5": ANSI Class 150-1500
  - DN15-DN40: PN40-PN160
  - 2"-4": ANSI Class 150-900
  - DN50-DN100: PN40-PN160
  - 6"-12": ANSI Class 150-600
  - DN150-300: PN16-PN100

Table 9. Flanged Flowmeter Body Internal Dimensions for Schedule 160 Bore (a)

ANSI/DIN Nominal Line Size		Bore (ID)	
in	mm	in	mm
2.00	50	1.69	42.8
3.00	80	2.63	66.7
4.00	100	3.44	87.3
6.00	150	5.19	131.8
8.00	200	6.81	173.1

- a. Dimensions are for following flange offerings:
- 2"-4": ANSI Class 1500
  - 6"-8": ANSI Class 900-1500
  - DN150-200: PN160

PRODUCT SAFETY SPECIFICATIONS

**Pressure Safety**

Designed to withstand pressure within ANSI/ASME B16.5 up to Class 1500 flange ratings, and DIN EN 1092-1, up to PN160 flange ratings. See MI 019-202 and MI 019-211 for ANSI and DIN flange pressure-temperature ratings. For other flange ratings, centering spacers are provided.

**Personnel and Electrical Fire Safety**

This device is designed to be a minimum fire hazard by using low energy power and adequate insulation and separation of electrical circuits. The required standards of worldwide testing agencies such as FM, CSA, ATEX, and IECEx have been fulfilled.

**ELECTRICAL SAFETY SPECIFICATIONS**

The Model 84 has been designed to meet the electrical safety descriptions listed below. For detailed information, or status of the testing laboratory approval/certification, contact Invensys.

With intrinsically safe approvals and certifications with a 24 V dc supply, an active barrier is required.

Refer to MI 019-177 for FM and CSA Connection Diagrams; refer to MI 019-179 for ATEX and IECEx Safety Information.

Agency, Types of Protection, and Area Classification	Application Conditions	Elect. Safety Design Code
ATEX Intrinsically safe: II 1G; II 2D; Ex ia IIC T4 Ga Ex tb IIIC T103°C Db	Sira 06ATEX2067X Integrally mounted or remote mounted (electronics and junction box). Temperature Class T4; Ta = -40° to +80°C	E
ATEX Flameproof: II 2/1 (1) G; II 2D Ex d [ia Ga] ia IIC T4 Gb; Ex tb IIIC T85°C Db	Sira 06ATEX2067X Integrally mounted electronics. Temperature Class T4; Ta = -20° to +80°C	H
ATEX Flameproof: II 2/1 (1) G; II 2D Ex d [ia Ga] IIC T4 Gb; Ex tb IIIC T85°C Db	Sira 06ATEX2067X Electronics housing of remote mounted version. Temperature Class T4; Ta = -20° to +80°C	H
CSA Intrinsically safe: Class I, II, III, Div. 1, Groups A, B, C, D, E, F, and G. Ex ia IIC T4	Temperature Class T4; Ta = -40° to +80°C	C
CSA Explosionproof with Intrinsically Safe sensor connections: Class I, Div. 1, Groups A, B, C, and D; Class II, Div 1, Groups E, F, and G; Class III; [Ex ia]; T5; Ex d [ia] IIC T5 Dust-ignitionproof for Class II, Div. 1, Groups E, F, and G; Class III, Div. 1 Also Zone certified Ex d [ia] IIC.	Temperature Class T5; Ta = 60°C       Temperature Class T5; Ta = -40° to +80°C	D
CSA Class I, Division 2: Class I, Div. 2, Groups A, B, C, and D; Class II, Div. 2, Groups E, F and G; Class III.	Temperature Class T4; Ta = 80°C	M
FM Intrinsically safe: Class I, II, III, Div. 1, Groups A, B, C, D, E, F, G; T4 Class I Zone 0 AEx ia IIC T4	Temperature Class T4; Ta = 80°C	F
FM Explosionproof with Intrinsically Safe sensor connection: Class I, II, III, Div.1, Groups B, C, and D; T5 Dust-ignitionproof for Class II, III, Div. 1, Groups E, F, and G	Temperature Class T5; Ta = 85°C	G
FM Nonincendive: Class I, II, Div. 2, Groups A, B, C, and D; T4 Class II, III, Div. 2, Groups F and G	Temperature Class T4; Ta = 80°C	K
IECEx Intrinsically safe: Ex ia IIC T4 Ga; Ex tb IIIC T103°C Db	IECEx SIR 06.0020X Temperature Class T4; Ta = -40° to +80°C	L

Agency, Types of Protection, and Area Classification	Application Conditions	Elect. Safety Design Code
IECEX Flameproof: Ex d [ia Ga] ia IIC T4 Gb Ex tb IIIC T85°C Db	IECEX SIR 06.0020X Integrally mounted electronics. Temperature Class T4; Ta = -20° to +80°C	B
IECEX Flameproof: Ex d [ia Ga] IIC T4 Gb Ex tb IIIC T85°C Db	IECEX SIR 06.0020X Electronic housing of remote mounted version. Temperature Class T4; Ta = -20° to +80°C	B
NEPSI Intrinsically safe, Zone 0, Ex ia IIC	Temperature Class T4; Ta = -40° to +80°C	R
NEPSI Flameproof, Zone 1, Ex d IIC (except acetylene)	Temperature Class T5; Ta = -40° to +85°C	S
Unit with CE mark and PED controls and records		Y
Unit does not have CE mark; not to be installed in European Union (EU) countries		Z

RECOMMENDED MOUNTING ARRANGEMENTS

Table 10. Recommended Flowmeter Mounting

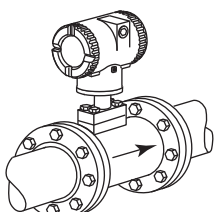
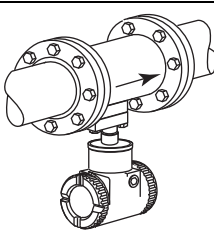
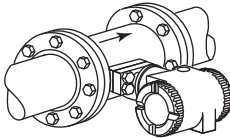
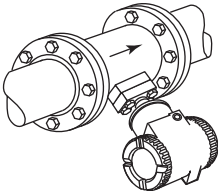
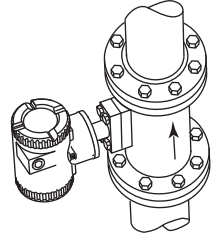
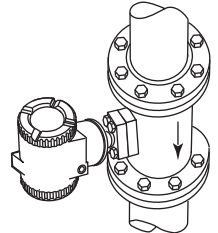
Flowmeter Mounting Arrangements Model 84F (Style B) Single Measurement Flowmeter Shown (For Dual Measurement Flowmeters, refer to the associated MI for mounting arrangements)		Flowmeter for Use With:			
		Liquid	Gas	Saturated Steam	Superheated Steam
	Housing Above Pipe; Isolation Valve and Dual Measurement Flowmeter NOT Used	Yes (a)	Yes	No	Yes (b)
	Housing Above Pipe; Isolation Valve and Dual Measurement Flowmeter CAN be Used	No (c)	Yes	No	Yes (b)
	Housing Below Pipe	Yes (d) (e) (f)	Yes (e)	Yes	Yes (b)
	Housing to Side of Pipe	Yes	Yes	No	Yes (b)

