

Model CFT50 Digital Coriolis Mass Flow Transmitter
I/A Series® Mass Flow and Density Meters
with HART or Modbus Communication Protocol



The Foxboro® brand Model CFT50 Digital Coriolis Mass Flow Transmitter combines with a Model CFS10 or CFS20 Mass Flowtube to form an I/A Series Mass Flow and Density Meter. Use of digital signal processing (DSP) techniques provides enhanced flowmeter performance, and adds new features over previous transmitter versions. The CFT50 uses HART or Modbus protocol for remote communications.

FEATURES

- ▶ Patented DSP techniques add new capabilities over existing Coriolis flowmeters for continuous 2-phase measurement, partial empty tube conditions, and start-from-empty batching.
- ▶ Numerous, separate output signal combinations, including pulse output, current output, contact output, and contact input, are selectable for HART or Modbus communication protocol.
- ▶ Modbus version offers quadrature pulse output for custody transfer applications.
- ▶ Local configuration using LCD Indicator.
- ▶ Available for ac or dc supply voltage applications.
- ▶ Weights and Measures Custody Transfer and Tamperproof Sealing options offered.
- ▶ Bracket allows transmitter to be mounted to a surface, or to a DN 80 (3-in) pipe.
- ▶ CFT50 Transmitter is backward compatible to existing CFS10 and CFS20 flowtube installations.
- ▶ Transmitter meets IP66 and NEMA 4X ratings.
- ▶ Suitable for use in Hazardous Area locations. Agency plate also includes CE mark.

INTRODUCTION

This I/A Series Mass Flow and Density Meter, comprising a CFT50 Mass Flow Transmitter and a CFS10 or CFS20 Mass Flowtube, measures fluid mass flow rate directly, not inferentially as volumetric flowmeters do. With direct measurement of mass, the inaccuracies of multiple process measurements associated with volumetric flow devices are eliminated.

The transmitter is an advanced generation of mass flow devices using digital signal processing technology. This technology provides improved performance over previous Coriolis flowmeters. This is particularly evident when two-phase flow is present. The transmitter allows for continual operation with a large amount of entrained air. It also allows the Foxboro mass flowtubes to continue operation during transition from a liquid to a gas, and back again.

The transmitter provides multiple measurements, remote communications, and selectable multiple current outputs, pulse outputs, contact outputs, and contact inputs.

In addition to the above, automated manufacturing processes, construction and testing all add up to an ideal product for today and tomorrow's "real world" process flow applications.

SUITABLE FOR USE IN HAZARDOUS AREA LOCATIONS

These flowmeters meet the requirements of many agencies for use in hazardous area locations. Refer to "Electrical Safety Specifications" section.

CE COMPLIANCE

CE marked; complies with all applicable European union Directives.

APPLICATION VERSATILITY

- ▶ Programmable Alarms, Contacts, and Relays
- ▶ Digital Circuitry eliminates Zero Drift
- ▶ High Accuracy over Wide Range of Flow Rates
- ▶ Remote and Local Configuration
- ▶ Direct Measurement of Mass, Density, and Temperature
- ▶ Density Optimization provides Unsurpassed Density Accuracy
- ▶ Selection of inferred measurements, such as Volume, Volume Total, Mass Total, % Concentration, Solids and % Solids, Net Flow, °Brix, and Brix Rate, and °Baumé
- ▶ Suitable for applications including:
 - Tanker unloading
 - Centrifuge bottoms
 - Ethylene oxide
 - Sanitary batching
 - Pharmaceuticals batching
 - Food, dairy, and beverage
 - Custody transfer using Modbus version with quadrature pulse output.

HART COMMUNICATION PROTOCOL

The HART 4 to 20 mA output signal allows direct analog connection to common receivers while still providing full Intelligent Transmitter Digital Communications using a HART Communicator, or PC-based configurator, such as a Foxboro Model PC50 Field Device Tool, and Model HHT50 Configurator.

Measurements and diagnostics are available from the Communicator connected to the two-wire loop carrying the 4 to 20 mA signal by using a bidirectional digital signal superimposed on the 4 to 20 mA current signal. Multidrop configurations are also supported.

Multiple measurements are transmitted digitally in a choice of EGU. Transmitter diagnostics are also communicated. Configuration and reranging can be accomplished remotely with the Communicator, or PC-based Configurator, or locally with the LCD indicator with pushbuttons.

MODBUS COMMUNICATION PROTOCOL

Communication with Host processors is made using the Modbus RTU (Remote Terminal Unit) mode over a 2-wire RS-485 multidrop serial connection.

The CFT50 uses the Modcom RTU mode, rather than the ASCII mode, for communication. The main advantage of the RTU mode is that its greater character density allows better data throughput than ASCII for the same baud rate. Each message must be transmitted in a continuous stream. The format for each byte in RTU mode is:

- ▶ Coding System:
 - 8-bit binary
- ▶ Bits per Byte
 - One start bit
 - Eight data bits, least significant bit sent first
 - One bit for even/odd parity
 - One stop bit if parity is used; two bits if no parity
- ▶ Error Check Field: Cyclical Redundancy Check (CRC)

The CFT50 functions as a Modbus slave device. See Table 1 and the paragraphs that follow.

