

SCOPE: This specification covers a clamp-on, ultrasonic Doppler flow meter, as manufactured by Greyline Instruments Inc., Largo, Florida / Long Sault, Ontario. The meter shall provide for non-intrusive velocity or flow measurement, direction indication, and transmitting of the flow rate in a full pipe.

1. PERFORMANCE SPECIFICATIONS

- 1.1 The flow meter shall operate with a single-head flow sensor mounted externally on any contiguous pipe material that conducts sound including but not limited to: carbon steel, stainless steel, ductile iron, cement lined ductile iron, copper, FRP, PVC, or ABS pipe from 1/2" to 180" (12.5 mm to 4.5 m) ID.
- 1.2 Measure and indicate flow rates from +0.1 to +40 ft/sec and -0.1 to -40 ft/sec (+0.03 to +12.2 m/sec and -0.03 to -12.2 m/sec) with accuracy of $\pm 2\%$ of reading or ± 0.1 ft/sec, whichever is greater, on liquids with entrained particles or gases of 100 microns or larger and minimum concentrations of 75 ppm.

2. TRANSDUCER (FLOW SENSOR)

- 2.1 The flow sensor shall be single-head, ultrasonic in a stainless steel housing. It shall be installed on the outside of a pipe without interrupting flow. The sensor shall be capable of continuous operation at temperatures from -40°F to 300°F (-40°C to 150°C), and able to withstand accidental submersion pressures to 10 psi. Manufacturer's recommended coupling compound and stainless steel mounting clamp shall be included.
- 2.2 Shall include 25 ft (7.6m) sensor cable, shielded coaxial pair.
- 2.3 Shall be capable of extending sensor cable up to 500 ft (152m) without requirement for operator adjustment.
- 2.4 Shall be transformer isolated and designed to meet intrinsic safety requirements. Shall be designed and CE tested for maximum industrial noise rejection.
- 2.5 Sensor shall be rated Non-incendive for Class I, Division 2, Groups A, B, C & D locations.

3. TRANSMITTER

- 3.1 The transmitter indicator shall be housed in a watertight and dust tight NEMA4X (IP 66) polyester and polycarbonate enclosure with a gasketed shatter proof window, suitable for wall mounting.
- 3.2 Flow meter electronics shall be designed to operate at temperatures from -10°F to 140°F (-23°C to 60°C). Electronic circuits are interchangeable with other flow meters having the same model number. The transmitter circuit and calibration frequency standard shall be crystal controlled. The transmitter shall be powered by 100-240VAC 50/60Hz requiring less than 10 VA.
- 3.3 The transmitter shall include a built-in 5-Key programming system with operator selection of parameters through visual prompts from a menu system. Systems requiring programming by parameter codes or external calibrators shall not be accepted.

- 3.4 The 4-20mA output shall be flow proportional and isolated, with programmable zero and full scale offsets. Maximum resistive load shall be 1000 ohms.
- 3.5 Shall include noise suppression circuitry to filter electrical interference, and shall be tested for industrial noise immunity for CE certification, European Directive 2014/30/EU.
- 3.6 Shall be certified to UL/CSA/EN 61010-1.
- 3.7 Have a white, backlit matrix LCD display indicating flow rate and total in user-selected engineering units, relay states, and important diagnostics like signal strength.
- 3.8 Have 2 SPDT control relays rated 5 ampere. Relays shall be programmable for flow proportional pulse output, or as flow rate alarms with separate ON/OFF set points.
- 3.9 Shall display and totalize forward and reverse flow.
- 3.10 Have a built-in 26 million point data logger with USB output to flash drive or mass storage device. Includes Windows software for plotting and exporting.
- 3.11 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. ADDITIONAL FEATURES FOR INSERTION IN SPECIFICATION AS REQUIRED:

- 4.1 Sensor shall be rated intrinsically safe to Class I, Groups C,D; Class II, Groups E,F,G; Class III with Intrinsic Safety Barriers.
- 4.2 Sensor cable shall be 50 ft (15m) length shielded coaxial pair.
- 4.3 Sensor cable shall be 100 ft (30 m) length shielded coaxial pair.
- 4.4 Have a Sensor Cable Junction Box and up to 500 ft (152m) length total shielded coaxial pair cable installed in conduit for mechanical protection.
- 4.5 Have a thermostatically controlled AC-powered enclosure heater for condensation protection in locations with temperature below -10°F (-23°C).
- 4.6 Have power input of 9-32VDC, 10 Watts maximum.
- 4.7 Transmitter shall have serial communications for flow rate, total, previous day average flow rate, previous day volume total, and diagnostic values. Field selectable between Modbus® RTU via RS-485 or HART (Highway Addressable Remote Transducer).

5. MANUFACTURER

The instrument shall be a Model DFM 6.1 Doppler Flow Meter as manufactured by Greyline Instruments Inc., and warranted against defects in materials and workmanship for one year.