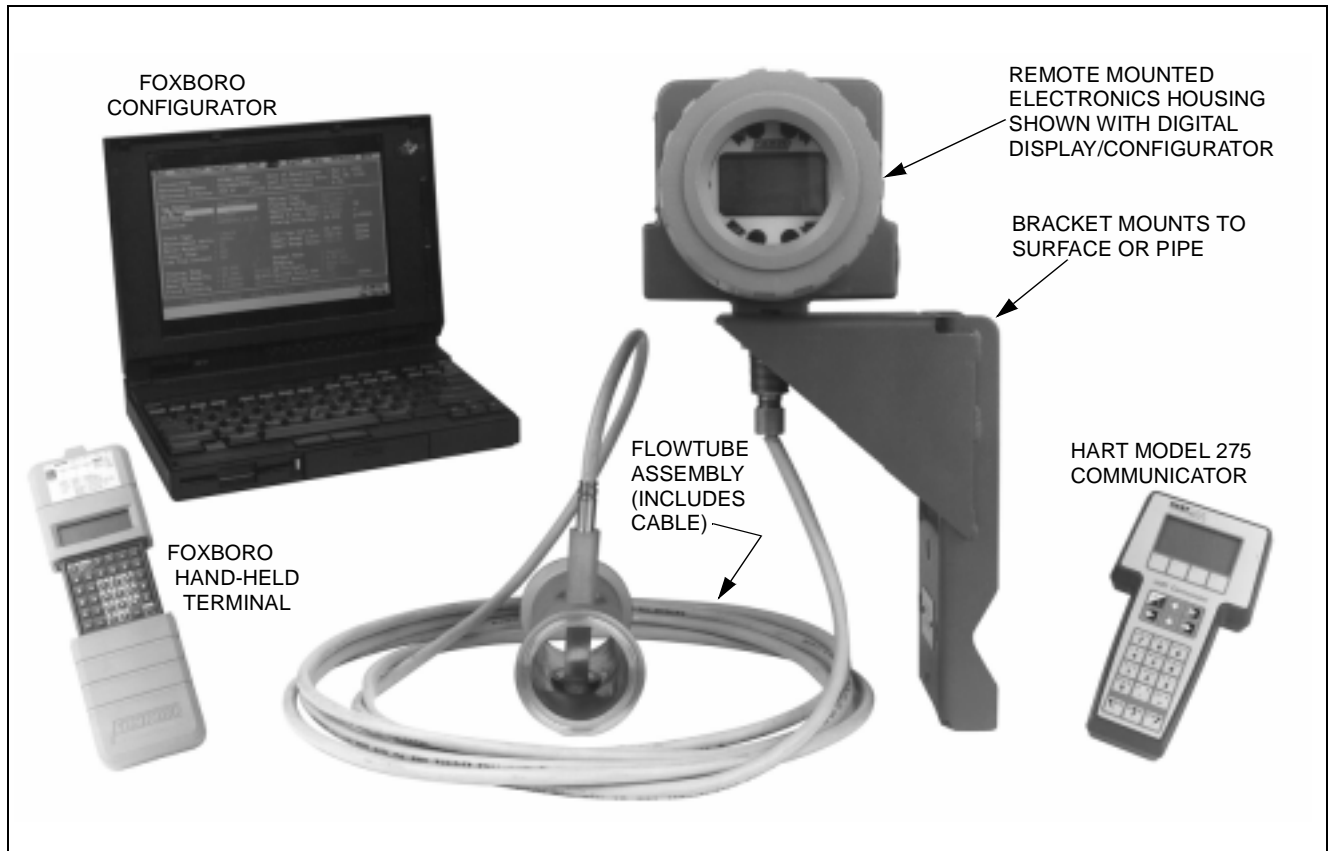


I/A Series[®] Intelligent Sanitary Vortex Flowmeters



The Model 83S is a high-performance Intelligent Vortex Flowmeter designed for food and pharmaceutical sanitary liquid service and CIP (clean-in-place) systems.

The 83S sanitary vortex flowmeter is 3A authorized per specification 28-02. It is available with the more common crevice-free 3A sanitary end connections or sanitary flanged end connections. The meter is a crevice-free design with no moving parts. The design allows for in-line cleaning using various combinations of cleaning solutions, air purging, or SIP (steam-in-place). It provides wide rangeability, high accuracy and low installation cost.

The vortex flowmeter is an ideal low cost, low maintenance flowmeter for a wide variety of sanitary liquid applications.

FEATURES

- Manufactured to 3A Standards
- 316L Stainless Steel Flowtube with 25RA Finish
- Complete Line of Sanitary End Connections
- Excellent Accuracy and Repeatability
- 4 to 20 mA, Scaled Pulse and Digital Outputs
- Choice of Foxboro or HART Protocol
- Remote Configuration and Diagnostics
- Easy to Use Local Digital Display
- On-Line Diagnostics
- Internal Flow Totalizer
- Excellent Low Flow Rate Characteristics
- Conforms to FM, CSA, CENELEC safety requirements and Applicable European Union Directives

DESIGNED FOR SANITARY SERVICE

The 83S is designed for either general sanitary applications or certified for CIP (clean-in-place) 3A authorized sanitary service. The process-wetted parts are manufactured from 316 stainless steel and finished to 3A (25µin) sanitary standards. The flowmeter body (with integral shedding element/detector assembly) is free from internal crevices. The design allows for in-line cleaning using various combinations of cleaning solutions, air purging, or saturated steam at temperatures up to 200°C (400°F). It is an ideal flowmeter for air purging since it has no moving parts and can be configured to measure only the liquid flow.

DESIGNED FOR MEASUREMENT INTEGRATION

The I/A Series Intelligent Vortex Flowmeters provide efficient integration of measurements into process control schemes.

The FoxCom (-D) Versions are designed with the Foxboro I/A Series Systems in mind. Seamless integration is achievable in a digital or 4 to 20 mA environment with the flexible hardware and software design used in the I/A Series architecture. Remote communication of digital values plus status and configuration information is via FoxCom protocol.

The HART (-T) Versions operate primarily in a 4 to 20 mA environment. Remote communication of digital values plus status and configuration information is via HART protocol.

The I/A Series Intelligent Sanitary Vortex Flowmeter measures flow rates of liquids. It has the same flowtube as the 83S Analog Output Product: a flowtube with a vortex generating shedder and a sensor for detecting vortices.

HIGH PERFORMANCE AT LOWER COST

This sanitary vortex flowmeter has the excellent accuracy, reproducibility, and wide rangeability (up to 50:1) previously found only with such devices as positive displacement and turbine flowmeters. Yet, unlike a positive displacement or turbine flowmeter, the intelligent 83S has no moving parts. This simplicity, and the fact that field calibrations are not required, provides a durable, high-performance, flow measuring instrument of low initial cost, low maintenance and low operating costs, and therefore contributing to an overall low cost of ownership.