Station Addresses Supported (Modbus)

Station (or slave) addresses supported are in the range of 1 to 247.

Floating Point Support (Modbus)

Each Modbus register is a 16-bit register. Floating-point numbers in the CFT50 are each stored in two consecutive registers. Floating-point values must be retrieved by requesting the contents of both registers with the same poll command. Both registers of a floating-point value must be written in the same Modbus message. The floating-point numbers should be interpreted according to the IEEE-754 floating-point format for 32-bit numbers. Floating Point Byte order is selectable.

Table 1. Function Codes Supported (Modbus)

| Code | Description | Comment |
|------|---------------------------|---|
| 01 | Read Coils | Read multiple coils. |
| 02 | Read Discrete Inputs | Read multiple discrete inputs. |
| 03 | Read Holding Registers | Read contents of multiple holding registers |
| 04 | Read Input Registers | Read contents of multiple input registers. |
| 05 | Write Single Coil | Set a single coil ON or OFF. |
| 06 | Write Single Register | Change contents of a single holding register. |
| 08 | Diagnostics | Perform diagnostic tests and return communication status information. |
| 15 | Write Multiple Coils | Set Multiple coils ON or OFF. |
| 16 | Preset Multiple Registers | Change contents of multiple holding registers. |
| 17 | Report Slave ID | Read device specific identification. |

LCD INDICATOR WITH LOCAL CONFIGURATOR

An LCD Indicator is used for local indication of flow measurement, total, and other menu-driven parameters. The indicator, with four multifunction pushbuttons, also allows flowmeter calibration, configuration, and self-test. The indicator scrolls and displays between multiple measurements. See Figure 1

CUSTODY TRANSFER – OPTION -T

This option provides for Weights and Measures Custody Transfer per NIST Handbook 44. (An NTEP approved label is also applied to the enclosure.) This option incorporates the Tamperproof Sealing option below, and must be combined with CFS10 and CFS20 Flowtubes Custody Transfer Option Code -T.

TAMPERPROOF SEALING – OPTIONS -S OR -T

Tamperproof Sealing of the enclosure and terminal box covers is provided by selecting Options -S or -T.

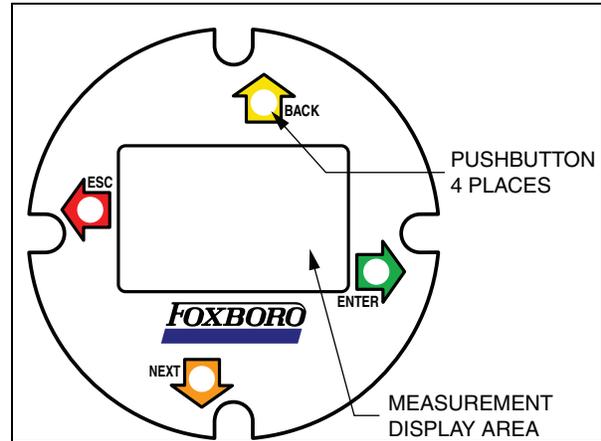


Figure 1. LCD Indicator Face Plate

OPERATING, TRANSPORTATION, AND STORAGE CONDITIONS

| Influence | Reference Operating Conditions | Normal Operating Condition Limits | Transportation and Storage Limits |
|---|------------------------------------|--|--|
| Ambient Temperature | 23 ±2°C (73 ±3°F) | -40 and +60°C (a) (-40 and +140°F) (a) | -40 and +85°C (-40 and +185°F) |
| Relative Humidity | 50 ±10% | 5 and 100% (b) | 5 and 100% (a) |
| Supply Voltage and Supply Frequency, ac | 120/240 V ac, ±1% 50/60 Hz, ±1% | 120/240 V ac, +10/-15% 50/60 Hz, ±5% | N/A |
| Supply Voltage, dc | 24 V dc, ±1% | 10 and 36 V dc | N/A |
| Vibration | 1 m/s ² (0.1 "g") | 5 m/s ² (0.5 "g") from 5 to 500 Hz | 11 m/s ² (1.1 "g") from 2.5 to 5 Hz (in shipping package) |

(a) Refer to the Electrical Safety Specifications section for a restriction in ambient temperature limits with certain electrical approvals/certifications.

(b) Relative humidity specifications listed apply when transmitter covers are properly installed. Also, conditions producing sustained condensate are not allowed.