Table 10. Recommended Flowmeter Mounting (Continued)

Flowmeter Mounting Arrangements (Continued) Model 84F (Style B) Single Measurement Flowmeter Shown (For Dual Measurement Flowmeters, refer to the associated MI for mounting arrangements)		Flowmeter for Use With:			
		Liquid	Gas	Saturated Steam	Superheated Steam
	Housing to Side and Below Pipe	Yes (f)	Yes	No	Yes (b)
	Vertical Pipe, Flow upward	Yes	Yes	No	Yes (b)
	Vertical Pipe, Flow Downward	Yes (g)	Yes	No	Yes (b)

- a. Possibility of temporary start-up error due to trapped air.
- b. Requires adequate insulation.
- c. Not recommended for liquids with isolation valve.
- d. Best choice when errors due to start-up cannot be tolerated.
- e. Recommended only for clean fluids.
- f. Preferred for liquids with isolation valve.
- g. Not preferred; must maintain full pipe with no voids in fluid.



OPTIONAL SELECTIONS AND ACCESSORIES

**Options -B, -D, -E, -G: Cable Assembly to Remote Electronics Housing**

When selecting Code -R for a Remote Mounted Housing, a cable length must be selected. Four cable lengths are offered as follows:

Option	Cable Length
-B	20 ft (6 m)
-D	30 ft (9 m)
-E	40 ft (12 m)
-G	50 ft (15 m)

**Option -H: Cleaning for Oxygen or Chlorine Gas Service**

Process wetted parts are cleaned for oxygen or chlorine service in compliance with Compressed Gas Association's CGA-4.1 and ASTM G93. Cleaning is not offered when an isolation valve, or dual measurement or extended temperature meters are selected. Select Option -H.

**Options -L, -M, -Q: Foxboro Certificates of Conformance and Compliance**

Three material certificates are offered. Option -L provides a certificate of compliance to the specifications of the Invensys/Foxboro Quality System, which conforms to ISO 9001. Option -M is a certification of material for process wetted metal (conforms to BS EN 10204 3.1). Option -Q certifies that process-wetted materials meet NACE Standards MR-0175-2003 and MR-0103-2007.

**Option -N: Certified Calibration Certificate**

A calibration and pressure test sheet come standard with each flowmeter. A certified flow calibrated K-factor and pressure test certificate is available by selecting Option -N.

**Options -F and -X: Welding Certificates**

Two certificates are available. Option -F certifies that the fabrication of flowtubes by welders is to ASME Boiler Code, Section IX. Option -X provides radiographic examination and certification of circumferential welds and certifies that welding is per ASME Boiler Code, Section IX and Radiographic Examination.

Temperature Options E and G are high temperature options (400°F to 800°F or 200°C to 430°C); both of these high temperature options require that you also order Welding Certificate Option -X.

**Option -P: Cable Connector - Hawke-Type Cable Gland**

Brass cable gland with 1/2 NPT external thread. Provides support for field cable. Ensure that this cable connector is qualified to meet the electrical safety specification selected. See ELECTRICAL SAFETY SPECIFICATIONS section. Available with Electronics Housing Codes T and R only (1/2 NPT). Select Option -P.

**Option -R: Cable Connector - PG11 Cable Gland**

A PG11 cable gland with 1/2 NPT external thread. Provides strain relieved support for field cable. The PG11 is for cable diameters from 8 to 12 mm. Ensure that this cable connector is qualified to meet the electrical safety specification selected. See ELECTRICAL SAFETY SPECIFICATIONS section. Available with Electronics Housing Codes T and R only (1/2 NPT). Select Option -R.

**Option -T: Conduit Fitting**

A conduit fitting is available with Remote Mounting Code R only. It is provided when conduit is used to enclose the cable between the flowtube body and remote transmitter. Both ends of the fitting are 1/2 NPT and interconnect the conduit and transmitter at the housing and flowtube ends. Specify Option -T.

**AS Code MTS: Stainless Steel Customer Tag Accessory**

A 1.5 x 3.5 in (40 x 90 mm) stainless steel tag for customer data that does not fit on the standard plate. It is fastened to housing with wire. Accommodates 10 lines of data with 40 characters/spaces per line. Tag will also show customer's K-factor (information with flowing conditions being submitted to Invensys with sales order). Specify AS Code MTS.

