

Series DFXD

Doppler Ultrasonic Flow Meter

Part 1. General

1.1 Scope

- A. This section describes the requirements for an ultrasonic flow measurement transmitter plus transducer.
- B. Under this item, the contractor shall furnish and install the flow measurement equipment and accessories as indicated on the plans and as herein specified.

1.2 Submittals

- A. The following information shall be included in the submittal for this section:
 - 1. Data sheets and catalog literature for microprocessor-based transmitter and transducer.
 - 2. Interconnection and dimensional drawings.
 - 3. List of spare parts

Part 2. Products

2.1 Doppler Ultrasonic Flow Meter

- A. The Doppler ultrasonic flow measurement system shall be a microprocessor-based measuring type providing an electronic output signal proportional to the flow of liquid in closed piping systems as may be required. It shall consist of a transmitter and one transducer connected by up to 990 feet [300 meters] of cable.
- B. **Transducer:**
 - 1. Operating principle: Two ultrasonic transducers (as discrete pieces or contained in a single element) function discretely as transmitter and receiver. Continuous-wave ultrasound is transmitted into the flowing fluid and reflected frequencies from scatterers suspended within the fluid to be measured

are received. Transmitted and received signals are mixed resulting in difference frequencies (Doppler) whose frequency spectrum and mean value vary with scatterer velocity. The Doppler shift is proportional to the velocity of the scatterers and it is assumed in the method that the scatterers flow with the same velocity as the fluid.

2. Transducer: The compression-mode acoustic transducer shall contain a polarized Zirconium crystal with impedance matched wave-guide.
 - a. Universal transducers shall operate on pipe/tubing sizes ranging from 1" through 100" [25 through 2540 mm].
 - b. Small-pipe transducers shall operate on pipe/tubing sizes from 1/4" through 1" [6 through 25 mm].
 - c. Clamp-on transducer housing shall be PVC, CPVC, Teflon, anodized aluminum, Ultem® or Vespel®.
 - d. Insertion transducer housing shall be constructed from 316 SS, Ultem® and Viton®. The insertion transducer shall be of "hot-tap" construction – permitting installation without depressurizing the piping conduit.
 - e. Process connection shall be 3/8" or 1/2" NPT
 - f. Standard operating temperature shall be -40° to 250°F [-40° to +121° C]
 - g. Optional operating temperature shall be -40° to 400°F [-40° to +200° C]

C. Transmitter

1. Enclosure shall be NEMA 4X polycarbonate
2. Power supply shall be 115/230 VAC +/- 15% @ 50/60 Hz or 9-28 VDC

3. Power consumption shall be 5 VA Maximum
4. Operating temperature shall be -40° to 185° F [-40° to 85° C.
5. Input/output options: The transmitter shall accept up to two input/output options to be installed. Input/output options are field installable and replaceable.
 - a. 4-20ma into 800 ohms; jumper configurations for internal or external power
 - b. 2 form C, SPDT multi-purpose relays rated 0.5 A /200 VAC non-inductive
 - c. Pulse rate output, 0-2,500 Hz, open-collector and turbine meter simulation
6. Control and Programming
 - a. 4-key keypad.
7. Transmitter shall output a crystal controlled continuous wave signal.
8. Measurements shall be made by mixing the transmitted signal with the received signal – relating difference frequency to liquid velocity.

D. Transmitter and Transducer Performance

1. Measuring range 0.1-30 FPS [0.03-9 MPS]
2. Accuracy shall be $\pm 2\%$ of full, calibrated span
3. Repeatability 0.5% of full, calibrated span
4. Sensitivity is 0.001 FPS [0.001 MPS]
5. Maximum separation between transmitter and transducer shall be 990 feet

E. Indication

1. Display shall be two lines: 8-digit LCD with .7" high numerical values and 8-digit LCD with 0.35" high alpha numeric values. Display is back lighted with white LEDs.
2. Indicators for Run and Program modes and Relay 1 and Relay 2 status

F. Equipment

The Doppler ultrasonic flow meter shall be a Dynasonics Series DTFXD transmitter and either Dynasonics Series DT94 (standard temperature multi-size pipe), DT96 (high temperature multi-size pipe), DT93 (standard temperature small-pipe), DT97 (high temperature small-pipe) or DP7 (insertion probe) ultrasonic transducer.

Part 3. Operator Functions

3.1 Calibration

- A. Flow meter calibration shall be completed at the factory.
- B. Internal self-diagnostics shall be available to assist in installation and maintenance of the flow meter.

3.2 Transmitter Function Details

The following functions shall be provided:

- A. The flow meter shall have local display of flow rate, accumulated flow (totalizer) and diagnostic data.
- B. The transducers shall be mounted at the measuring site and shall be installed in accordance with the manufacturers recommendations.
- C. The transducers shall transmit and receive acoustic signals to accurately measure liquid flow.
- D. Operational range shall be adjustable by entering new data via local keypad.
- E. If equipped with an optional output module, the flow meter shall be capable of zero to full scale output simulation to

assure proper operation with regards to flow charts or pump control parameters.

- F.** There shall be no internal potentiometers or switches used in programming or adjusting the transmitter.
- G.** The power to operate the transducers shall come solely from the transmitter over the signal interconnection cable.
- H.** If the flow meter is equipped with dual alarm relays it shall be programmable for rate of flow, batch/total accumulation or system error.
- I.** The flow meter shall have a FLASH memory and shall not require a battery to ensure protection of stored data.

Part 4. Execution

4.1 Installation

- A.** Follow manufacturers recommendation upstream and downstream straight pipe diameters and transducer orientation.
- B.** Enter pipe configuration information into the flow meter.
- C.** Mount the transducers onto the pipe as described in the product manual.
- D.** Additional cable for the transducers shall be RG59 coaxial. All connections shall be 75 Ohm.

Part 5. Warranty

5.1 Terms

- A.** The manufacturer of the above specified equipment shall guarantee for twelve (12) months from date of shipment that the equipment shall be free from defects in design, workmanship or materials.
- B.** In the event a component fails to perform as specified or is proven defective in service during the warranty period, the manufacturer shall promptly repair or replace the defective part at no cost to the owner.

Part 6. Options

6.1 Related Equipment

- A. Panel Mounting Bracket Kit
- B. 36" [915 mm] x ½" [12 mm] stainless steel transducer mounting straps
- C. Bronze or stainless steel isolation valve kit – Insertion probe transducer only
- D. Portable installation crank – Insertion probe transducer only

Part 7. Spare Parts

7.1 Recommended Spare Parts

- A. Dow 111 silicone grease (for temperatures lower than 160 degrees F or 70 degrees C) – Clamp-on transducer only
- B. Sonotemp grease (for temperatures to 400 degrees F or 200 degrees C) – Clamp-on transducer only