SIMPLIFIED FLOW START-UP

No primary device calculations or mechanical calibrations are required with the Model 83S. It 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.

Foxboro will preconfigure the flowmeter using flow data supplied by the customer. Generically configured flowmeters can be used as shipped, but for more precise application, the flowmeter should be configured to specific process usage.

CONFIGURATION

The I/A Series Sanitary Vortex Flowmeter provides a 4 to 20 mA or digital output linear with flow and can be locally or remotely reconfigured as follows:

- 4 to 20 mA with HART Communication Protocol: Local configuration via optional integral LCD Indicator/Configurator. Remote configuration using HART Model 275 Configurator.
- Intelligent: Configurable for 4 to 20 mA or FoxCom digital output. Local configuration via optional integral LCD Indicator/Configurator. Remote configuration via a Model PC10, Model HHT Hand-Held Terminal, or I/A Series System.

LOCAL DIGITAL DISPLAY/CONFIGURATOR

A 16-character display is available. 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 keys, located on the display panel, can be used to configure the 83S. This feature is a Model Code selection.

A VARIETY OF APPLICATIONS

This sanitary flowmeter is available in nominal 50 and 80 mm (2 and 3 in) sizes, with a large selection of end connections to satisfy a variety of applications. Influences on flow measurement due to changes in density and/or viscosity will be within the limits of the accuracy specified. It is ideally suited for the Pharmaceutical, Food, and Dairy Industries. Difficult fluids, such as slurries, can also be measured. It can also be configured, for example, to measure the flow of liquids in a batch process without measuring the inert gas following the batch, thereby providing an accurate measurement of the process liquid only.

CAN BE USED IN HAZARDOUS LOCATIONS

These flowmeters have been designed to meet certification and approval requirements of many testing agencies for use in hazardous area locations. Refer to "Product Safety Specifications" section.

COMPACT, EFFICIENT, AND DURABLE DESIGN

The 83S is offered in the most common sanitary line sizes, and has the same electronics housing as the general purpose 83F and 83W flowmeters. The electronics housing is of durable construction and provides environmental protection to the enclosed parts, such as the environmentally protected amplifier, local digital display/ configurator, and terminal block. The plug-in amplifier can be calibrated in place and can be replaced without interrupting the flow in the pipe.

"CE" COMPLIANCE

This family of flowmeters displays on the product the "CE" designation (logo) indicating conformance to the applicable new European Community Standards for immunity to sources of electromagnetic interference. This compliance also includes conformance to a maximum level of self-generated electromagnetic energy.

OPERATING CONDITIONS(a)

Influence	Calibration Operating Conditions(b)	Normal Operating Condition Limits	Operative Limits
Process Fluid	Clear Water	Liquid	Liquid
Process Temperature	20 to 30°C (70 to 85°F)	-18 and +200°C (0 and 400°F)	-18 and +200°C (0 and 400°F)
Ambient Temperature (Electronics Housing)	20 to 30°C (70 to 85°F)	-40 and +85°C (-40 and +185°F)	-40 and +85°C (-40 and +185°F)
Relative Humidity	50 to 90% RH	0 and 100%	0 and 100%
Supply Voltage (c)	24 V dc	12.5 and 42 V dc	12.5 and 42 V dc

(a) Limited to nonflashing, noncavitating conditions. Flow rate and temperature of process may induce flashing and cavitation which is dependent on pressure drop and process vapor pressure. A minimum positive back-pressure is required for proper operation.

(b) Assumes compatible process piping and fittings; gaskets not protruding into process line; a minimum of thirty pipe diameters of straight pipe upstream of flowmeter and eight pipe diameters downstream; clear water free of air or particles.

(c) See Figure 1 for a plot of supply voltage vs. loop load.

PERFORMANCE SPECIFICATIONS

(Under Calibration Operating Conditions unless Otherwise Specified)

Factory Calibration Flow Ranges

Nominal Meter Size	Nominal Mean K-Factor in Pulses/ft ³ (Pulses/L)	Factory Calibrated Flow Range for Water		
		Range in USgpm	Range in L/s	Reynolds Number Range
2 in (50 mm)	282 (9.96)	58 to 210	3.6 to 14	100 000 to 380 000
3 in (80 mm)	78.0 (2.75)	34 to 500	2.1 to 32	38 000 to 570 000

NOTES:

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

PERFORMANCE SPECIFICATIONS (Cont.)

Improved Accuracy

To maintain accuracy under noncalibration conditions, this I/A Series Vortex Flowmeter automatically compensates for the following influences when the requested process and piping information is entered during configuration:

- **PROCESS TEMPERATURE**
Changes in the process temperature cause a shift in the K-factor.
- **PROCESS PIPING**
Installation parameters, such as location of valves, proximity to elbows, etc., affect the accuracy of the flow measurement.
- **OPERATION AT LOW FLOW RATES**
At low flow rates [Reynolds Number less than 20 000 for the 3 in (80 mm) meter, and less than 100 000 for the 2 in (50 mm)], the K-factor deviates from the mean value determined via the water calibration. An algorithm, requiring values for the flowing density and viscosity, is embedded in the flowmeter to correct for this nonlinearity.

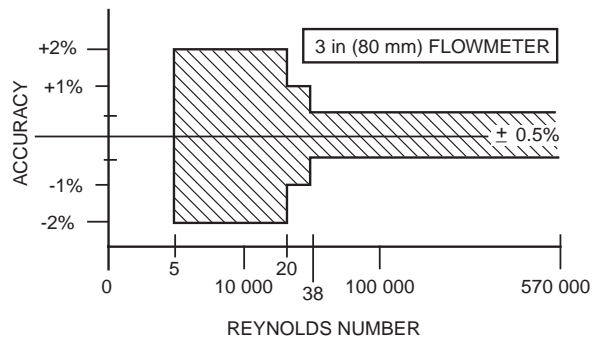
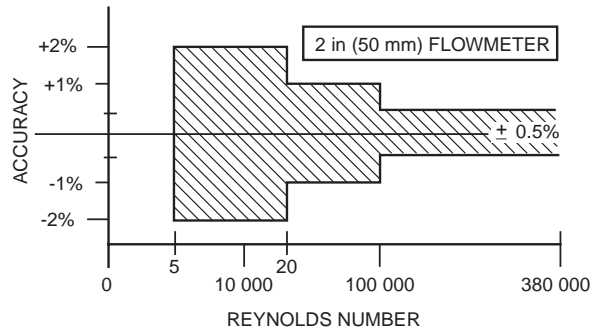


Figure 1. Flowmeter Accuracy for Liquids

Accuracy for Liquids (Figure 1)

2 in (50 mm) FLOWMETER

Accuracy within the calibrated Reynolds Number (R_D) range of 100 000 to 380 000 is $\pm 0.5\%$ of reading. For the R_D range of 20 000 to 100 000, and above 380 000, the accuracy is $\pm 1\%$ of reading. Within the R_D range of 5 000 to 20 000 the accuracy is $\pm 2\%$ of reading. See adjacent **NOTE**.