## MODEL CODE

Description	Model
Intelligent Vortex Flowmeter – Flanged Body	84F
<b>Electronics Version</b>	
Intelligent Electronics, HART Communication Protocol, with Pulse Output	-T
Intelligent Electronics, HART Communication Protocol, without Pulse Output	-U
Intelligent Electronics, Low Power HART Communication Protocol, with Pulse Output	-L
Intelligent Electronics, Low Power HART Communication Protocol, without Pulse Output	-M
<b>Nominal Line Size</b>	
3/4 in (DN15) Line Size	3Q
1 in (DN25) Line Size	01
1 1/2 in (DN40) Line Size	1H
2 in (DN50) Line Size	02
3 in (DN80) Line Size	03
4 in (DN100) Line Size	04
6 in (DN150) Line Size (a)	06
8 in (DN200) Line Size (a) (b)	08
10 in (DN250) Line Size (a)	10
12 in (DN300) Line Size (a)	12
<b>Body, Flange, and Shedder Bar Material</b>	
CF8M 316 SS Cast Body/Shedder and Type 316 SS Flanges (Line Sizes 3Q to 04) and Type 304 SS Flanges (Line Sizes 06 to 8); Line sizes 10 to 12, Fabricated 304 SS (c)	R
CF8M 316 SS Cast Body/Shedder and Type 316 SS Flanges (Line Sizes 3Q to 04) (Face-to-face lengths are backward compatible with Style A Model 84 Vortex Flowmeters) (d) (e) (f)	Y
Nickel Alloy CX2MW (equivalent to Hastelloy® C-22) Cast Body/Shedder and Nickel Alloy N06022 Flanges (Line Sizes 3Q to 08); Line Sizes 10 and 12 are fabricated (a)	H
Duplex SS Cast Body/Shedder per ASTM A 995, Grade 4A, CD3MN and Duplex SS Flanges per A182 Grade F51 (Line Sizes 3Q to 08); Line Sizes 10 and 12 are fabricated (a)	D
<b>End Connections and Flange Rating</b>	
ANSI Class 150 RF	1
ANSI Class 300 RF	2
ANSI Class 600 RF	3
ANSI Class 900 RF (Not Available with Line Sizes 10 and 12)	4
ANSI Class 1500 RF (Not Available with Line Sizes 10 and 12)	9
ANSI Class 150 RTJ (Not Available with Line Size 3Q)	N
ANSI Class 300 RTJ	P
ANSI Class 600 RTJ	R
ANSI Class 900 RTJ (Not Available with Line Sizes 10 and 12)	S
ANSI Class 1500 RTJ (Not Available with Line Sizes 10 and 12)	T
PN16 EN1092-1 Raised Face Type “D” Nut Groove (Available with Line Sizes 06 through 12 only)	5
PN25 EN1092-1 Raised Face Type “D” Nut Groove (Available with Line Sizes 08 through 12 only)	J
PN40 EN1092-1 Raised Face Type “D” Nut Groove	6
PN63 EN1092-1 Raised Face Type “D” Nut Groove (g)	7
PN100 EN1092-1 Raised Face Type “D” Nut Groove	8
PN160 EN1092-1 Raised Face Type “D” Nut Groove (Not Available with Line Sizes 3Q, 10, and 12)	K
PN16 EN1092-1 Raised Face Finish Type B1 (Available with Line Sizes 06 through 12 only)	D
PN25 EN1092-1 Raised Face Finish Type B1 (Available with Line Sizes 08 through 12 only)	L
PN40 EN1092-1 Raised Face Finish Type B1	F
PN63 EN1092-1 Raised Face Finish Type B2 (h)	G
PN100 EN1092-1 Raised Face Finish Type B2	H
PN160 EN1092-1 Raised Face Finish Type B2 (Not Available with Line Sizes 3Q, 10, and 12)	M
PN40 EN1092-1 Raised Face Finish Type F	C
PN100 EN1092-1 Raised Face Finish Type F	Q

## MODEL CODE

## MODEL CODE (CONTINUED)

Description	Model
NPT Connection (Only Available with 3/4 inch - 1 1/2 inch Class 1500, and 2 inch Class 900 for R material option)	V
<b><u>Single or Dual Measurement; Isolation Valve and Manifold</u></b>	
Single Measurement; No Isolation Valve	S
Dual Measurement; Manifold with no Isolation Valves	D
Single Measurement; Manifold with one Isolation Valve; CF8M (316 SS); Not Available with End Connections 4, 9, H, K, M, S, and T (a)	K
Dual Measurement; Manifold with two Isolation Valves; CF8M (316 SS); Not Available with End Connections 4, 9, H, K, M, S, and T (a)	L
<b><u>Sensor Fill, Temperature Range, and Material</u></b>	
<b>Standard Temperature Range (with Fill Fluid)</b>	
Fluorolube Fill, 0° to 200°F (-20° to +90°C) Nickel alloy CW2M (equivalent to Hastelloy® C-4C)	D
Fluorolube Fill, 0° to 200°F (-20° to +90°C) Stainless Steel Type CF3M	F
Silicone Fill, 0° to 400°F (-20° to +200°C) Nickel alloy CW2M (equivalent to Hastelloy® C-4C)	R
Silicone Fill, 0° to 400°F (-20° to +200°C) Stainless Steel Type CF3M	S
<b>Extended Temperature Range (No Fill Fluid) (i) (j)</b>	
Unfilled, 400° to 700°F (200° to 370°C) Nickel alloy CW2M (equivalent to Hastelloy® C-4C)	A
Unfilled, 400° to 700°F (200° to 370°C) Stainless Steel Type CF3M	B
Unfilled, 400° to 800°F (200° to 430°C) Nickel alloy CW2M (equivalent to Hastelloy® C-4C)	E
Unfilled, 400° to 800°F (200° to 430°C) Stainless Steel Type CF3M	G
<b><u>Electronics Housing Mounting, Material, and Conduit Connections</u></b>	
Integral Top Mounted 1/2-NPT Conduit Connections	T
Integral Top Mounted M20 Conduit Connections	V
Remote Mounted 1/2-NPT Conduit Connections (k)	R
Remote Mounted M20 Conduit Connections (k)	W
<b><u>Local Digital Indicator/Configurator</u></b>	
No Digital Indicator/Configurator	N
Full Function Digital Indicator/Configurator	J
<b><u>Electrical Safety (refer to ELECTRICAL SAFETY SPECIFICATIONS section for details)</u></b>	
ATEX intrinsically Safe	E
ATEX flameproof	H
CSA intrinsically safe	C
CSA Division 2	M
CSA explosionproof	D
FM intrinsically safe	F
FM nonincendive	K
FM explosionproof	G
IECEX intrinsically safe	L
IECEX flameproof	B
NEPSI intrinsically safe	R
NEPSI flameproof	S
No Agency Electrical Certifications; with CE mark, PED Controls and Records	Y
No Agency Certifications; no CE mark; Units not to be installed in European Union (EU) countries	Z
<b><u>Optional Selections</u></b>	
<b>Cable Length Selection for Remote Electronics Housing</b>	
20 ft (6 m) Cable to Connect to Remote Electronics Housing	-B
30 ft (9 m) Cable to Connect to Remote Electronics Housing	-D
40 ft (12 m) Cable to Connect to Remote Electronics Housing	-E
50 ft (15 m) Cable to Connect to Remote Electronics Housing	-G

MODEL CODE (CONTINUED)

