# Series DFX

**Doppler Ultrasonic Flow Meter, Clamp-on, Liquid, Single-Channel**

# Part 1. General

* 1. **Scope**
     1. This section describes the requirements for an ultrasonic flow measurement transmitter plus transducers.
     2. Under this item, the contractor shall furnish and install the flow measurement equipment and accessories as indicated on the plans and as herein specified.

# Submittals

* + 1. 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

* 1. **Doppler Ultrasonic Flow Meter**
     1. The Doppler ultrasonic flow measurement system shall be a microprocessor based Doppler 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 connected by up to 990 feet [300 meters] of cable.
     2. Transducer:
        1. Operating principle: Doppler flow meters utilize two piezoelectric crystals contained within two transducer heads to transmit ultrasonic waves into the fluid stream and receive reflected waves from reflectors (suspended solids or entrained gases) within the liquid. If the liquid is moving (and therefore carrying the reflectors with it), the reflected wave’s frequency of oscillation will be altered with respect to the transmitted frequency. The magnitude of frequency change is directly proportional to the velocity of the reflector.
        2. Primary Sensor: The compression-mode acoustic transducer shall contain a PZT (Lead, zirconium, titanate) crystal with impedance matched wave-guide.  
           1. Standard clamp-on transducers shall operate on pipe sizes ranging from 1 to 120 inch [25 to 3050 mm]
           2. Small-pipe clamp-on transducers shall operate on pipe sizes ranging from ¼ to 1 inch [6 to 25 mm]
           3. Standard operating temperature shall be -40o to 194oF [-40° to +90° C]
           4. Optional operating temperature shall be -40o to 400oF [-40° to +204° C]
     3. Transmitter
        1. Enclosure shall be NEMA 4X polycarbonate
        2. Power supply shall be 115/230 VAC 50/60 Hz +/- 15% @ 17 VA max; 12-28 VDC @ 7 VA max
        3. Operating temperature shall be -40o to 185o F [-40o to 85o C]
        4. Input/output options: The transmitter shall accept up to two input/output options to be installed. Input/output options are field installable and replaceable.
           1. 4-20mA: 800 ohms max; internal or external power supply; 12 bit resolution
           2. Dual Relay: independent form C, 200 VAC @ 0.5 A resistive
           3. Rate Pulse: two output types – 500 mV AC or open collector; 2,500 Hz max; 12 bit resolution
        5. Control and Programming

All parameter and commands shall be entered via a 4-key keypad.

* + - 1. Measurements shall be taken by measuring the frequency shift between sent and received ultrasonic sound energy that has reflected off suspended solids or entrained gas in a fluid stream
    1. Transmitter and Transducer Performance
       1. Measuring range 0.15 to 30 FPS [0.05 to 9 MPS]
       2. Accuracy shall be ±2% of full scale, over calibrated span
       3. Maximum separation between transmitter and transducer shall be 990 feet
    2. Indication
       1. 2 line by 8 character LCD; LED backlighting; Top row 7-segment 0.7 inch; Bottom row 14-segment 0.35 inch; 8 digit rate & total (resettable)
    3. Equipment
       1. The Doppler ultrasonic flow meter shall be a Dynasonics Series DFXD transmitter and Dynasonics Series DT94 (standard temperature, standard pipe), DT95 (standard temperature, small pipe), DT96 (high temperature, standard pipe), DT97 (high temperature, small pipe) ultrasonic transducer.

# Part 3. Operator Functions

* 1. **Calibration**
     1. Flow meter calibration data shall be entered via a 4-key keypad. No additional equipment shall be required.
     2. Internal self-diagnostics shall be available to assist in installation and maintenance of the flow meter.

# Transmitter Function Details

The following functions shall be provided:

* + 1. A local display shall display flow rate and total accumulated flows.
    2. The transducers shall be mounted at the measuring site and shall be installed in accordance with the manufacturer’s recommendations.
    3. The transducers shall transmit and receive acoustic signals to accurately measure liquid flow.
    4. Operational range shall be adjustable be entering new data via a 4-key keypad.
    5. 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.
    6. There shall be no internal potentiometers or switches used in programming or adjusting the transmitter.
    7. The power to operate the transducers shall come solely from the transmitter over the signal interconnection cable.
    8. If the flow meter is equipped with dual alarm relays it shall be programmable for rate of flow, batch/total accumulation, loss of signal strength or system error.
    9. The flow meter shall have a FLASH memory and shall not require a battery to ensure protection of stored data.

# Part 4. Execution

* 1. **Installation**
     1. Follow manufacturer’s recommendation upstream and downstream straight pipe diameters and transducer orientation.
     2. Enter pipe and liquid configuration information into the flow meter.
     3. Additional cable for the transducers shall be RG59 coaxial or twinax. All connections shall be 75 Ohm.

# Part 5. Warranty

* 1. **Terms**
     1. 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.

* + 1. 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

* 1. **Related Equipment**
     1. 36” [915 mm] x ½” [12 mm] stainless steel mounting straps
     2. Dow 111 silicone grease

# Part 7. Spare Parts

**7.1 Recommended Spare Parts**