3 in (80 mm) FLOWMETER

Accuracy within the calibrated R_D range is $\pm 0.5\%$ of reading. Outside calibrated range, the accuracy is $\pm 1\%$ of reading for flow rates with R_D of 20 000 or greater. Within the R_D range of 5 000 to 20 000, the accuracy is $\pm 2\%$ of reading. See adjacent **NOTE**.

Accuracy for Gases and Steam

2 in (50 mm) FLOWMETER

Accuracy is $\pm 1\%$ of reading for flow rates with R_D of 20 000 or greater. To achieve this accuracy below 100 000, the flowing density and viscosity must be entered. Within the R_D range of 5 000 to 20 000, the accuracy is $\pm 2\%$ of reading. See adjacent **NOTE**.

3 in (80 mm) FLOWMETER

Accuracy is $\pm 1\%$ of reading for flow rates with R_D of 20 000 or greater. Within the R_D range of 5 000 to 20 000, the accuracy is $\pm 2\%$ of reading. See adjacent **NOTE**.

NOTE

To achieve the accuracy stated for liquids, gases, and steam, the flowing density and viscosity must be input during meter configuration.

Supply Voltage Effect (Within Stated Limits)

WITH SCALED PULSE OUTPUT

No effect on accuracy

WITH ANALOG OUTPUT

Less than 0.005% per volt

WITH DIGITAL OUTPUT

No effect on accuracy

Relative Humidity Effect

No effect as long as covers and seals are properly installed.

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 with no effect on performance. Positioning the flowtube so that pipeline vibrations are parallel to the sensor diaphragm will minimize the effects of vibration.

Emission Effect

Radiated and conducted electromagnetic emissions meet the requirements of North America, NAMUR, and CENELEC.

PERFORMANCE SPECIFICATIONS (Cont.)

Ambient Temperature Effect (Amplifier only)

WITH SCALED PULSE OUTPUT

±0.01% of reading from
-40° to +85°C (-40° to +185°F)

WITH ANALOG OUTPUT

For 55°C (or 100°F) change in ambient temperature within operative limits.

Zero (4 mA)

±0.1% of span maximum

Span (16 mA)

±0.1% of span maximum

WITH DIGITAL OUTPUT

±0.01% of reading from
-40° to +85°C (-40° to +185°F)

Process Temperature Effect on K-Factor

There is an effect on the reference K-factor due to a diameter change of the flowmeter bore with temperature. The effect is -0.3% of flow rate for a 55°C (or 100°F) increase in temperature. The intelligent flowmeter will automatically recompute a flowing K-factor when process temperature is entered.

Electromagnetic Compatibility (RFI)

The output error from RFI at radio frequencies ranging from 27 to 1 000 MHz is less than ±1% of span at a field intensity of 10 V/m; and less than ±2% of span at a field intensity of 30 V/m. This applies only when the electronics housing is properly earthed (grounded).

FUNCTIONAL SPECIFICATIONS

Direct Connectivity to Foxboro I/A Series Open Industrial System

The Intelligent 83S Vortex Flowmeters can be connected directly to the Foxboro I/A Series System via the following I/O modules:

ANALOG INPUT (4 TO 20 mA)

Modules FBM 01A, 01B, and 04 for 83S-D and 83S-T Flowmeters

DIGITAL INPUT (FoxCom DIGITAL)

Modules FBM 18, 39, 43, 44, and 46 for 83S-D Flowmeter only

Local Interrogation/Configuration

In addition to remote communications, a Local Digital Display/Configurator (selected by Model Code) is also available for local interrogation and configuration for both the FoxCom and HART Versions.

Remote Interrogation/Configuration

Many Configurators/Communicators are available to remotely configure and interrogate the Model 83 for measurements and parameters, as follows:

MODEL 83S-D (FoxCom Version)

- I/A Series IT Maintenance Workbench in I/A Series Software, Version 4.0 or later
- Model PC10 Intelligent Transmitter Configurator (PC based), Version 4.0 or later
- Model HHT Hand-Held Terminal, Revision D or later

MODEL 83S-T (HART Version)

- HART Communicator Model 275

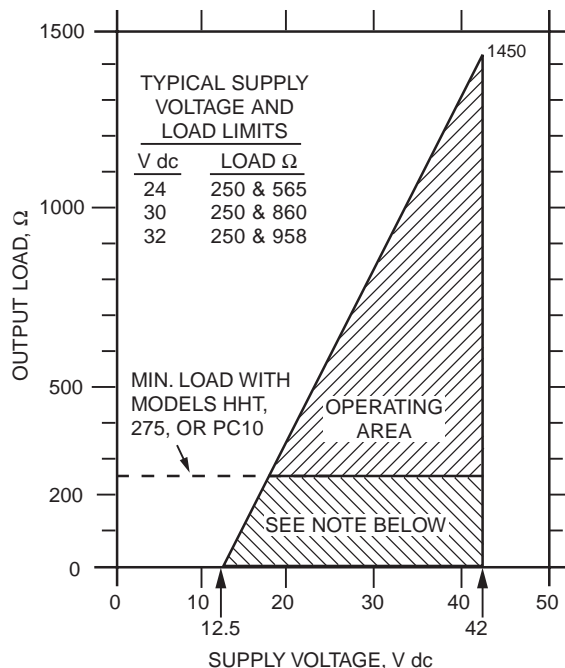
Supply Voltage Requirements and External Loop Load Limitations

DIGITAL MODE (83S-D ONLY)

Power is supplied by the I/A Series System.

ANALOG MODE (83S-D AND 83S-T)

See Figure 2.



NOTE

The transmitter will function with an output load less than 250 Ω provided that a Model HHT, PC10, or Model 275 is not connected to it. Connecting a Model HHT, PC10, or Model 275 while operating in this area may cause output disturbances and/or communication problems.

Figure 2. 4 to 20 mA Output (Analog Mode) Supply Voltage vs. Output Load

FUNCTIONAL SPECIFICATIONS (Cont.)

Signal Conditioning

A digital smoothing algorithm can be enabled with the configurator to condition the raw vortex signal. This results in improved performance particularly at low flow.

Password Protection

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

Communications Format

Both the Foxboro Communications protocol (FoxCom) and the HART protocol use the FSK (Frequency Shift Keying) technique. Information is communicated as digital parameters by modulating the carrier. The tones are superimposed on the transmitter power/signal leads.