Description	Model
<b>Cleaning - Oxygen/Chlorine Service</b> Cleaning of Process Wetted Parts per Compressed Gas Association's CGA G-4.1 and ASTM G93 - Available only with Body/Flange/Shedder Material Codes R and Y. - Not available with Line Sizes 10 and 12 or with Isolation Valve Codes D, K, and L. - Not available with Extended Temperature Codes E and G.	-H
<b>Sensor Plating</b> Gold Plated Sensor	-J
<b>Foxboro Certificates of Compliance/Conformance</b> Standard Certificate of Compliance Foxboro Material Certification of Process Wetted Metal (Conforms to BS EN 10204 3.1) Process Wetted Parts Comply with NACE Standards MR-0175-2003 and MR-0103-2007	-L -M -Q
<b>Foxboro Calibration Certificate</b> Calibration and Pressure Test Certified Copy	-N
<b>Cable Connectors – with Electronics Housing Codes T and R only (1/2 NPT)</b> Hawke-Type Cable Gland (available only with electrical safety codes Y and Z) PG11 Cable Gland, Trumpet Shaped (not available with explosionproof/flameproof certifications)	-P -R
<b>Conduit Fitting</b> Adapter for use with 1/2 NPT conduit (Available only with Remote Mounted Housing Code R)	-T
<b>Welding Certificate</b> Welding certified to conform to ASME Boiler and Pressure Vessel Code, Section IX Welding certified to conform to ASME Boiler and Pressure Vessel Code, Section IX and Radiographic Examination (X-Ray) of welds	-F -X
<b>Instruction Manual</b> Detailed Instruction Manual in place of Universal MI 019-146	-C
Examples: 84F-T02R1SDTNK-X; 84F-M04J7DRRJG-GQNT	

- a. Contact Invensys for availability in Style B.
- b. For Line Size 08 with 4, 9, S, T, K, and M End Connections, Welding Certificate Option -X is required.
- c. Required with Male NPT end connections (Option -V).
- d. Available with ANSI End Connections 1, 2 and 3 for Line Sizes 3Q through 08.
- e. Equivalent to Hastelloy® C-22. Hastelloy is a registered trademark of Haynes International, Inc.
- f. For line sizes 06 to 12, Body, Flange, and Shedder Bar Material Option R provides the same face-to-face lengths as Style A Model 84 Vortex Flowmeters.
- g. For Line Sizes 3Q, 01, and 1H, select End Connection 8.
- h. For Line Sizes 3Q, 01, and 1H, select End Connection H.
- i. Welding Certificate Option -X is required for extended temperature range (400° to 800° F) (200° to 430° C).
- j. High Temperature Sensors are not available with Body, Flange, and Shedder Bar Material selection D (Duplex SS).
- k. For remote mounting, select optional cable length.

**SUGGESTED RFQ SPECIFICATIONS**

The manufacturer shall provide field-mounted vortex flowmeters featuring digital signal processing techniques capable of accurately measuring liquid, gas, or steam flows. The specifications for these meters are as follows:

<b>Communication Protocol:</b>	HART
<b>Outputs:</b>	Analog (4 to 20 mA) and digital, with or without pulse output
<b>Remote Communications:</b>	Direct digital with HART Multidrop
<b>Configuration:</b>	Can be configured from the LCD indicator, HART communicator, or PC-based configurator
<b>Accuracy:</b>	0.5% of reading in liquids, 1.0% of reading in gas and steam (a)
<b>Internal Flow Totalizer:</b>	Standard
<b>Sensor:</b>	Replaceable without meter recalibration required
<b>EMI and RFI:</b>	Meets the EMI and RFI requirements for EN 61326-1
<b>Voltage Supply:</b>	2-wire 24 V dc loop powered
<b>Power Supply:</b>	10 to 42 V dc
<b>Supply Current:</b>	10 mA dc nominal
<b>Mounting:</b>	Electronics to accommodate integral or remote mounting
<b>Electronics Housing:</b>	Aluminum housing with epoxy finish 84F; Remote or integrally mounted to flowtube. With remote mount, interconnecting cable up to 50 ft (15 m) required
<b>Electronics:</b>	Enclosed in a NEMA 4X/IP66 rated housing sealed with O-rings for protection against moisture or other contaminants, optional integral LCD indicator with on-board configuration pushbuttons
<b>Body and Shedder Bar Materials:</b>	316 or 304 stainless steel, nickel alloy CX2MW (equivalent to Hastelloy® C-22), Duplex SS, or carbon steel
<b>Flowmeter Sizing:</b>	Sizing tools with free web site access at <a href="http://www.FlowExpertPro.com">www.FlowExpertPro.com</a>
<b>Electrical Classification:</b>	Refer to ELECTRICAL SAFETY SPECIFICATIONS table
<b>Model Code:</b>	Model 84F Vortex Flowmeters, or equivalent

- a. For male NPT Vortex flowmeters (Option -V), accuracy is  $\pm 1.0\%$  for liquids with Reynolds numbers above 30,000 and  $\pm 1.5\%$  for gases and steam with Reynolds numbers above 20,000.

