Series TFXE Ultra

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

Part 1. General

1.1 Scope

A. This section describes the requirements for an ultrasonic energy/flow measurement transmitter plus transducers.

B. Under this item, the contractor shall furnish and install the energy 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 transducers
2. Interconnection and dimensional drawings
3. Installation and Operations manual
4. List of spare parts

Part 2. Products

2.1 Transit Time Ultrasonic Energy/Flow Meter

A. The transit time ultrasonic energy/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 liquid thermal energy and/or flow delivered/utilized in closed systems as may be required. It shall consist of a transmitter, flow transducer set that is either integrally connected or remotely connected by up to 990 feet [300 meters] of cable and temperature sensor set.

B. Certifications

a. Ordinary Area

b. CE certification to IEC 61326-1

c. CIP™ Common Industrial Protocol certification

C. Operating principle: Two ultrasonic transducers function as both transmitters and receivers. Volumetric 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. Energy measurement is provided by integrating supply and return difference temperature with system mass flow, including compensation for the specific heat capacity of the fluid.

D. Transducers:

1. Flow Transducers: 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]

2. Temperature Transducers

a. Temperature sensors shall be class A or B, 1,000 ohm, 3-wire, TCR 0.00385 platinum RTD devices

b. Insertion or surface mount RTDs shall be acceptable

E. Transmitter

1. Enclosure shall be Type 4 rated; 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 energy/flow rates; test function allows simulated energy/flow output to verify

proper installation and span settings on receiving equipment

6. Industrial Communications (native):

   a. RS485, ¼-node, 126 units/network; Modbus RTU protocol

   b. 10/100 Base-T Ethernet, RJ45 connection, (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 permits entry of standard configuration parameters

   d. 10/100 Base-T Ethernet communication port shall contain an integrated HTML application utilized for configuration of the Ethernet port

8. For the purpose of flow measurement, the transmitter shall output a digitally synthesized waveform from a discrete, field up loadable file.

9. Transmitter shall permit individual calibration of RTDs

10. Flow 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. Energy measurements will integrate flow, difference temperature and specific heat capacity parameters.

11. Rate and accumulated measurement units shall be user selected. Flow measurement units will include: gallons, ft3, barrels, lbs., m3, liters and kg. Energy measurement units shall include: tons, BTU, MBTU and MMBTU.

F. Transmitter and Transducer Performance

1. Flow measuring range –40 to +40 FPS [-12 to +12 MPS]; accuracy shall be ±1% of reading at rates > 1 FPS [0.3 MPS]

2. Temperature measuring ranges between -40 and +350 F [-40 and +177 C] shall be accommodated, with difference temperature accuracy to 0.09 F [0.05 C]

3. Repeatability: 0.5% of reading

4. Sensitivity is 0.001 FPS [0.0003 MPS]

5. Maximum separation between transmitter and transducers 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

H. Equipment

The transit time ultrasonic energy/flow meter shall be a Dynasonics Series DTFXE transmitter and Dynasonics Series DTTN (standard temperature multi-size pipe), DTTH (high temperature multi-size pipe) or DTTS (standard temperature small-pipe) ultrasonic transducer. Dynasonics offers pre-wired RTD kits in both clamp-on and insertion configurations.

I. PC Software

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

Part 3. Operator Functions

3.1 Calibration/Verification

A. Energy/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 energy/flow meter.

3.2 Transmitter Function Details

The following functions shall be provided:

A. The energy/flow meter shall output, via USB port, flow rate, positive, negative and net flow accumulations and diagnostic data.

B. A local display shall display energy/flow rate and total accumulated energy/flows. Supply and return temperature readings can be accessed.

C. The flow transducers and transmitter shall transmit and receive acoustic signals to accurately measure liquid flow rate.

D. The flow and temperature transducers and transmitter shall permit the accurate measurement of liquid thermal energy delivered.

E. Operational range shall be adjustable by entering new data via USB port or optional keypad.

F. The flow meter shall be capable of zero to full scale 4-20 mA output simulation to assure proper operation with receiving equipment.

G. There shall be no internal potentiometers used in programming or adjusting the transmitter.

H. The power to operate the transducers shall come solely from the transmitter over the transducer interconnection cable.

I. The energy/flow meter shall have a FLASH memory and shall not require a battery to ensure protection of stored data.

J. Energy/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 energy/flow meter. The meter will calculate transducer separation from the data entered.

C. Mount the transducers onto the pipe at the calculated separation distance – if required. Additional cable for the transducers shall be RG59 coaxial. All connections shall be 75 Ohm.

D. Mount the temperature transducers onto the supply and return pipes.

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)