MODEL 83S-D (FoxCom Version)

Analog 4 to 20 mA Mode

The transmitter sends its flow measurement to the loop as a continuous 4 to 20 mA dc signal. Communication between the transmitter and the PC10, Model HHT Hand-Held Terminal, or I/A Series System does not disturb the 4 to 20 mA output signal. Specifications include the following:

Communication Distance:
3000 m (10 000 ft) maximum
Data Transmission Rate – 600 Baud

Digital Mode

The flowmeter sends its flow measurements to the I/A Series System as a digital signal through an FBM. Remote communications occur between the transmitter and the Model HHT, PC10, or any I/A Series Console. Digital Mode specifications are:

Communication Distance:
600 m (2 000 ft) maximum between the flowmeter and the FBM; the distance between the FBM and the I/A Series System can be as great as 20 kilometers (12 miles)

Data Transmission Rate – 4800 Baud

Measurement Update Rate:

Flow and Total – 10 times/sec
Electronics Temperature – 1 time/sec

Communications Format (Cont.)

MODEL 83S-T (HART Version)

The transmitter sends its flow measurement to the loop as a continuous 4 to 20 mA dc signal. Communication between transmitter and Model 275 Communicator does not disturb the 4 to 20 mA output signal.

The data transmission rate is 1200 baud. The maximum cable length conforms to the HART Physical Layer Specification and will vary according to the characteristics of the individual transmitters if used in a multidrop environment.

Totalization

The flowmeter has a built-in flow totalizer eight digit display. Flow total is not lost in the event of a power interruption, but is resettable if desired.

Low and High Frequency Filter Settings

The low and high frequency filters are set automatically based on the flowmeter configuration. The parameters required to set the filters are Model Number, reference K-factor, flowing density, and full scale flow rate. The low frequency filter is set with the 3 dB point⁽¹⁾ at approximately one half the low flow cut-in frequency. The high frequency filter is set with the 3 dB⁽¹⁾ point at approximately one half the upper range value frequency. The density values corresponding to the following conditions have been embedded in the flowmeter for use when general default configurations are selected.

Liquid – Water at 21°C (70°F)
Gas – Air at 690 kPa (6.9 bar) and 21°C (100 psig and 70°F)
Steam – Saturated Steam at 862 kPa, 8.62 bar, or 125 psig

Improved performance at other flow conditions can be achieved by inputting the actual process parameters.

Adaptive Filtering

The flowmeter provides an adaptive mode which automatically moves the high and low frequency filters closer to the vortex frequency to affect an improved signal-to-noise ratio. This feature provides:

- Low Flow Measurability
- Improved Vibration Immunity

(1) The 3 dB point is the frequency at which the filter attenuation is 50%.

FUNCTIONAL SPECIFICATIONS (Cont.)

Outputs

The flowmeter has three outputs, as follows:

SCALED PULSE OUTPUT

Flow Rate available as a 0 to 100 Hz contact-closure rate

ANALOG OUTPUT

Flow rate available as a 4 to 20 mA signal

DIGITAL OUTPUT

Model 83S-D (FoxCom Version)

Three measurements (Flow Rate, Totalized Flow, and Electronics Temperature) are available via FoxCom, a Foxboro communication protocol. Two data transmission rates are supported:

- 4800 baud – Digital Information is superimposed on a constant 10 mA current
- 600 baud – Digital information is superimposed on a traditional 4 to 20 mA signal

Model 83S-T (HART Version)

Four measurements (Flow Rate, Totalized Flow, Vortex Frequency, and Scaled Pulse Output Frequency) are available via HART, communication protocol. Digital Information is superimposed on a traditional 4 to 20 mA signal at 1200 baud.

Scaled Pulse Output

The scaled pulse output is an externally powered two-wire contact-closure type output. The contact-closure rate (0 to 100 Hz) is linearly proportional to the flowrate, the Upper Range Value being automatically set to 100 Hz. Pulse resolution is 0.025%. The specifications for the contact-closure output are as follows:

- Isolated two-wire contact-closure
- Applied voltage limits: 12.5 V dc minimum and 42 V dc maximum (see Figure 2)
- Maximum "ON" state voltage drop: 0.5 V dc
- Maximum "ON" state current: 250 mA
- Update rate:
 - Model 83S-D (FoxCom Version)
 - 10 Hz in Digital Mode
 - 4 Hz in Analog Mode
 - Model 83S-T (HART Version)
 - 4 Hz
- Maximum "OFF" state leakage current:
 - 0.10 mA at 12.5 V dc
 - 0.25 mA at 24 V dc
 - 0.42 mA at 42 V dc
- 250 mA short circuit protected
- Reverse polarity protected

Output Combinations

Possible flowmeter output combinations depends on whether the flowmeter is wired as a 2-, 3-, or 4-wire device as shown below.

MODEL 83S-D (FoxCom Version)

2-Wire Hookup

Digital Mode

FoxCom at 4800 Baud

Analog Mode

4 to 20 mA and FoxCom at 600 Baud

3-Wire Hookup

Analog Mode

4 to 20 mA, FoxCom at 600 Baud, and Scaled Pulse

4-Wire Hookup

Digital Mode

FoxCom at 4800 Baud and Scaled Pulse

Analog Mode

4 to 20 mA, FoxCom at 600 Baud, and Scaled Pulse

MODEL 83S-T (HART Version)

2-Wire Hookup

4 to 20 mA and HART at 1200 Baud

3-Wire or 4-Wire Hookup

4 to 20 mA, HART at 1200 Baud, and Scaled Pulse

On-Line Diagnostics

The flowmeter uses a number of 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.

Off-Line Diagnostics (Self Test)

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

Low Flow Cut-In (LFCI) Selections

There are eight configurable low flow cut-in selections ranging from minimum flow rate to ten times the minimum low flow rate. Refer to Table 1 for minimum flow rate values.

Automatic Low Flow Cut-In Feature

The flowmeter can be configured to automatically select the lowest LFCI selection that produces a zero output under no-flow conditions.

FUNCTIONAL SPECIFICATIONS (Cont.)

Nominal Flow Velocity Limits

These limits can be calculated using the table below. In the table, ρ_f is the process fluid density at flowing conditions in kg/m^3 or lb/ft^3 , as applicable. The specifications apply for most applications, but can deviate slightly for some combinations of density and line size.

Nominal Flow Velocity Limits

Range Limit	Flow Velocity Limit	
	m/s	ft/s
Lower	$4.8/\sqrt{\rho_f}$	$4.0/\sqrt{\rho_f}$
Upper	$240/\sqrt{\rho_f}$	$200/\sqrt{\rho_f}$

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 flow rate units from a built-in menu-selectable list, or entering custom flow rate units.

Flowmeter Rangeability

Compared to other Vortex Flowmeters, the 83S has an enhanced rangeability due to its lower LFCI capability and improved frequency filtering. Rangeability of up to 50:1 is achievable.