DIMENSIONS – NOMINAL

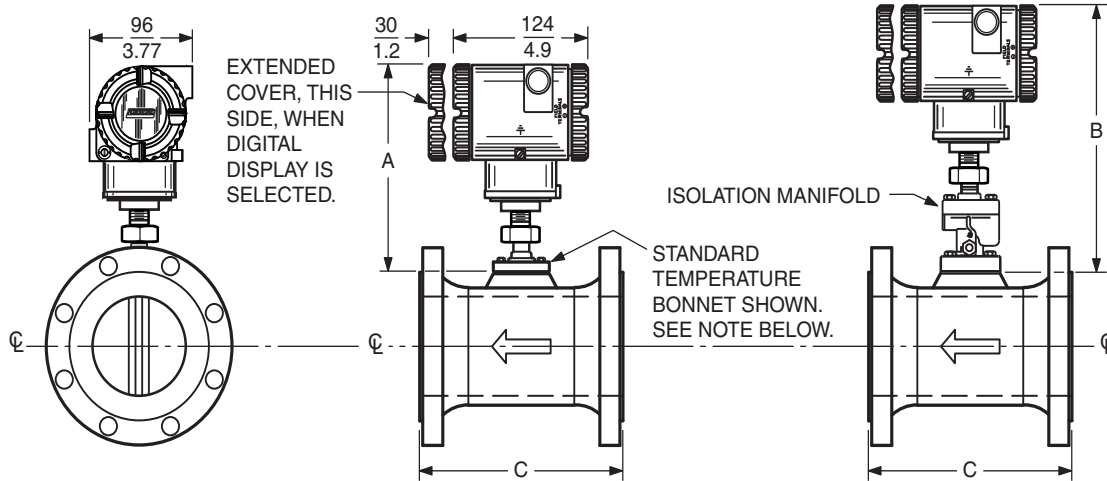
**mm**  
**in**

84F (Style B) FLANGED BODY FLOWMETERS; INTEGRAL MOUNT; SINGLE MEASUREMENT

84F (Style B) FLANGED BODY

84F (Style B) FLANGED BODY

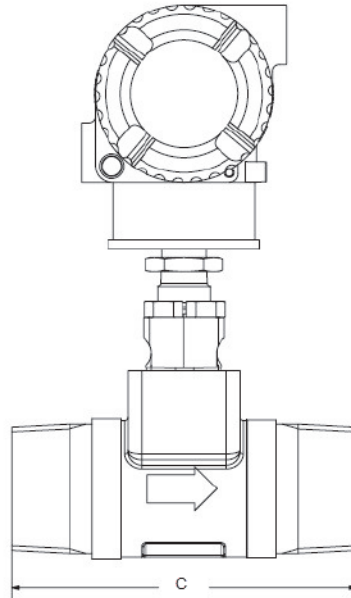
84F (Style B) WITH ISOLATION MANIFOLD



Dimension	Dimensions - Nominal Line Size Code (a)									
	3Q	01	1H	02	03	04	06	08	10	12
A (b)	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$	$\frac{205}{8.1}$
B (b)	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$
C (c)	Dimension C varies with flange type, rating, and size used. See Table 11 and Table 12 for dimensions.									

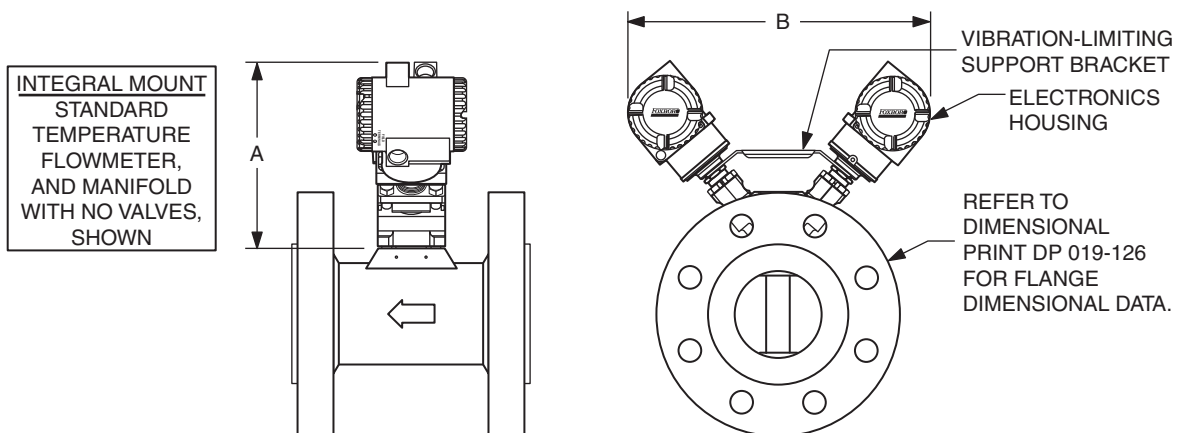
- Refer to the MODEL CODE section for sizes.  
Also, refer to DP 019-125 and DP 019-126 for additional 84F (Style B) dimensions.
- Dimensions A and B are shown with the standard temperature bonnet with extended temperature applications, add 3.6 in (91.4 mm) to Dimensions A and B because of the longer bonnet.
- Dimension C is a face-to-face dimension.

**84F MALE NPT FLOWMETERS**



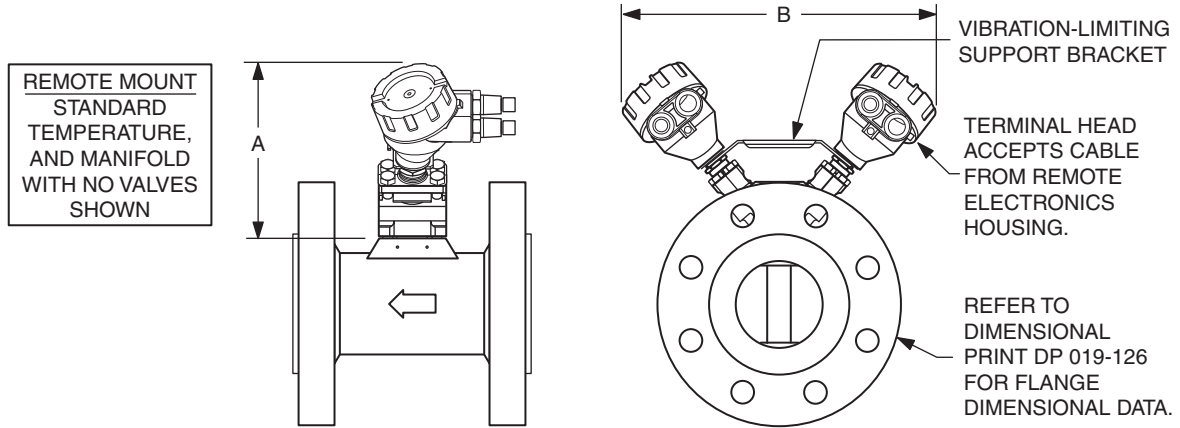
ANSI/DIN Nominal Line Size		Bore (ID)		Overall Length	
in	mm	in	mm	in	mm
1.00	25	0.96	24.3	4	101.6
2.00	51	1.94	49.2	6	152.4

**84F (Style B) FLANGED FLOWMETER; INTEGRAL MOUNT; DUAL MEASUREMENT**



Dimension	Standard Temperature Flowmeter		Extended Temperature Flowmeter	
	No Isolation Valves	With Isolation Valves	No Isolation Valves	With Isolation Valves
A	8.6 in (218 mm)	9.3 in (236 mm)	11.4 in (290 mm)	12.1 in (307 mm)
B	15.4 in (391 mm)	19.4 in (493 mm)	20.0 in (508 mm)	24.0 in (610 mm)