SYSTEM PERFORMANCE SPECIFICATIONS (1)
(Under Reference Operating Conditions unless Otherwise Specified)

Accuracy - Mass Flow Rate (Liquids)
(Includes Linearity, Hysteresis, and Repeatability)

±0.10% + Zero Instability (see Table 2)

Accuracy in % of rate is therefore,

$$\text{Accuracy} = \pm 0.10\% + \left(\frac{\text{Zero Instability}}{\text{Mass Flow Rate}} \times 100 \right)\%$$

Accuracy - Mass Flow Rate (Gases)
(Includes Linearity, Hysteresis, and Repeatability)

±0.50% + Zero Instability (see Table 2)

Accuracy in % of rate is therefore,

$$\text{Accuracy} = \pm 0.50\% + \left(\frac{\text{Zero Instability}}{\text{Mass Flow Rate}} \times 100 \right)\%$$

Accuracy - Volumetric Flow Rate (Liquids Only)

Volumetric flow rate accuracy is the root sum of the squares (RSS) of Mass Flow Rate and Density accuracies. Mass Flow Rate and Density accuracies must be in the same units of measure.

Accuracy - Density (Liquids Only)

±0.0005 g/cm³ with both CFS10 and CFS20 mass flowtubes, provided by built-in density optimization function.

Accuracy - Process Temperature

- ▶ ±1°C (1.8°F) for process temperatures between -60 and +100°C (-76 and 212°F).
- ▶ ±3°C (±5.4°F) for process temperatures from -130 to -60°C (-202 to -76°F) and from 100 to 180°C (212 to 356°F).

Table 2. Zero Instability (a)

| Flowtube Model | Flowtube Size | Zero Instability | |
|----------------|------------------|------------------|---------|
| | | kg/min | lb/min |
| CFS10 | 3 mm (1/8 in) | 0.000016 | 0.00035 |
| | 6 mm (1/4 in) | 0.00045 | 0.001 |
| | 15 mm (1/2 in) | 0.00204 | 0.0045 |
| | 20 mm (3/4 in) | 0.00454 | 0.010 |
| | 25 mm (1 in) | 0.00907 | 0.020 |
| | 40 mm (1 1/2 in) | 0.0204 | 0.045 |
| | 50 mm (2 in) | 0.0340 | 0.075 |
| CFS20 | 40 mm (1 1/2 in) | 0.0204 | 0.045 |
| | 80 mm (3 in) | 0.0907 | 0.200 |

(a) In the accuracy equation, Zero Instability and Mass Flow Rate units must be the same.

Supply Voltage Effect

A change in the supply voltage of +10 or -15% from reference voltage causes the output to change less than 0.1% of reading or less than 0.001% of meter capacity, whichever is greater.

Humidity Effect

No effect from 0 to 95% RH, noncondensing.

Ambient Temperature Effect

(For any variation from Reference Operating Temperature within the Operating Limits)

±0.0028% of span per °C

Electromagnetic Compatibility (EMC)

The CFT50 Transmitter complies with International and European Union standards. Transmitter must be properly installed and housing earthed (grounded) per installation instructions. See Table 3 that follows.

(1) Accuracy specifications are listed for flows between 100% and 1% of flowtube URL. The flowmeter will operate below 1% of URL, but no accuracy statements are made at these conditions. Also, the transmitters and flowtubes are interchangeable provided calibration parameters are loaded into the transmitter.

SYSTEM PERFORMANCE SPECIFICATIONS (CONT.)
(Under Reference Operating Conditions unless Otherwise Specified)

Table 3. Electromagnetic Compatibility (a)

| Parameter | IEC Standard | EN Standard |
|---|--|---|
| Radiated RFI Immunity | 10 V/m per IEC 61000-4-3 | 10 V/m per EN 61000-4-3 |
| Conducted RFI Immunity | 10 V per IEC 61000-4-6 | 10 V per EN 61000-4-6 |
| RFI Radiated and Conducted Emissions | CISPR, Class A | EN 55011 Class A |
| ESD Immunity | 6 kV contact discharge per IEC 61000-4-2 | 6 kV contact discharge per EN 61000-4-2 |
| Electrical Fast Transients/Burst Immunity | 2 kV per IEC 61000-4-4 | 2 kV per EN 61000-4-4 |
| Surge Immunity | 4 kV per IEC 61000-4-5 | 4 kV per EN 61000-4-5 |
| Power Dips and Interruptions | IEC 61000-4-11 | EN 61000-4-11 |

(a) Accuracy specifications are listed for flows between 100% and 1% of flowtube URL. The flowmeter will operate below 1% of URL, but no accuracy statements are made at these conditions. Also, the transmitters and flowtubes are interchangeable provided calibration parameters are loaded into the transmitter.