Flowmeter Sizing – FlowExpert Sizing Program

Foxboro’s FlowExpert provides the best means of selecting the correct flowmeter size for any application. Also, the sizing program will calculate minimum and maximum flow rates, rangeability, pressure loss, Reynolds Number, and calibration frequency. For example, you can use FlowExpert to determine the nominal shedding frequency for any flow rate for a given line size.

For many applications, Table 1 can be used (in lieu of FlowExpert) as a quick guide to flowmeter sizing. This table lists operating flow rate limits for water for each line size. Note that flowmeter must operate within the flow velocity limits previously defined.

Reference K-Factor

The reference K-factor is a coefficient that specifies the flowmeter calibration and is expressed as the ratio of pulses per unit volume, where pulses/unit volume = pulses per second divided by volume flow per second. Refer to Table 1 for the reference K-factor for each flowmeter size. The reference K-factor is the arithmetic mean value of K over the factory-calibrated flow range.

Reference K-Factor Determination

The reference K-factor is determined at the factory flow facility by actual flow calibration with water by comparison to a master flowmeter calibration or by actual static weight. Both calibrations are traceable to NIST (National Institute of Standards and Technology). The reference K-factor is embedded in the flowmeter database and is stamped on the data plate.

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

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.

Table 1. Reference K-Factor. And Water Flow Rates and Upper Range Value Limits at 20°C and 101.3 kPa absolute (68°F and 14.7 psia)

Nominal Line Size		Nominal Reference K-Factor			Minimum and Maximum Operating Flow Rates (a)		Recommended Min. URV(b)	
mm	in	p/L	p/ft ³	p/U.S. gal	L/s	U.S. gpm	L/s	U.S. gpm
50	2	9.96	282	37.7	0.346 and 17.3	5.50 and 275	1.3	21
80	3	2.75	78	10.4	0.816 and 40.8	12.96 and 648	4.6	74

(a) The approximate values listed are with the low flow cut-in set at its minimum value. For flow rate values at other conditions, refer to the Foxboro FlowExpert Sizing Program or TI 027-067.

(b) The recommended minimum upper range value is shown; the maximum URV is the maximum operating flow rate.

FUNCTIONAL SPECIFICATIONS (Cont.)

Process Temperature Correction

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

Static Pressure Limits

MINIMUM

The minimum static pressure is that pressure which is sufficient to prevent flashing (see adjacent paragraph).

MAXIMUM

The maximum static pressure is 275 psi at 100°F (with an ANSI Class 150 Flange). The actual pressure-temperature limits are determined by the selected end connections used.

Approximate Pressure Loss

The maximum pressure loss at maximum flow for every flowmeter with any fluid is 55 kPa (8 psi). Sample plots for water are shown in Figure 3. Note that for many flow conditions, the actual pressure loss is much less than 55 kPa (8 psi). Use the Foxboro FlowExpert Sizing Program to determine actual pressure loss for a given set of conditions.

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 determine the need for incorporating or considering 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
- ΔP = Calculated pressure loss in kPa or psi (see "Approximate Pressure Loss" section)
- p_v = Vapor pressure at line conditions in kPa or psi absolute
- p_{atm} = Atmospheric pressure in kPa or psi absolute

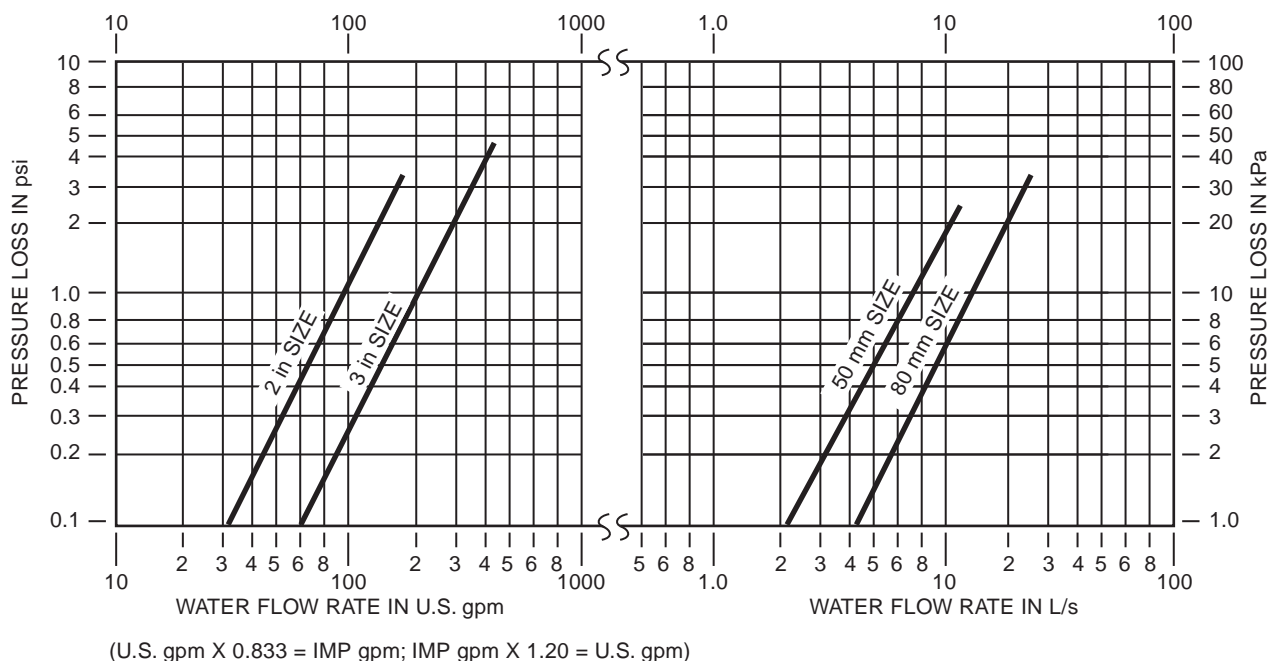


Figure 3. Water Flow Rate vs. Pressure Loss at Base Conditions of 15.6°C (60°F)

FUNCTIONAL SPECIFICATIONS (Cont.)

Response Time (Without Damping)

ANALOG MODE (FoxCom or HART Versions)
 0.25 second or the vortex shedding period for frequencies less than 4 Hz, plus the rise time of 0.25 seconds (90% recovery time to an 80% input step with zero output damping).

DIGITAL MODE (FoxCom Only)
 0.1 second for the vortex shedding period for frequencies less than 10 Hz.

SCALED PULSE MODE
 Same as for Digital Mode.

Output Damping

The flowmeter provides user-selectable damping to smooth the flow rate output, or to optimize the response time of the flowmeter to the control system. Damping can be set between 0 (none) and 32 seconds.