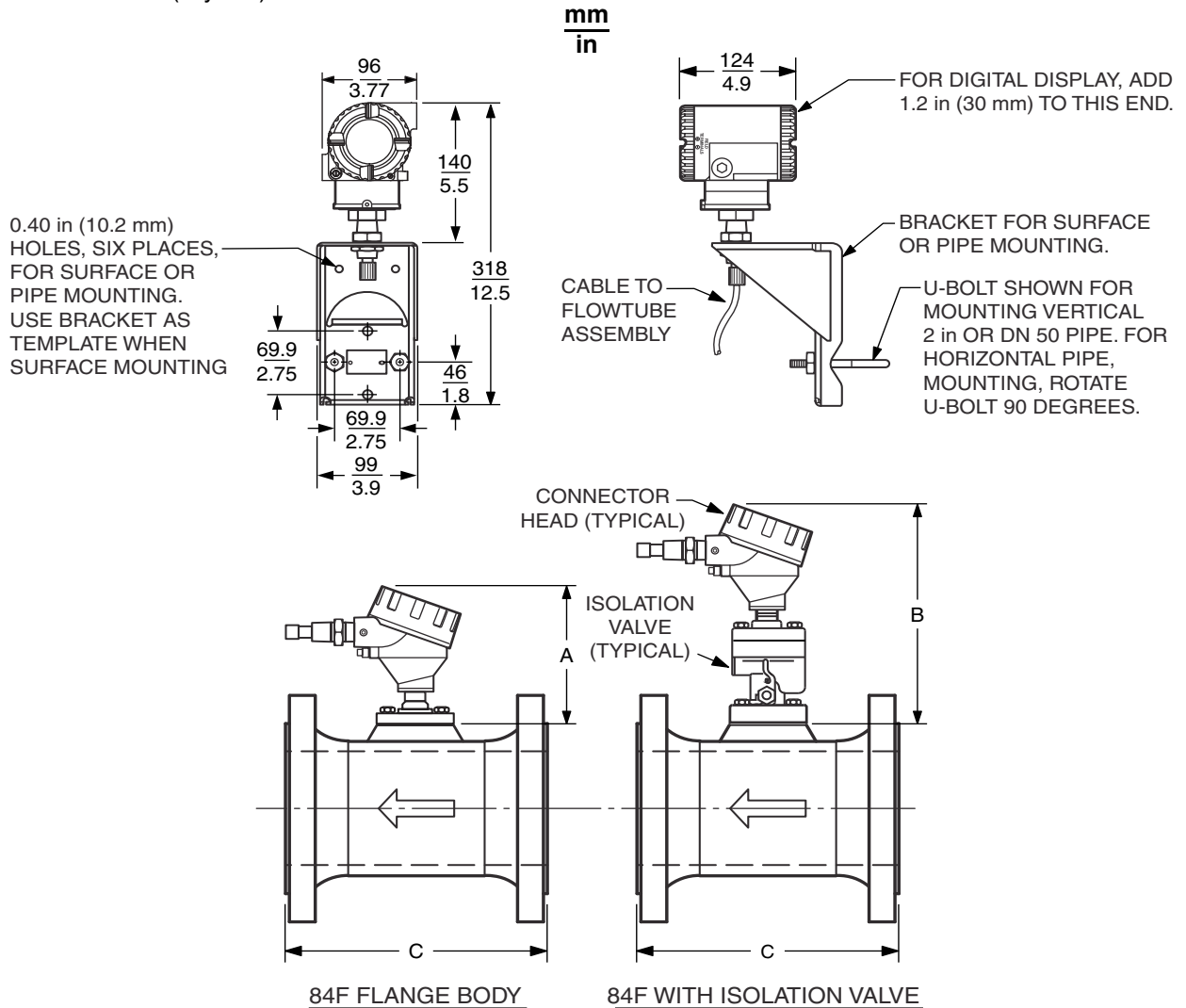
84F (Style B) FLANGED FLOWMETER; REMOTE MOUNT; DUAL MEASUREMENT



Dimension	Standard Temperature Flowmeter		Extended Temperature Flowmeter	
	No Isolation Valves	With Isolation Valves	No Isolation Valves	With Isolation Valves
A	7.8 in (198 mm)	8.9 in (226 mm)	11.4 in (290 mm)	12.1 in (307 mm)
B	15.4 in (391 mm)	19.4 in (493 mm)	20.0 in (508 mm)	24.0 in (610 mm)



84F (Style B) FLANGED BODY FLOWMETERS WITH REMOTE MOUNTED ELECTRONICS



Dimension	Dimensions - Nominal Line Size Code (a)									
	3Q	01	1H	02	03	04	06	08	10	12
A (b)	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$	$\frac{205}{8.0}$
B (b)	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$	$\frac{306}{12}$
C (c)	Dimension C varies with flange type, rating, and size used. See Table 11 and Table 12 for dimensions.									

- Refer to the MODEL CODE section for sizes. Also, refer to DP 019-125 and DP 019-126 for additional 84F (Style B) dimensions.
- Dimensions A and B are shown with the standard temperature bonnet with extended temperature applications, add 3.6 in (91.4 mm) to Dimensions A and B because of the longer bonnet.
- Dimension C is a face-to-face dimension.

### Face-to-Face Dimensions

Before installing your flowmeter, check its data plate to determine whether it is Style A or Style B. The style indicator (ST) on the data plate is illustrated below for a Style A flowmeter.

The face-to-face dimensions given in Table 11 and Table 12 correspond to Model 84 Style B flowmeters, and the face-to-face dimensions given in Table 13 and Table 14 correspond to Model 84 Style A flowmeters.

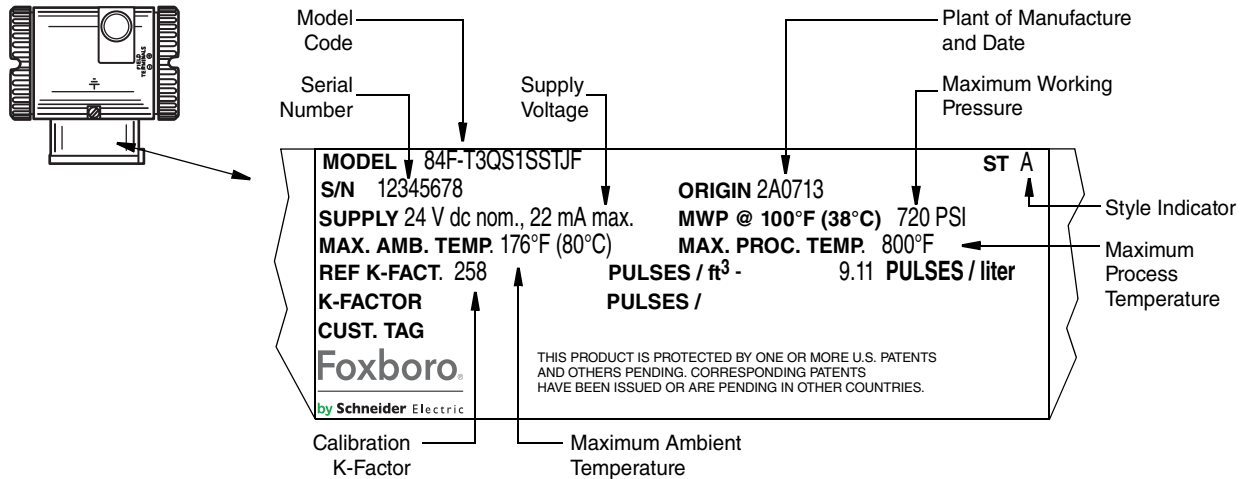


Table 11. 84F Single Measurement Configuration With ANSI Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Options R, D, and H