FUNCTIONAL SPECIFICATIONS

Power Requirements

ac SUPPLY

Supply Voltage: 102 to 264 V ac

Supply Frequency: 47 to 63 Hz

Power: 18 VA maximum

dc SUPPLY

Supply Voltage: 10 to 36 V dc

24 V dc nominal

Power: 15 W maximum

Operating Current: 1 A

Start-up Current: 3 A

Transmitter Capabilities

- ▶ Direct Mass Flow Rate
- ▶ Volumetric Flow Rate
- ▶ Totalized Mass Flow Rate
- ▶ Totalized Volumetric Flow Rate
- ▶ Process Fluid Density
- ▶ Temperature
- ▶ Bidirectional Flow
- ▶ Percent Solids/Concentration
- ▶ Net Flow, Component A, Component B
- ▶ Brix and Baumé Scales

Totalization

The transmitter has nonvolatile memory for the four on-board totalizers each of which support:

- ▶ Forward Total
- ▶ Reverse Total
- ▶ Net Total
- ▶ Grand Total
- ▶ Bi-Direction

Diagnostics/Alarms

Diagnostic and alarm functions are provided. These can be configured to be visual via the local display/keypad, as a signal output via the 4 to 20 mA outputs, or as a contact output.

Response Time (Undamped)

The undamped transmitter response time is 50 ms.

Transmitter I/O (also see paragraphs that follow)⁽²⁾

- ▶ Analog Current Outputs (Multiple)
- ▶ Analog Current Output Alarm
- ▶ Selectable Frequency Output
- ▶ Scaled Pulse Output
- ▶ Contact Output - Configurable
- ▶ Contact Input - Configurable

Analog Current Outputs - Multiple

There are up to three independent, 4 to 20 mA outputs on the HART version, and up to two independent, 4 to 20 mA outputs on the Modbus version. HART communication is provided on the first current output (see Model Code). All transmitter I/Os must be externally powered, and are connected at the positive power input. Specifications are:

Output Load: 0 to 680 Ω

Supply Voltage: 24 V dc $\pm 10\%$

Current: 22 mA maximum, 3.9 mA minimum

Analog Current Output Alarm

This output alarm feature allows communicating a diagnostic error to the current loop receiver. When the error is flagged, the current output can go Upscale, go Downscale, or remain at last value.

Quadrature Pulse Output

A quadrature pulse output uses two pulsed outputs that are $\pm 90^\circ$ out of phase with one another. The polarity (\pm) indicates the flow direction. The quadrature output can be configured to output any reading that a pulsed output can.

Contact Output - Configurable

A contact output is provided and configurable as:

- ▶ Hi-Lo Level Alarm
- ▶ Diagnostic Alarm

Specifications are as follows:

Type: Relay, 1 Form A (Isolated)

Supply Voltage: 24 V dc $\pm 10\%$

Current Rating: 100 mA maximum

⁽²⁾ All transmitter I/O must be externally powered, and are connected at the positive power input.

FUNCTIONAL SPECIFICATIONS (CONT.)

Contact Input - Configurable

A contact input is provided and configurable as:

- ▶ A 4 to 20 mA Output Lock
- ▶ Or an External Totalizer Reset
- ▶ Or an Alarm Reset
- ▶ Or Zero Flow Calibration

Specifications are as follows:

Type: Requires current linking device such as contact closure or transistor switch between terminal block connections provided.

Supply Voltage: 24 V dc $\pm 10\%$

Current Rating: 15 mA maximum

Frequency or Pulse Output - Selectable

This output is a transistor switch which can be configured as a frequency or pulse output signal.

FREQUENCY OUTPUT

This output configuration can be assigned to mass or volume flow rate, density, temperature, or percent solids measurements. The frequency can be configured to as high as 10 kHz.

Frequency Output specifications are as follows:

- Selectable Frequency: 0 to 10 kHz
- Frequency Duty Cycle: 50% nominal
- Supply Voltage: 24 V dc $\pm 10\%$
- Load Current: 80 mA maximum

SCALED PULSE OUTPUT

This output drives low speed totalizers. A pulse is sent for every user-configured mass total that has accumulated. Specifications are as follows:

- Supply Voltage: 24 V dc $\pm 10\%$
- Load Current: 80 mA maximum
- Pulse Width: See table below
- Maximum Frequency: See table below

| Configurable Speed | Pulse Width | Maximum Frequency |
|--------------------|-------------|-------------------|
| SLOW | 50 ms | 10 Hz |
| FAST | 5 ms | 100 Hz |

NOTE: A 256 pulse buffer stores pulses in case of temporary overrange conditions.

Local Interrogation/Configuration

In addition to HART or Modbus remote communications (see paragraphs that follow), a local LCD Indicator with four multifunction pushbuttons is offered. This allows the transmitter to be a stand-alone unit that allows for local interrogation and full configuration capability. The electronics enclosure cover must be removed to access the pushbuttons.

Modbus Remote Communications

See Table 4 for Modbus communication parameters, see Figure 2 for a typical block diagram.

