

Series TFXB Ultra

Transit Time Ultrasonic Flow Meter, Clamp-on, Liquid, Single-Channel

Part 1. General

1.1 Scope

- A. This section describes the requirements for an ultrasonic flow measurement transmitter plus transducers.
- 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. Installation and Operations manual
 - 4. List of spare parts

Part 2. Products

2.1 Transit Time Ultrasonic Flow Meter

- A. The transit time ultrasonic flow measurement system shall be a digital signal processing (DSP) based transit time (time of flight) 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 set that is either integrally connected or remotely connected by up to 990 feet [300 meters] of cable.
- B. Certifications
 - a. Class I Division 2 Groups C, D T6 Hazardous Areas

- b. Class I Zone 2 EEx nA IIB T6 Hazardous Areas
- c. CE certification to IEC 61326-1
- d. CIP™ Common Industrial Protocol certification

C. Operating principle: Two ultrasonic transducers function as both transmitters and receivers. Flow measurement is made by measuring the difference time of flight between two digitally synthesized contra propagating acoustic chirps traveling between the two ultrasonic transducers positioned lineally, a known distance apart, on the outside of a closed pipe. Difference time is proportional to fluid velocity, with system Reynolds Number, pipe roughness and speed of sound correction factors applied.

D. Transducer:

1. Primary Sensor: The compression-mode acoustic transducer shall contain a polarized PZT crystal with impedance matched wave-guide.
 - a. Standard transducers shall operate on pipe sizes ranging from 2” through 100” [50 through 2540 mm] and have a center frequency of 1 MHz.
 - b. Large pipe transducers shall operate on pipes larger than 24” [600 mm] and have a center frequency of 0.5 MHz.
 - c. Small-pipe transducers shall operate on pipe sizes from 1/2” through 2” [12 through 50 mm], are specific to a pipe outside diameter and have a center frequency of either 1 or 2 MHz. Small-pipe transducer can be integrally mounted with the transmitter enclosure or remotely connected with coaxial cable.
 - d. Transducer housing shall be constructed from PVC, CPVC, PTFE, Ultem® and/or Vespel®.
 - e. Transducers shall be rated for a Type 6 [IP 67] environment.

- f. PVC transducers shall have continuous operating temperature of -40° to 185°F [-40° to +85° C]
- g. CPVC transducers shall have continuous operating temperature of -40° to 250°F [-40° to +121° C]
- h. PTFE transducers shall have continuous operating temperature of -40° to 350°F [-40° to +176° C]

E. Transmitter

- 1. Enclosure shall be Type 4; epoxy-coated aluminum, stainless steel and polycarbonate construction.
- 2. Power supply shall be 95-264 VAC @ 47-63 Hz or 10-28 VDC
- 3. AC power consumption shall be 17 VA maximum and DC power consumption shall be 5 VA maximum
- 4. Operating temperature shall be -40° to 185° F [-40° to 85° C]
- 5. Outputs:
 - a. 4-20ma; 12-bit resolution, internally powered, can span negative to positive flow rates; test function allows simulated flow output to verify proper installation and span settings on receiving equipment
 - b. Pulse rate output, 0-1,000 Hz, 12-bit resolution, open-collector and turbine meter simulation, internal/external pull-up resistor selection, can span negative to positive flow rates
 - c. Control outputs; 2 independently configurable open-collector outputs, can be configured as flow rate alarm, signal

strength alarm, error alarm or totalizer pulse;
internal/external pull-up resistors selection

6. Industrial Communications (native):
 - a. RS485, 1/4-node, 126 units/network; Modbus RTU protocol
 - b. 10/100 Base-T Ethernet (ODVA™ CIP™ Compliant); Modbus TCP/IP and BACnet®/IP protocols
7. Control and Programming:
 - a. All parameter and commands shall be entered via a personal computer, Windows® software utility and standard USB A/B cable. Windows utility permits flow meter configurations to be saved and recalled.
 - b. Firmware shall up field upgradeable via the USB connection
 - c. Optional 4-key keypad
8. Transmitter shall output a digitally synthesized waveform from a discrete, field uploadable file.
9. Measurements shall be made by measuring differential time of contrapropogating waveforms using cross-correlation of data sets. Automatic Reynolds Number and pipe roughness corrections are applied.

F. Transmitter and Transducer Performance

1. Measuring range –40 to +40 FPS [-12 to +12 MPS]
2. Accuracy shall be ±1% of reading at rates > 1 FPS [0.3 MPS]
3. Repeatability: 0.5% of reading
4. Sensitivity is 0.001 FPS [0.0003 MPS]

5. Maximum separation between transmitter and transducer shall be 990 feet

G. 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 backlit with white LEDs.
2. Indicators for Run and Program modes and Relay 1 and Relay 2 status

H. Equipment

The transit time ultrasonic flow meter shall be a Dynasonics Series DTFXB transmitter and Dynasonics Series DTTN (standard temperature multi-size pipe), DTTH (high temperature multi-size pipe) or DTTS (standard temperature small-pipe) ultrasonic transducer.

I. PC Software

A software utility can be utilized to configure, calibrate, backup and conduct diagnostics on the flow meter. The software shall be compatible with Windows 95, Windows 98, Windows 2000, Windows 2000, Windows XP, Windows Vista® and Windows 7 operating systems.

Part 3. Operator Functions

3.1 Calibration/Verification

- A. Flow meter calibration data shall be entered via a personal computer, Windows® software utility and USB A/B programming cable. No additional equipment shall be required.
- 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 output, via USB port, flow rate, positive, negative and net flow accumulations and diagnostic data.
- B. A local display shall display flow rate and total accumulated flows.
- 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 USB port or optional keypad.
- E. The flow meter shall be capable of zero to full scale 4-20 mA output simulation to assure proper operation with receiving equipment.
- F. There shall be no internal potentiometers used in programming or adjusting the transmitter.
- G. The power to operate the transducers shall come solely from the transmitter over the transducer interconnection cable.
- H. If the flow meter is equipped with dual control signal outputs it shall be programmable for rate of flow, batch/total accumulation, loss of signal strength or system error.
- I. The flow meter shall have a FLASH memory and shall not require a battery to ensure protection of stored data.
- J. Flow meter shall provide automatic Reynolds Number, pipe roughness and speed of sound compensation.

Part 4. Execution

4.1 Installation

- A. Follow manufacturer's recommendation upstream and downstream straight pipe diameters and transducer orientation to achieve optimum performance.
- B. Enter pipe and liquid configuration information into the flow meter. The flow meter will calculate transducer separation from the data entered.

- C. Mount the transducers onto the pipe at the calculated separation distance – if required.
- 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. USB A/B cable
- B. Transducer mounting track: 10” or 16” transducer separation
- C. 10/100 Base-T Ethernet (native)
- D. Keypad

Part 7. Spare Parts

7.1 Recommended Spare Parts

- A. Acoustic couplant
- B. 0.5 A Time Lag Fuse (AC powered units only)