Nominal Line Size	Flange Type	Dimensions in inches				
		A (O.D.)	B (I.D.)	C (a) RF	C (a) RTJ	F
3/4 in	Class 150	3.88	0.74	6.56	--	1.82
	Class 300	4.62	0.74	6.94	7.32	1.82
	Class 600	4.62	0.74	7.44	7.44	1.82
	Class 900	5.12	0.74	8.44	8.44	1.82
	Class 1500	5.12	0.74	8.44	8.44	1.82
1 in	Class 150	4.25	0.96	6.80	7.18	1.93
	Class 300	4.88	0.96	7.32	7.70	1.93
	Class 600	4.88	0.96	7.82	7.82	1.93
	Class 900	5.88	0.96	8.7	8.70	1.93
	Class 1500	5.88	0.96	8.7	8.70	1.93

Table 11. 84F Single Measurement Configuration With ANSI Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Options R, D, and H (Continued)

Nominal Line Size	Flange Type	Dimensions in inches				
		A (O.D.)	B (I.D.)	C (a) RF	C (a) RTJ	F
1 1/2 in	Class 150	4.62	1.50	7.32	7.70	2.20
	Class 300	6.12	1.50	7.82	8.20	2.20
	Class 600	6.12	1.50	8.44	8.44	2.20
	Class 900	7.00	1.50	9.44	9.44	2.20
	Class 1500	7.00	1.50	9.44	9.44	2.20
2 in	Class 150	6.00	1.94	7.75	8.13	2.32
	Class 300	6.50	1.94	8.25	8.75	2.32
	Class 600	6.50	1.94	9.01	9.13	2.32
	Class 900	8.50	1.94	11.25	11.37	2.32
	Class 1500	8.50	1.69	11.25	11.37	2.20
3 in	Class 150	7.50	2.87	8.88	9.26	2.75
	Class 300	8.25	2.87	9.62	10.12	2.75
	Class 600	8.25	2.87	10.38	10.50	2.75
	Class 900	9.50	2.87	11.88	12.00	2.75
	Class 1500	10.50	2.63	13.12	13.25	2.62
4 in	Class 150	9.00	3.83	9.62	10.00	3.35
	Class 300	10.00	3.83	10.38	10.88	3.35
	Class 600	10.75	3.83	12.12	12.24	3.35
	Class 900	11.50	3.83	13.12	13.24	3.35
	Class 1500	12.25	3.44	13.88	14.00	3.35
6 in	Class 150	11.00	5.76	12.00	12.38	4.42
	Class 300	12.50	5.76	12.76	13.26	4.42
	Class 600	14.00	5.76	14.74	14.86	4.42
	Class 900	15.00	5.19	16.5	16.62	4.42
	Class 1500	15.50	5.19	19.00	19.25	4.42
8 in	Class 150	13.50	7.63	15.00	15.38	5.47
	Class 300	15.00	7.63	15.75	16.26	5.47
	Class 600	16.50	7.63	18.00	18.12	5.47
	Class 900	18.50	6.81	20.26	20.38	5.47
	Class 1500	19.00	6.81	24.26	24.64	5.47
10 in	Class 150	16.00	9.56	15.00	15.38	6.55
	Class 300	17.50	9.56	16.24	16.74	6.55
	Class 600	20.00	9.56	19.5	19.62	6.55

Table 11. 84F Single Measurement Configuration With ANSI Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Options R, D, and H (Continued)

Nominal Line Size	Flange Type	Dimensions in inches				
		A (O.D.)	B (I.D.)	C (a) RF	C (a) RTJ	F
12 in	Class 150	19.00	11.37	17.00	17.38	7.55
	Class 300	20.50	11.37	18.24	18.74	7.55
	Class 600	22.00	11.37	20.74	20.76	7.55

a. Overall length "C" is  $\pm 0.250$  in ( $\pm 6.4$  mm).

Table 12. 84F Single Measurement Configuration With DIN Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Options R, D, and H

Nominal Line Size	Flange Type	Dimensions in mm			
		A (O.D.)	B (I.D.)	C (a)	F
15 mm	PN 40 (b)	95.00	18.80	138.00	46.20
	PN 100	105.00	18.80	152.00	46.20
25 mm	PN 40 (b)	115.00	24.31	142.00	49.00
	PN 100	140.00	24.31	178.00	49.00
	PN 160	140.00	24.31	178.00	49.00
40 mm	PN 40 (b)	150.00	38.10	152.00	55.90
	PN 100	170.00	38.10	186.00	55.90
	PN 160	170.00	38.10	190.00	55.90
50 mm	PN 40 (b)	165.00	49.20	166.00	58.90
	PN 63	180.00	49.20	194.00	58.90
	PN 100	195.00	49.20	206.00	58.90
	PN 160	195.00	49.20	220.00	58.90
80 mm	PN 40 (b)	200.00	72.90	202.00	69.90
	PN 63	215.00	72.90	230.00	69.90
	PN 100	230.00	72.90	242.00	69.90
	PN 160	230.00	72.90	258.00	69.90
100 mm	PN 40 (b)	235.00	97.18	222.00	85.10
	PN 63	250.00	97.18	248.00	85.10
	PN 100	265.00	97.18	272.00	85.10
	PN 160	265.00	97.18	292.00	85.10
150 mm	PN 16	285.00	146.30	237.00	112.30
	PN 40 (b)	300.00	146.30	277.00	112.30
	PN 63	345.00	146.30	317.00	112.30
	PN 100	355.00	146.30	357.00	112.30
	PN 160	355.00	131.80	383.00	112.30

**Table 12. 84F Single Measurement Configuration With DIN Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Options R, D, and H (Continued)**

Nominal Line Size	Flange Type	Dimensions in mm			
		A (O.D.)	B (I.D.)	C (a)	F
200 mm	PN 16	340.00	193.68	302.00	138.90
	PN 25	360.00	193.68	338.00	138.90
	PN 40	375.00	193.68	354.00	138.90
	PN 63	415.00	193.68	398.00	138.90
	PN 100	430.00	193.68	438.00	138.90
	PN 160	430.00	173.05	458.00	138.90
250 mm	PN 16	405.00	242.87	318.00	166.40
	PN 25	425.00	242.87	354.00	166.40
	PN 40	450.00	242.87	388.00	166.40
	PN 63	470.00	242.87	428.00	166.40
	PN 100	505.00	242.87	492.00	166.40
300 mm	PN 16	460.00	288.90	359.00	191.80
	PN 25	485.00	288.90	387.00	191.80
	PN 40	515.00	288.90	433.00	191.80
	PN 63	530.00	288.90	483.00	191.80
	PN 100	585.00	288.90	543.00	191.80

- a. Overall length "C" is  $\pm 0.250$  in ( $\pm 6.4$  mm).
- b. May be used with PN 25 mating flange.