Table 4. Modbus Communication Parameters

| Parameter | Multidrop Mode |
|-------------------------|---|
| Communication Rate | 1200, 2400, 4800, 9600, 19200, 38400 baud |
| Measurement Update Rate | 1200 baud: 4 times/s 2400 baud: 9 times/s 4800 baud: 19 times/s 9600 baud: 38 times/s 19200 baud: 76 times/s 38400 baud: 153 times/s |

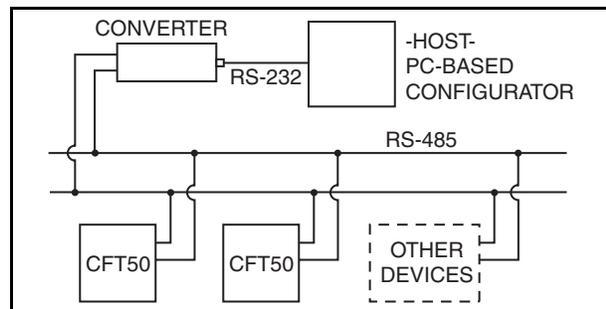


Figure 2. Modbus Typical Multidrop Block Diagram

FUNCTIONAL SPECIFICATIONS (CONT.)

HART Remote Communications

See Table 4 for HART communication parameters, and see Figures 3 and 4 for typical block diagrams.

Table 5. HART Communication Parameters

| Parameter | Analog Mode | Multidrop Mode |
|----------------------------|--------------------|--------------------------------|
| Communication Rate | 1200 baud | 1200 baud |
| Communication Distance | 3050 m (10 000 ft) | 1525 m (5000 ft) |
| Minimum Loop Load Required | 250 Ω | 250 Ω |
| Meas. Updates | 4 times/s | 4 times/s |
| Number of Devices | One Device in Loop | Fifteen Devices Maximum on Bus |

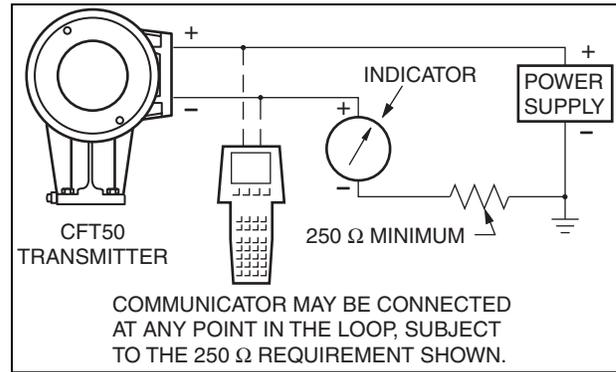


Figure 3. HART 4 to 20 mA Output Block Diagram

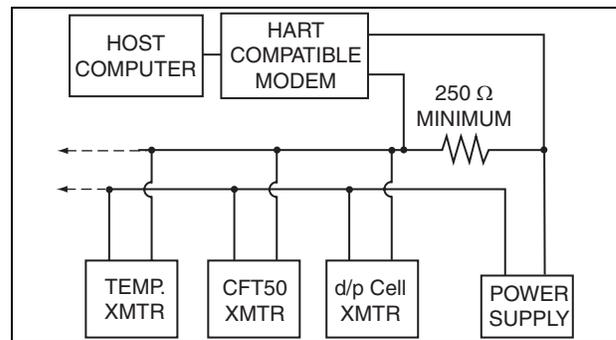


Figure 4. HART Multidrop Block Diagram

PHYSICAL SPECIFICATIONS

Transmitter Enclosure (Figure 5)

Two transmitter enclosures are available, one for standard installations and one for flameproof/explosionproof installations. See Electrical Safety Specifications section.

The enclosure is an aluminum alloy with an epoxy finish. A junction box is attached to the enclosure to accommodate interconnections between the transmitter and flowtube. The main enclosure comprises two compartments – one compartment is for the electronics (includes LCD Indicator with local configurator, if specified), and the other compartment is for the user's field wiring. Covers are provided for the field terminals compartment, electronics compartment, and junction box.

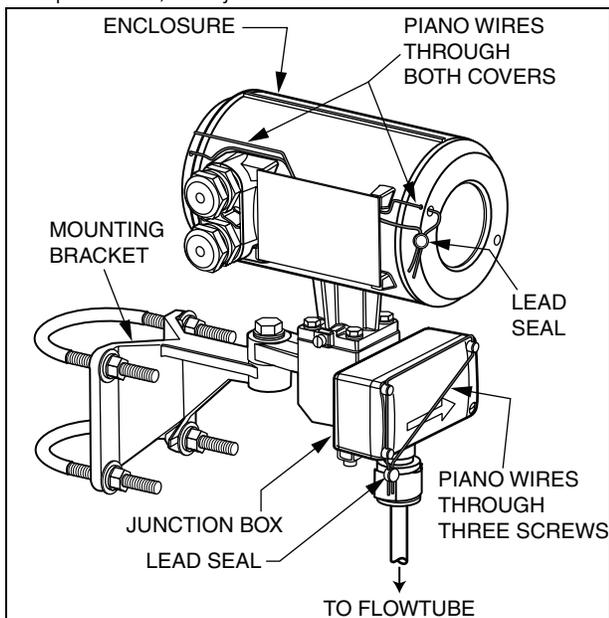


Figure 5. Tamperproof Sealing of Enclosure and Junction Box Covers provided with Option -S and -T (Standard Enclosure Shown)

To allow use in Division 1 explosionproof and ATEX flameproof applications, the field wiring and electronics compartments are sealed from one another. Enclosure cover locks are also provided.

