SCOPE: This specification covers an ultrasonic, area-velocity flow monitor as manufactured by Pulsar Measurement, Malvern, UK / Largo, Florida / Long Sault, Ontario. The instrument shall provide for indicating, transmitting, totalizing, and logging of the flow rate through partially filled or surcharged round pipes, and rectangular, trapezoidal, egg or irregular shaped open channels.

1. GENERAL

1.1 Flow meter to consist of a submersible ultrasonic sensor, connecting cable, and remote enclosure with indicating, logging, totalizing, transmitting and controlling electronics. System shall have no moving parts

1.2 Level measurement accuracy shall be ±0.25% of reading or ±0.08”, whichever is greater. Repeatability & Linearity 0.1%. Velocity measurement accuracy shall be ±2% of reading or ±0.04 ft/sec, whichever is greater. Requires solids or bubbles minimum size of 100 microns, minimum concentration 75ppm. Repeatability & Linearity 0.5%.

2. TRANSDUCER (SENSORS)

2.1 Ultrasonic sensor shall be rated for continuous submersion up to 15 feet (4.57 meters).

2.2 Using the Doppler principle, the sensor shall measure fluid velocities from 0.1 to 20 ft/sec (0.03 to 6.2 m/sec) and reverse flow to -5 ft/sec (-1.5 m/sec).

2.3 Using ultrasonic echo-ranging principle, the submerged sensor shall measure liquid level from 1" to 15 ft. (25.4 mm to 4.57 m).

2.4 Level sensing circuitry shall include a temperature sensor for automatic temperature compensation.

2.5 Sensor shall be constructed of 316 stainless steel and epoxy resin.

2.6 Sensor operating temperature shall be 5°F to 175°F (-15°C to 80°C).

2.7 Shall include manufacturer's recommended stainless steel sensor mounting bracket.

3. SENSOR CONNECTING CABLE

3.1 Provide minimum length 25 ft (7.6 m) tri-coaxial cable with potted bond to the Sensor head. Sensor cable shall be waterproof and electrically shielded. Exposed material shall only be polyurethane.

3.2 Extended sensor cable shall be shielded tri-coaxial to a maximum length of 500 ft (152m). Cable shall be spliced with screw terminal connections in manufacturer’s recommended steel 4 NEMA Junction Box.

4. TRANSMITTER

4.1 The transmitter shall provide for field calibration to round pipes and open channels of any shape.

4.2 Configuration shall be via built-in 5-key calibration system with menu selection of parameters. Systems requiring calibration by Parameter codes, switches or external calibrators shall not be BCD accepted.

4.3 Configuration data shall be password protected and permanently stored through power interruptions for a minimum of 12 months.

4.4 Field configuration shall allow selection and automatic conversion of measurement units, measurement span, high/low flow alarm relay and flow proportional relay pulse rates.

4.5 Transmitter shall permit independent field programmable damping of both the level and velocity to smooth output in turbulent flow conditions

4.6 Transmitter operating temperature shall be from -5° to 140°F (-20° to 60°C). Transmitter shall contain a thermostat-controlled enclosure heater for condensation protection below 30°F (-1°C).

4.7 Transmitter shall have three isolated 4-20mA outputs rated for 1000 ohm maximum load with menu-selectable 0-5VDC alternative. Outputs shall be configured to transmit level, velocity and flow.

4.8 Provide two relay contacts rated 5 amp SPDT programmable for flow proportionate pulse to a remote totalizer or sampler, high or low flow alarm, velocity and/or level alarm, and echo loss alarm.

4.9 Provide a white, backlit matrix LCD display indicating flow rate, level, velocity, relay states, 14-digit totalizer in user-selected engineering units and multiplier, logger status, and sensor status.

4.10 Transmitter display indicating flow rate, units of calibration, totalizer, relay states, logger status, and sensor status shall be visible without opening cover.

4.11 Have a built-in 26 million point data logger with USB output to flash drives or mass storage devices. Data logger shall support time and date-stamped logging and generate formatted flow reports including total, average, minimum, maximum and times of occurrence. Include Windows software for data log graphing and export.

4.12 Meter shall store the minimum, maximum, and daily total flow for the last 365 days. This data can be downloaded directly to flash drives or mass storage devices for easy reporting.

4.13 Configuration parameters can be downloaded by invoking menu selection. Parameters download directly to flash drive or mass storage device.

4.14 Level and Doppler signals can be downloaded to flash drive or mass storage device, for diagnostic purposes, by invoking menu selection.

4.15 Transmitter shall be housed in a wall-mount, watertight NEMA4X (IP66) enclosure with hinged, clear cover. Mounting hardware shall be included.

4.16 Transmitter electronics shall be surge protected on AC power input, sensor, and 4-20mA outputs.

4.17 Transmitter power input shall be 100-240VAC 50-60Hz with power consumption of 10VA or less.

4.18 The transmitter shall permit plug-in field installation and autodetection of optional accessories including alternative sensor configurations, serial communications, and additional control relays.

5. OPTIONAL FEATURES FOR INSERTION AS REQUIRED:

<u>Sensors</u>

5.1 Have separate, submerged Doppler velocity sensor, plus a non contacting ultrasonic level sensor mounted above the liquid. Doppler velocity sensor shall be designed for continuous submersion in liquids and rated for fluid velocities from 0.1 to 20 ft/sec (0.03 to 6.2 m/sec) and reverse flow to -5 ft/sec

(-1.5 m/sec). Non-contacting ultrasonic level sensor shall be rated for measurement range from 8" to 15 ft. (203.2 mm to 4.57 m) and shall include integral temperature compensation.

5.2 Sensor cable shall be 50 ft. (15 m) continuous length with potted bond to the Sensor head.

5.3 Sensor cable shall be 100 ft. (30 m) continuous length with potted bond to the Sensor head.

5.4 Sensor and connecting cable shall be rated intrinsically safe to Class I,II,III, Div. I,II, Groups C,D,E,F,G for installation in hazardous locations.

5.5 Sensor shall mount with manufacturer's stainless steel mounting band for specified pipe diameter from 6" to 72" (150 to 1800 mm).

Electronics

5.6 Have a thermostat controlled enclosure heater for Transmitter operation at temperatures below freezing.

5.7 Have manufacturer's recommended enclosure sunscreen to permit Electronics enclosure mounting in direct sunlight.

5.8 Transmitter power input shall be 9-32VDC with minimum power consumption of 10 Watts max.

6. MANUFACTURER Area-Velocity Flow Meter shall be Greyline Model AVFM 6.1 and warranted against defects in materials and workmanship for two years.