PHYSICAL SPECIFICATIONS

Materials of Construction

PROCESS-WETTED PARTS
Flowmeter Body
 AISI Type 316 stainless steel (316 ss) tube.

Vortex Shedding Element
 316L stainless steel per ASTM 276

Detector Diaphragm
 316L ss

End Connections
 316 ss

NONWETTED PARTS

Electronics Housing and Covers
 Low copper aluminum alloy. Gray epoxy powder-coated finish electronics housing and covers.

Cover Gaskets
 Buna-N O-ring

Detector Capsule Fill Material
 Food grade silicone oil. Volume is 0.262 cm³ (0.016 in³).

Mounting

Flowmeter body can be located in pipeline which may run in any direction from the vertical (flow in upward direction) to the horizontal. The electronics housing is mounted (remotely) to a bracket, which in turn is attached to a surface, or DN 50 or 2 in pipe. The body and housing are electrically connected by a 4.5 m (15 ft) cable. The cable is an integral part of the flowmeter body assembly. During operation, the flow line must remain full.

Electrical Connections

Electronics Housing tapped for 1/2 NPT conduit. See "Dimensions–Nominal" section.

Enclosure Protection

The electronics housing meets the requirements of IP66 and provides the environmental and corrosion resistant protection of NEMA Type 4X.

Data Plate

Stainless steel data plate fastened to electronics housing with self-tapping drive screws. Includes space for customer tag data up to a maximum of 32 characters and spaces. This tag also shows the factory calibration factor (K-factor). If additional space is required for tag data, an optional Customer Stainless Steel Tag is offered. See Optional Selections section.

Approximate Weight

Nominal Size		Flowmeter Description	Approximate Weight with			
			Connections C, M, R, T and U		Connection F	
mm	in		kg	lb	kg	lb
50	2	Body and Cable	0.72	1.6	5.7	12.6
		Housing and Bracket	4.1	9	4.1	9
		Total	4.8	10.6	9.8	21.6
80	3	Body and Cable	1.1	2.5	10.5	23
		Housing and Bracket	4.1	9	4.1	9
		Total	5.2	11.5	14.6	32

MODEL CODE

I/A Series 83S Sanitary Vortex Flowmeters

Description	Model
Vortex Flowmeter – Sanitary	83S
Electronics Type	
Intelligent Electronics, FoxCom Protocol	–D
Intelligent Electronics, HART Protocol	–T
Nominal Line Size	
2 in (50 mm) Stainless Steel Tubing	02
3 in (80 mm) Stainless Steel Tubing	03
End Connection Type (Welded to Flowmeter Body)(a)	
3A I-Line Fitting, Mates with Cherry Burrell 15 WI or Equivalent	C
ANSI Class 150 RF Flange (Crevice-Free Design for Sanitary Service)	F
SI (DIN 11851) Coupling with External Knuckle Thread, per DIN 405, Part 1	M
RJT Coupling per BS 1864, with External Whitworth Thread, 6 TPI	R
3A Tri-Clamp Type Quick-Disconnect Ferrule, Mates with Tri-Clover 14 WMP or equivalent	T
ISS (ISO 2853) Coupling with External Trapezoidal Thread, 8 TPI	U
Local Digital Display/Configurator	
No Digital Display/Configurator (Blind Unit)	N
Full Function Digital Display/Configurator	J
Electrical Safety – See NOTE Below (See Electrical Safety Specifications Section for Description & Status)	
CSA, FM, and SAA Testing Laboratories as Described below:	A
CSA, ia, ia Connection; and CSA, d	
FM, ia, ia Connection	
SAA, ib, ib Connection	
No Approval/Certification Required	Z
Optional Selections	
Foxboro Certificates of Compliance/Conformance	
Standard Certificate of Compliance	–L
Foxboro Material Certification of Process Wetted Metal (Conforms to DIN 50049-3.1b)	–M
Foxboro Calibration Certificate	
Foxboro Calibration and Pressure Test Certification	–N
Examples: 83S–D02CJA–LN; 83S–T03TJA–M; 83S–D03TJA	

(a) Mating end connections, gaskets, and clamps to be supplied by the user.

NOTE

Certification is not presently available for Flowmeters with HART Electronics (–T). Contact Foxboro for status.

PRODUCT SAFETY SPECIFICATIONS

Electrical Classification

Refer to Electrical Classification table below for Testing Laboratory, Types of Protection and Area Classification, Conditions of Certification, and Electrical Certification Code.

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 requirements in the standards of FM, CSA, PTB, and BSI as applicable, and the consensus standards adopted by OSHA, have been fulfilled.

Pressure Safety

The maximum static pressure is 275 psi at 100°F (with an ANSI Class 150 Flange). The actual pressure-temperature limits are determined by the selected end connections used.

Electrical Safety Specifications (See NOTE Below)

Testing Laboratory, Types of Protection and Area Classification	Conditions of Certification	Electrical Safety Design Code
CSA certified intrinsically safe for Class I, Division 1, Groups A, B, C, and D; Class II, Division 1, Groups E, F, and G; and Class III, Division 1.	Temperature Class T3C at 85°C and T4A at 40°C maximum ambient. Connect per TI 005–105.	A
FM approved intrinsically safe for Class I, II, and III, Division 1, Groups A, B, C, D, E, F, and G; nonincendive Class I, II, and III, Division 2, Groups A, B, C, D, F, and G.	Temperature Class T3C at 85°C and T4A at 40°C maximum ambient. Connect per TI 005–101.	
SAA certified intrinsically safe for Gas Group IIC, Zone 1.	Temperature Class T4.	

NOTE

The 83S Vortex Flowmeter has been designed to meet the electrical classifications listed in table above. For detailed information on status of the Agency approvals or certifications, contact Foxboro.

OPTIONAL SELECTIONS AND ACCESSORIES

Calibration Certificate

Flow calibrated K-factor and pressure test certificate is available by specifying Optional Selection Suffix “-N”.

Stainless Steel Customer Tag

This optional accessory adds a 40 x 90 mm (1.5 x 3.5 in) stainless steel tag for customer data that does not fit on the standard stainless steel data plate. It is fastened to transmitter with stainless steel wire. There can be a maximum of 10 lines of data with 40 characters and spaces per line. This tag will also show the K-factor specific to customer application (information with flowing conditions being submitted to Foxboro with the purchase order). Specify AS Code MTS.

Foxboro Certificates of Conformance and Compliance

Two material certificates are offered. Option Suffix “-L” provides a certificate of compliance to Foxboro specifications. The Foxboro quality system conforms to ISO 9001. Suffix “-M” is a certification of material for process wetted metal (conforms to DIN 50049-3.1b).