Tamperproof sealing of the standard or explosionproof enclosure and junction box covers are provided when selecting either Custody Transfer Option -T, or Tamperproof Sealing Option -S. When selecting Option -T, an NTEP approved label is applied to the enclosure. Additionally, with Option -T, the customer must also select the CFS10 or CFS20 Flowtube Custody Transfer Option -T. See Figure 5.

A cover tightening and removal tool is provided for ease of tightening/removing the enclosure covers.

Electrical Connections

FIELD WIRING

Field wiring enters the field terminal compartment via two M20 conduit thread openings. IPS also offers 1/2 NPT and 3/4 NPT conduit thread adapters for use with the M20 conduit thread openings. Terminal blocks accept the field wires and the field wiring compartment provides adequate space for service loops.

TRANSMITTER TO FLOWTUBE WIRING

A cable interconnects the transmitter and flowtube, and terminates at a junction box at each end. The maximum cable length allowed for proper operation is approximately 305 m (1000 ft). Refer to the applicable flowtube PSS and MI for cable selection.

NOTE

The Model CFT50 Transmitter is backward compatible to existing CFS10 and CFS20 flowtube installations.

TRANSMITTER JUNCTION BOX TO ELECTRONICS COMPARTMENT

Two cable assemblies are available, one for standard installations and one for flameproof/explosionproof installations.

PHYSICAL SPECIFICATIONS (CONT.)

Transmitter Mounting

The transmitter enclosure is supported by a mounting bracket which can be attached to a surface, or to a nominal DN 80 (3-in) pipe. When installed, the housing itself is rotatable in 90° increments, and the transmitter/junction box assembly can be rotated on the mounting bracket to whatever angle is desired. See Figure 5 and “Dimensions-Nominal” section.

Environmental Protection

Printed wiring assemblies (PWAs) are conformally coated for moisture and dust protection. The enclosure has the dusttight and weatherproof rating of IP 66 as defined by IEC 60529, and provides the environmental and corrosion resistant protection rating of NEMA 4X.

Approximate Mass - Transmitter

4.2 kg (9.3 lb)

Dimensions

See “Dimensions-Nominal” section.

ELECTRICAL SAFETY SPECIFICATIONS

| Types of Protection and Area Classification | Application Conditions | Electrical Safety Design Code |
|---|--|-------------------------------|
| ATEX Flameproof/Increased Safety: II 2 G Ex de [ib] IIB, T6. | [ib] = Intrinsically safe sensor output connections; Zone 1. Ta = -20 to +60°C | Q (a) |
| ATEX Nonsparking: II 3(2) G Ex nA [nL] [ib] IIB, T4. | [ib] = Intrinsically safe output connections; Zone 1. Ta = -20 to +60°C [nL] = Energy limited contact output; Zone 2. Ta = -20 to +60°C | M (a) |
| ATEX Nonsparking: II 3 Ex nA [nL] IIC, T4. | [nL] = Energy limited sensor output connections; Zone 2. Ta = -20 to +60°C | T (a) |
| CSA for Class I, Division 2, Groups A, B, C, and D; Suitable for Class II, Division 2, Groups E, F, and G. | Temperature Class T4. Ta = 60°C maximum ambient. Connect to CFS10-....CNN or CFS20-....CNN per MI 019-133. | S (a) |
| FM Explosionproof for Class I, Division 1, Groups A, B, C, and D; dust-ignitionproof for Class II and III, Division 1, Groups E, F, and G. | Temperature Class T6. Ta = 60°C. Connect to CFS10-....FBB or CFS20-....FBB per MI 019-133. | N |
| FM Intrinsically Safe outputs to Class I, Division 1, Groups C, and D; and Nonincendive outputs to Class I, Division 2, Groups A, B, C, and D. | Temperature Class T4. Ta = 60°C. Connect to CFS10-....FNN or CFS20-....FNN per MI 019-133. | K |
| FM Nonincendive for Class I, Division 2, Groups A, B, C, and D; suitable for Class II and III, Division 2, Groups F and G. | Temperature Class T4. Ta = 60°C. Connect to CFS10-....FNN or CFS20-....FNN per MI 019-133. | R |
| No agency approvals or certifications required. | | Z |

(a) Not available with Modbus versions.

NOTE

For detailed information, or status of the testing laboratory approvals/certifications, contact IPS.