**Table 13. 84F Single Measurement Configuration With ANSI Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Option Y (Backward Compatible with Style A) (a)**

(Note: These versions should only be used when replacing a Model 84F Style A meter or for stocking purposes for Model 84F Style A meters.)					
Nominal Line Size	Flange Rating	Dimensions in inches			
		A (O.D.)	B (I.D.)	C (b)	F
3/4 in	Class 150	3.88	0.74	6.00	1.82
	Class 300	4.62	0.74	6.00	
	Class 600	4.62	0.74	6.50	
1 in	Class 150	4.25	0.96	6.50	1.93
	Class 300	4.88	0.96	6.50	
	Class 600	4.88	0.96	7.00	
1 1/2 in	Class 150	4.62	1.50	7.25	2.20
	Class 300	6.12	1.50	7.25	
	Class 600	6.12	1.50	7.88	

Table 13. 84F Single Measurement Configuration With ANSI Flanges and With Integral Housing; Body, Flange, and Shedder Bar Material Model Code Option Y (Continued)  
(Backward Compatible with Style A) (a)

(Note: These versions should only be used when replacing a Model 84F Style A meter or for stocking purposes for Model 84F Style A meters.)					
Nominal Line Size	Flange Rating	Dimensions in inches			
		A (O.D.)	B (I.D.)	C (b)	F
2 in	Class 150	6.00	1.94	7.75	2.32
	Class 300	6.50	1.94	7.75	
	Class 600	6.50	1.94	8.50	
3 in	Class 150	7.50	2.87	8.75	2.75
	Class 300	8.25	2.87	8.75	
	Class 600	8.25	2.87	9.50	
4 in	Class 150	9.00	3.83	9.50	3.35
	Class 300	10.00	3.83	9.50	
	Class 600	10.75	3.83	10.50	
6 in	Class 150	11.00	5.76	12.00	4.42
	Class 300	12.50	5.76	12.75	
	Class 600	14.00	5.76	14.75	
8 in	Class 150	13.50	7.63	15.00	5.47
	Class 300	15.00	7.63	15.75	
	Class 600	16.50	7.63	18.00	
10 in	Class 150	16.00	9.56	15.00	6.55
	Class 300	17.50	9.56	16.20	
12 in	Class 150	19.00	11.37	17.00	7.55
	Class 300	20.50	11.37	18.20	

- a. Style B Vortex flowmeters with ANSI flanges contain a model code option for face-to-face lengths that are backward compatible with Style A Vortex flowmeters. Style B model code selection "Y" matches Style A model code selection "S".
- b. Overall length "C" is  $\pm 0.250$  in ( $\pm 6.4$  mm).

Table 14. Style A Face-to-Face Lengths for DIN Flanges (a)

(Note: These versions should only be used when replacing a Model 84F Style A meter or for stocking purposes for Model 84F Style A meters.)					
Nominal Line Size	Flange Type	Dimensions in mm			
		A (O.D.)	B (I.D.)	C (b)	F
15 mm	PN 40 (c)	95.00	18.80	152.00	46.20
	PN 100	105.00	18.80	160.00	46.20
25 mm	PN 40 (c)	115.00	24.31	166.00	49.00
	PN 100	140.00	24.31	178.00	49.00
40 mm	PN 40 (c)	150.00	38.10	179.00	55.90
	PN 100	170.00	38.10	199.00	55.90
50 mm	PN 40 (c)	165.00	49.20	193.00	58.90
	PN 63	180.00	49.20	202.00	58.90
	PN 100	195.00	49.20	211.00	58.90
80 mm	PN 40 (c)	200.00	72.90	220.00	69.90
	PN 63	215.00	72.90	230.00	69.90
	PN 100	230.00	72.90	242.00	69.90
100 mm	PN 40 (c)	235.00	97.18	240.00	85.10
	PN 63	250.00	97.18	250.00	85.10
	PN 100	265.00	97.18	268.00	85.10
150 mm	PN 16	285.00	146.30	305.00	112.30
	PN 40 (c)	300.00	146.30	320.00	112.30
	PN 63	345.00	146.30	360.00	112.30
	PN 100	355.00	146.30	360.00	112.30
200 mm	PN 16	340.00	193.68	351.00	138.90
	PN 40	375.00	193.68	396.00	138.90
	PN 63	415.00	193.68	443.00	138.90
	PN 100	430.00	193.68	443.00	138.90
250 mm	PN 16	405.00	242.87	316.00	166.40
	PN 40	450.00	242.87	408.00	166.40
	PN 63	470.00	242.87	481.00	166.40
300 mm	PN 16	460.00	288.90	358.00	191.80
	PN 40	515.00	288.90	461.00	191.80
	PN 63	530.00	288.90	513.00	191.80

- a. The majority of Style B DIN flanges have shorter face-to-face lengths than those of Style A. Contact Invensys for backward compatibility of DIN face-to-face lengths.
- b. Overall length "C" is  $\pm 0.250$  in ( $\pm 6.4$  mm).
- c. May be used with PN 25 mating flange.

## ORDERING INSTRUCTIONS

1. Model Number.
2. Flow Data:
  - a. Maximum, minimum, and normal flow rate.
  - b. Fluid composition and viscosity at operating temperatures.
  - c. Fluid density or relative density (specific gravity).
  - d. Maximum, minimum, and normal operating temperatures.
  - e. Maximum, minimum, and normal operating pressures.
  - f. Mating pipe schedule.
  - g. Type and location (distance) of upstream disturbances.
3. Calibration Information (analog output only); maximum flow rate at 20 mA output.
4. Electrical Classification.
5. Optional Selections and Accessories  
Select from MODEL CODE or the OPTIONAL SELECTIONS AND ACCESSORIES section.
6. Customer Tag Data.

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