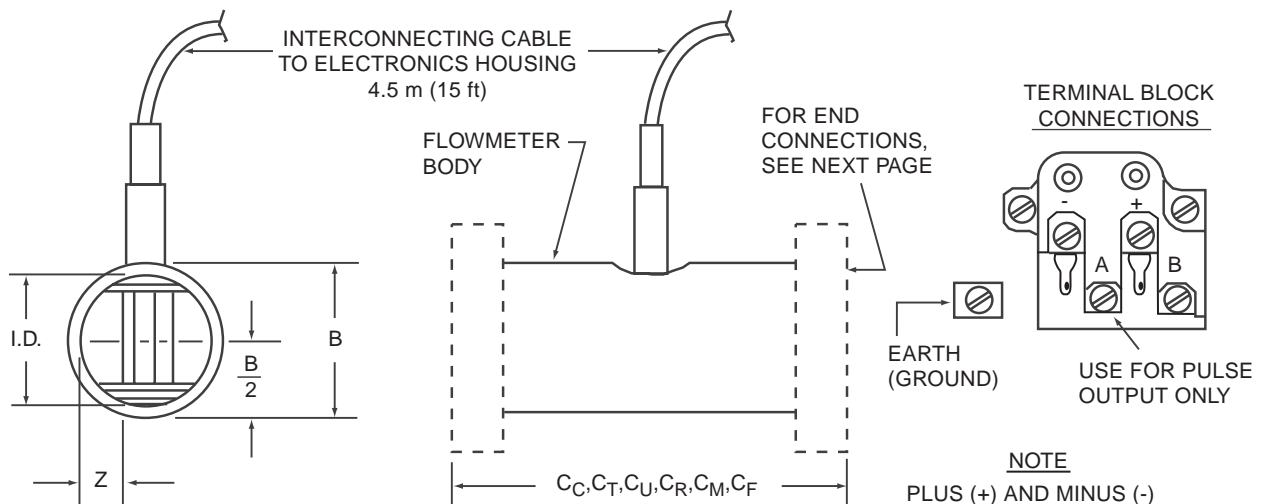
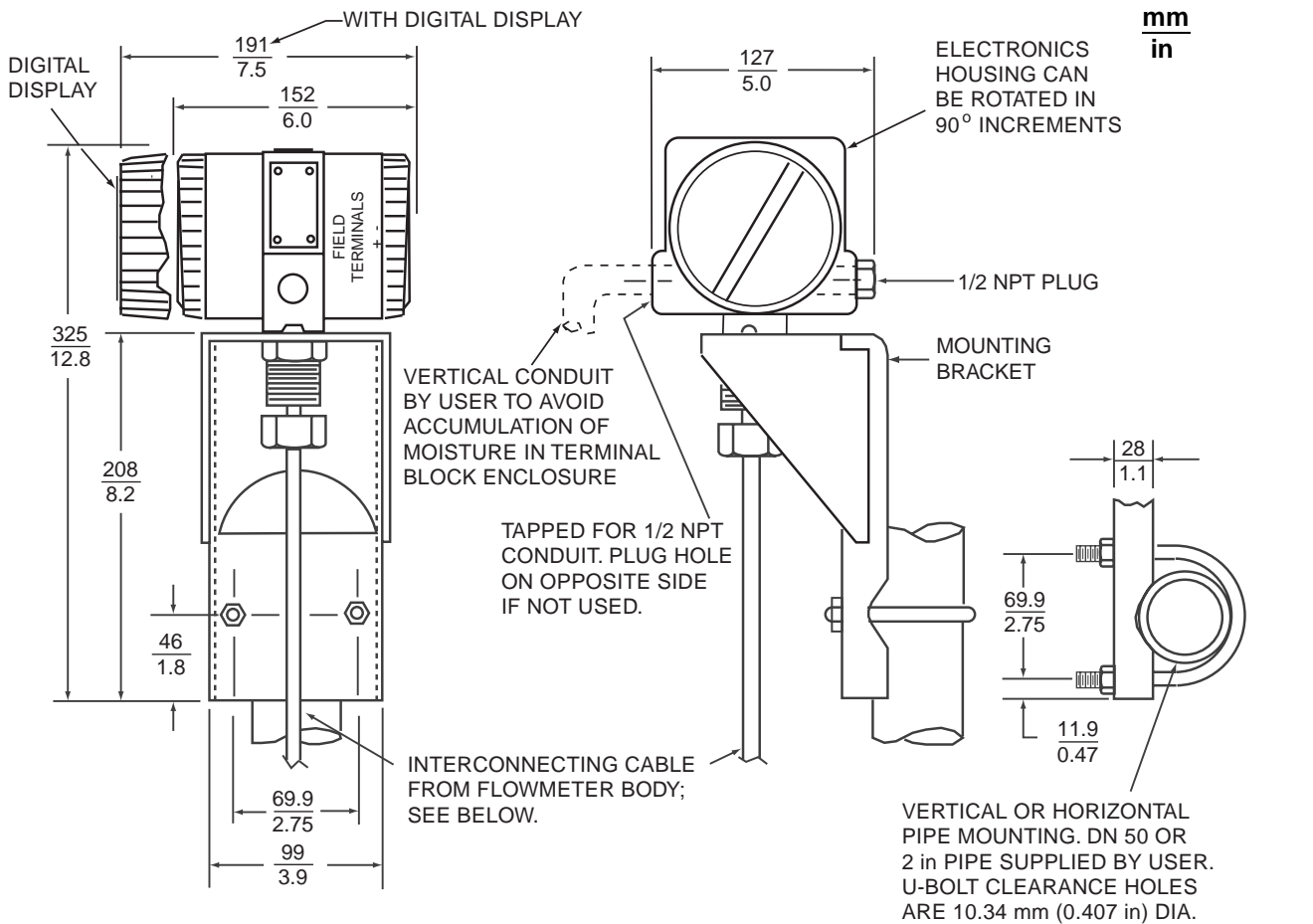
ORDERING INSTRUCTIONS

1. Model Number
2. Flow Data:
 - a. Maximum, minimum, and normal flow rate
 - b. Fluid composition and viscosity at operating temperatures
 - c. Density or relative density (specific gravity)
 - d. Maximum, minimum, and normal operating temperatures
 - e. Maximum, minimum, and normal operating pressures
3. Accessories
4. Customer Tag and Application

NOTE

The Analog Output will be Calibrated for the Maximum Flow Rate Specified in Item 2a, Above.

DIMENSIONS-NOMINAL



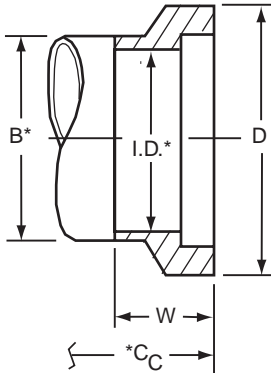
NOMINAL LINE SIZE	FLOWMETER BODY DIMENSIONS *								
	I.D.	B	C _C	C _T	C _U	C _R	C _M	C _F	Z
50 2	47.50 1.870	50.8 2.00	155 6.1	127 5.0	145 5.7	160 6.3	173 6.8	254 10.0	17.3 0.68
80 3	72.90 2.870	76.2 3.00	213 8.4	178 7.0	196 7.7	211 8.3	334 9.2	251 9.9	26.4 1.04

*C_T = TUBE LENGTH WITH END CONNECTION "T"; ETC.