MODEL CODE

| <u>Description</u> | <u>Model</u> | | | |
|---|--|----------------|------------------|---|
| Digital Coriolis Mass Flow Transmitter | CFT50 | | | |
| <u>Mass Flowtube Interface</u> Foxboro CFS10 and CFS20 Series Flowtubes | -B | | | |
| <u>Transmitter Mounting</u> Remote Mounted Transmitter (a) | 1 | | | |
| <u>Language</u> English | E | | | |
| <u>Nominal Supply Voltage</u> 120 to 240 V ac, 50 or 60 Hz 10 to 36 V dc (24 V dc nominal), with Externally Powered I/O | A B | | | |
| <u>Output Signals and Communication Protocol (b)(h)</u> | | | | |
| Output 1 (b) Output 2 Output 3 Output 4 | | | | |
| Current Output/HART | Contact Input | Pulse Output | Contact Output | 1 |
| Current Output/HART | Contact Input | Current Output | Contact Output | 2 |
| Current Output/HART | Current Output | Contact Input | Pulse Output | C |
| Current Output/HART | Current Output | Current Output | Pulse Output | D |
| Current Output/HART | Current Output | Current Output | Contact Input | E |
| Current Output/HART | Current Output | Current Output | Contact Output | F |
| Modbus (+) | Modbus (-) | Current Output | Pulse Output | G |
| Modbus (+) | Modbus (-) | Pulse Output | Pulse Output (g) | H |
| Modbus (+) | Modbus (-) | Pulse Output | Contact Output | J |
| Modbus (+) | Modbus (-) | Pulse Output | Contact Input | K |
| Modbus (+) | Modbus (-) | Current Output | Current Output | L |
| Modbus (+) | Modbus (-) | Current Output | Contact Output | M |
| Modbus (+) | Modbus (-) | Current Output | Contact Input | N |
| <u>LCD Indicator with Pushbuttons</u> None - Blind Unit Integral LCD Indicator with Pushbuttons | A B | | | |
| <u>Electrical Safety (Also see Electrical Safety Specifications section)</u> ATEX, Flameproof/Increased Safety, II 2 G Ex de [ib], IIB, T6 (c) ATEX, Nonsparking, II 3(2) G Ex nA [nL] [ib] IIB, T4 (c) ATEX, Nonsparking, II 3 Ex nA [nL] IIC, T4 (c) CSA for Class I, Div. 2, Groups A, B, C, D; and suitable for Class II, Division 2, Groups E, F, and G (c) FM, Explosionproof, Class I, Div. 1, Groups A, B, C, and D; and Dust-ignitionproof for Class II and III, Division 1, Groups E, F, and G. FM, Intrinsically Safe outputs to Class I, Division 1, Groups C and D; and Nonincendive outputs to Class I, Division 2, Groups A, B, C, and D. FM, Nonincendive, Class I, Div. 2, Groups A, B, C, D; and suitable for Class II and III, Div. 2, Groups F and G. No Approvals or Certifications required. | Q M T S N K R Z | | | |

Model Code continued on next page

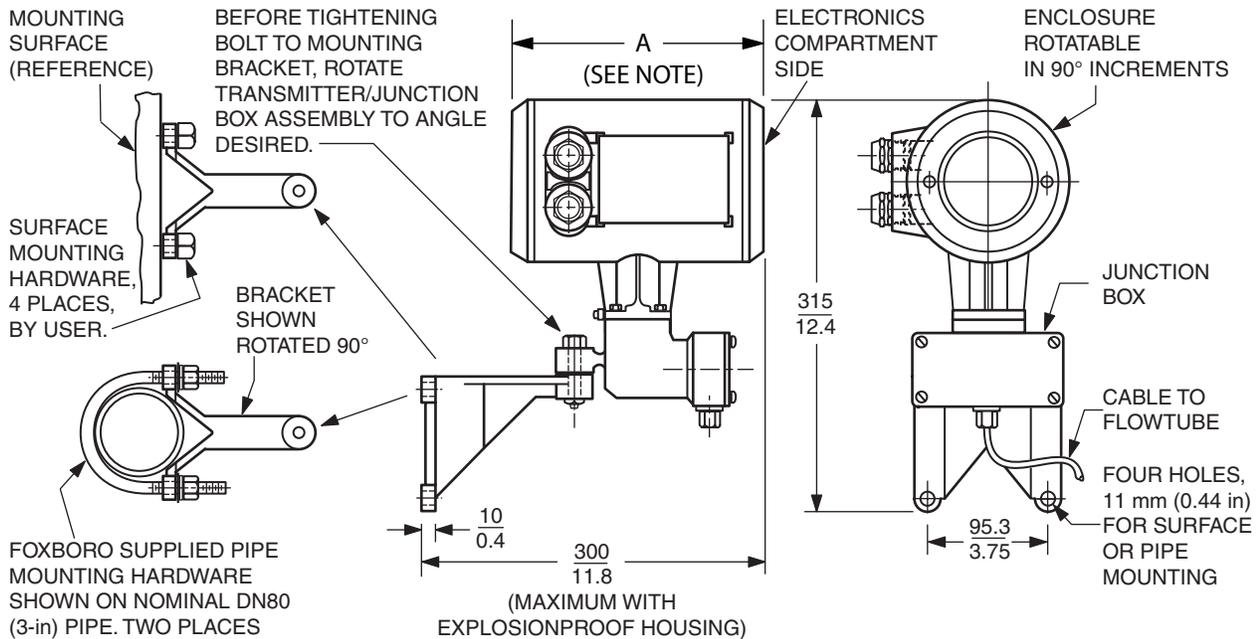
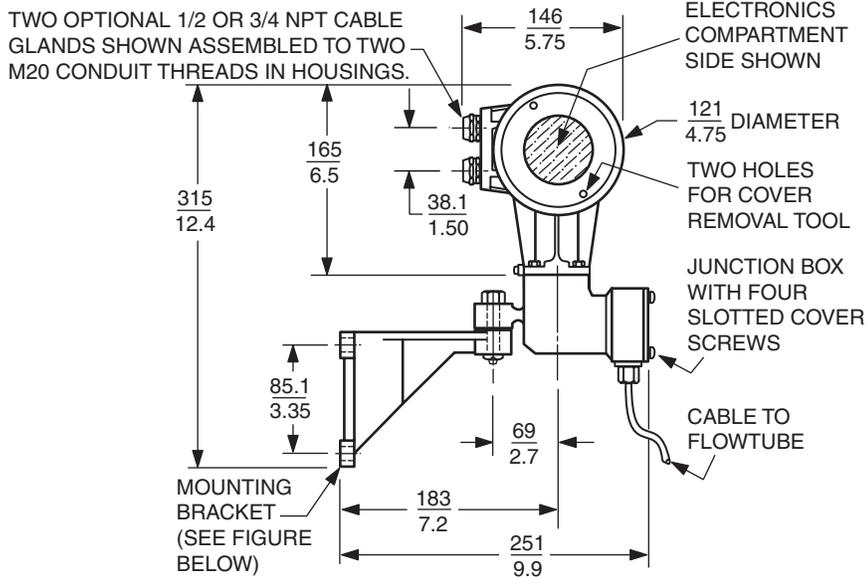
MODEL CODE (CONT.)

