

SCOPE: This specification covers a Clamp-On Transit-Time Ultrasonic Flow Meter as manufactured by Greyline Instruments, Largo, Florida / Long Sault, Ontario. The meter shall provide for non-intrusive flow measurement, direction indication, volume totalizing, and transmitting of the flow rate in a full pipe.

1. PERFORMANCE SPECIFICATIONS

- 1.1 The ultrasonic flow meter shall have an accuracy of $\pm 1\%$ of reading or ± 0.015 ft/sec (± 0.0046 m/sec), whichever is greater. Have repeatability and linearity of $\pm 0.25\%$.
- 1.2 Shall operate on relatively clean liquids in full pipes with less than 2% solids or gas bubbles at flow velocities from ± 0.07 to 40 ft/sec (± 0.02 to 12 m/sec).
- 1.3 Operate on any metal, or plastic, sonic conducting material including carbon steel, stainless steel, ductile iron, concrete lined ductile iron, cast iron, PVC, PVDF, fiberglass, galvanized steel, copper, brass and pipes with bonded liners including epoxy, rubber and Teflon.
- 1.4 The ultrasonic flow meter shall be optimized and pre-programmed for the application when information like pipe material, pipe size, wall thickness, fluid type, fluid temperature, and max flow rate are provided at time of order.

2. TRANSDUCERS (FLOW SENSORS)

- 2.1 The flow meter shall have a dual transmitting/receiving, clamp-on transducers.
- 2.2 The transducers shall operate continuously at temperatures from -40°F to 300°F (-40°C to 150°C).
- 2.3 The standard transducer pair shall be designed to install on pipes with inside diameter ranging from 2" to 48" (50 mm to 1200 mm).
- 2.4 Have 25 ft (7.6 m) length triaxial cables from the electronics with BNC connectors to transducers.
- 2.5 Shall include manufacturer's recommended sensor coupling compound. Shall include stainless steel mounting hardware with pipe clamps.
- 2.6 Shall include BNC seal jackets for transducer operation in wet or submerged conditions up to 10 psi (0.75 bar).
- 2.7 Transducers shall be rated non-incendive for Class I, Division 2, Groups A, B, C & D locations.

3. ELECTRONICS

- 3.1 The electronics shall be housed in a watertight and dust tight NEMA4X (IP 66) polyester and polycarbonate enclosure with a gasketed shatter proof window, and suitable for wall mounting.
- 3.2 Flow meter electronics shall be designed to operate at temperatures from -5°F to 140°F (-20°C to 60°C). The transmitter circuit and calibration frequency standard shall be crystal controlled. The transmitter shall be powered by 100-240VAC 50/60Hz requiring less than 10VA.
- 3.3 The transmitter shall include a built-in 5-Key calibration system with operator selection of parameters through visual prompts from a Menu calibration system. Systems requiring calibration by Parameter codes or external calibrators shall not be accepted.

- 3.4 The 4-20mA shall be flow proportional and isolated, with programmable zero and full-scale offsets. Maximum resistive load shall be 1000 ohms. It shall include automatic high voltage bleeds for nearby lightning strikes.
- 3.5 Electronics shall include noise suppression circuitry to filter electrical interference.
- 3.6 Electronics shall have a white, backlit matrix LCD display indicating flow rate in user-selected engineering units, units of calibration, relay states, signal strength, measured fluid speed of sound, and 14-digit totalizer.
- 3.7 Electronics shall have 2 control relays rated 5 amps SPDT. Relays shall be programmable for flow proportional pulse output, or as flow rate alarms with separate ON/OFF set points.
- 3.8 Electronics shall display and totalize forward and reverse flow.
- 3.9 Electronics shall have built-in data logger capable of storing up to 128MB of data. Data can be downloaded to flash drive via USB type-A port on the meter's front panel.
- 3.10 Electronics shall be modular and field replaceable by means of plug-in circuit boards. The instrument shall detect and load software menus automatically for field-installed options.

4. OPTIONAL FEATURES FOR INSERTION IN SPECIFICATION AS REQUIRED:

- 4.1 Transducer cables shall be 50 ft (15m) length triaxial with BNC transducer connections.
- 4.2 Transducer cables shall be 100 ft (30m) length triaxial with BNC transducer connections.
- 4.3 Transducer cable shall be extended length shielded triaxial pair up to 500 ft (150 m) with NEMA4X (IP 66) Junction Box.
- 4.4 Electronics shall include a MODBUS RTU output via RS-485. Data points shall include flow rate, flow total, previous day's average flow rate, previous day's volume total, totalizer reset, relay output status, signal strength, measured fluid speed of sound, run time, transducer connection status, logger status, and percent log used.
- 4.5 Transducers shall be rated Intrinsically Safe for Class I, Division 1, Groups C and D; Class II, Groups E, F and G; Class III; Type 4 hazardous locations.
- 4.6 Electronics shall have a thermostatically controlled AC-powered enclosure heater for condensation protection in locations with temperature below -5°F (-20°C).
- 4.7 Electronics shall have power input of 9-32VDC requiring less than 10 Watts.
- 4.8 Electronics shall have 4 additional (6 total) control relays, rated 5 amps SPDT and programmable for flow rate alarms or flow totalizer pulse.

5. MANUFACTURER

The instrument shall be a Model TTFM 6.1 Clamp-On Transit-Time Flow Meter as manufactured by Greyline Instruments, and warranted against defects in materials and workmanship for one year.