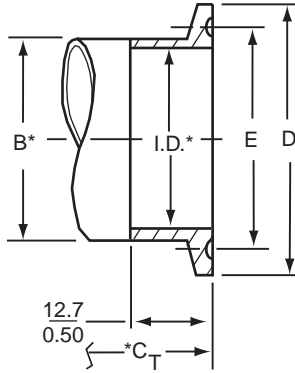
DIMENSIONS—NOMINAL (Cont.)

mm
in

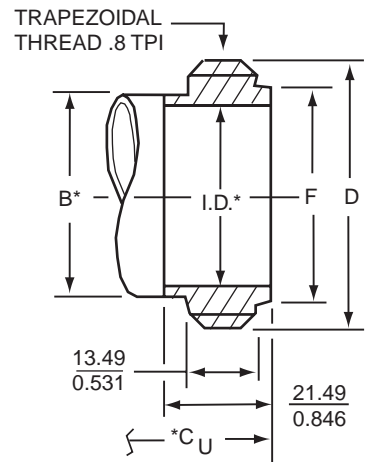
3A I-LINE FITTING (CODE C)



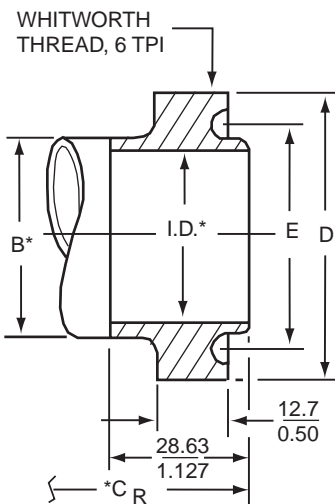
3A TRI-CLAMP (CODE T)



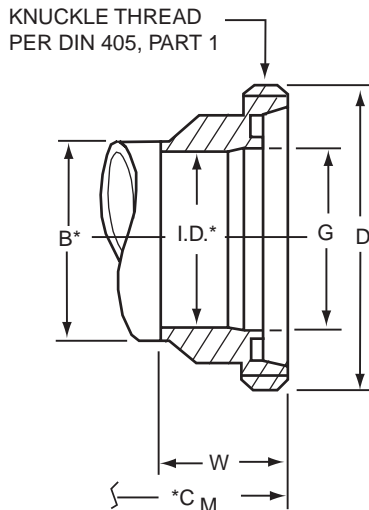
ISS COUPLING (CODE U)



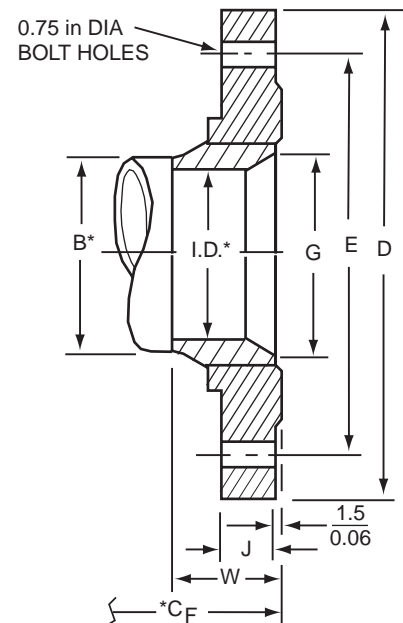
RJT COUPLING (CODE R)



SI COUPLING (CODE M)



ANSI CLASS 150 FLANGE (CODE F)



NOM. LINE SIZE	END CONNECTION DIMENSIONS *															
	CODE C		CODE T		CODE U		CODE R		CODE M			CODE F				
	D	W	D	E	D	F	D	E	D	G	W	D	E	G	J	W
50 2	67.06 2.640	26.19 1.031	64.0 2.52	56.4 2.22	64.08 2.523	56.21 2.213	72.72 2.863	58.67 2.310	78 3.1	50 2.0	35 1.4	152.4 6.00	120.7 4.75	57.02 2.245	17.5 0.69	41.1 1.62
80 3	98.30 3.870	30.96 1.219	90.9 3.58	83.3 3.28	91.11 3.587	82.60 3.252	98.12 3.863	84.07 3.310	110 4.3	81 3.2	40 1.6	190.5 7.50	152.4 6.00	84.68 3.334	22.4 0.88	46.0 1.81

* REFER TO FLOWMETER BODY DIMENSIONS TABLE FOR VALUES OF B, C, AND I.D.

I/A Series INTELLIGENT TRANSMITTERS



PRODUCT SPECIFICATION SHEETS (PSSs) FOR INTELLIGENT TRANSMITTERS

Category	Device Types	Models	PSS Numbers
Mass Flow	Flowtubes	CFS10; CFS20	1-2B1 A; 1-2B4 A
	Transmitters	CFT10; CFT15	1-2B3 C; 1-2B3 D
Magnetic Flow	Transmitters	IMT20; IMT25	1-6F3 B; 1-6F5 A
Vortex Flow	Flowmeters	83 Series	1-8A1 E (83F and 83W); 1-8A2 D (83S)
Pressure	Transmitters	820 Series	2A-1A1 C; 2A-1A3 E; 2A-1A3 F; 2A-1A3 G; 2A-1A4 C 2A-1Z3 K (Conversion Kit); 2A-1Z9 C (Options)
		860 Series	2A-1C3 A; 2A-1C5 A; 2A-1C6 A; 2A-1C7 A; 2A-1Z9 A (Options)
		I/A Series (-D, -I)	2A-1C13 A; 2A-1C14 A; 2A-1C16 A; 2A-1C16 B; 2A-1Z9 E (Options)
		I/A Series (-T)	2A-1C13 B; 2A-1C14 B; 2A-1C16 C; 2A-1C16 D; 2A-1Z9 E (Options)
Electrochemical	Transmitters	870IT Series	6-1B1 B; 6-3N2 A
Temperature	Transmitters	RTT10	2A-1F3 A
		RTT20	2A-1F4 A; 2A-1Z9 F (Options)
Remote Communication	Configurators	HHT (Foxboro)	2A-1Z3 A
		PC10 (Foxboro)	2A-1Z3 C
	I/A Series Interfaces	FBM18 & FBM39	21H-2D5 B4; 21H-2C4 B4
		FBM43 & FBM44	21H-2D8 B4; 21H-2D4 B4

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