| <u>Description (Cont.)</u> | <u>Model</u> |
|--|--------------------------------|
| <p>Optional Selections 1/2 NPT Cable Gland adapted to M20 thread in housing 3/4 NPT Cable Gland adapted to M20 thread in housing Tamperproof Sealing for Terminal Block and Housing Covers (d)(e) Weights and Measures Custody Transfer/NTEP (d)(f) - Includes Optional Selection -S (Tamperproof Sealing) - Must be combined with CFS10 and CFS20 Option -T (Custody Transfer)</p> <p>Example: CFT50-B1EA2BK-A</p> | <p>-A -B -S -T</p> |

- (a) The cable interconnecting the transmitter and flowtube must be ordered separately. See PSS 1-2B1 A (CFS10 and CFS20 Flowtubes) for cable ordering instructions. The maximum cable length for proper operation is 305 m (1000 ft).
- (b) The HART Communicator or PC-based Configurator can be used with the 4 to 20 mA current output signal 1 only.
- (c) ATEX and CSA certifications are not available with Modbus Communication transmitters.
- (d) Optional Selections -S and -T are not available when the LCD Indicator, Code A, is selected.
- (e) Optional Selection -S is not available with Electrical Safety Codes M, Q, and T.
- (f) Optional Selection -T is not available with the following:
 - Electrical Safety Codes Q, M, T, and S (ATEX and CSA)
 - HART Output Signal Codes 2, E, and F.
 - Modbus Output Signal Codes G, H, J, K, L, and M.
- (g) If user requires Quadrature Output, then Output Signal Code H must be selected.
- (h) External power is required for the user's I/O.

DIMENSIONS - NOMINAL
REMOTE MOUNTED TRANSMITTER

mm
in



NOTE: Dimension A is 210 mm (8.25 in) for standard housing and 239 mm (9.4 in) for explosionproof housing.

ORDERING INSTRUCTIONS

1. Model Number.
2. Process data and gas or liquid applications; visit FlowExpertPro.com sizing program.
3. If cable is required, refer to PSS 1-2B1 A (CFS10 and CFS20 Mass Flowtubes) for ordering instructions.
4. If ordering a replacement for a CFT10 or CFT15 Mass Flow Transmitter, specify meter serial number.
5. Flowtube Model Used.
6. User Tag Data.

REFERENCE DOCUMENTS

| Description | PSS Number |
|--|-------------|
| CFS10 Mass Flowtube, 3 to 50 mm (1/8 to 2 in) Sizes | PSS 1-2B1 A |
| CFS20 Mass Flowtube, 40 and 80 mm (1.5 and 3 in) Sizes | PSS 1-2B1 A |

OTHER M&I PRODUCTS

Foxboro provides a broad range of measurement and instrument products, including solutions for pressure, flow, analytical, positioners, temperature, controlling and recording. For a listing of these offerings, visit the Invensys Operations Management web site at:

www.iom.invensys.com