SCOPE: This specification covers a portable, ultrasonic area velocity flow meter as manufactured by Pulsar Measurement, Malvern, UK / Largo, FL / Long Sault, Ontario. The battery-powered instrument shall provide for indicating, transmitting, totalizing 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 Monitor to consist of a submersible ultrasonic sensor, connecting cable, and polycarbonate enclosure with indicating, data logging, transmitting and controlling electronics. The system shall have no moving parts.

1.2 Level measurement accuracy shall be ±0.25% of Range. Velocity measurement accuracy shall be ±2% of reading.

2. SUBMERSIBLE SENSOR

2.1 Ultrasonic sensor shall be rated IP68 for continuous submersion in liquids.

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 150°F (-15°C to 65°C). 2.7 Shall include manufacturer's recommended stainless steel sensor mounting bracket.

3. SENSOR CONNECTING CABLE

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

4. ELECTRONICS

4.1 The flow meter shall be powered by internal, rechargeable 12VDC NiMH batteries with 10,000 mAh capacity and maximum power consumption of 2.7 Watts.

4.2 Flow meter electronics shall be housed in a watertight, airtight, dust proof IP67 carry case with lockable, hinged cover.

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

4.4 The portable flow meter shall provide for field calibration to round pipes and open channels of any shape.

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

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

4.7 Flow meter shall permit field programmable damping to smooth output in turbulent flow conditions.

4.8 Flow meter operating temperature shall be from -5° to 140°F (-20° to 60°C).

4.9 Flow meter shall have menu-selectable 4-20mA output rated 500 ohms and 0-5VDC rated 100 mA.

4.10 Provide two solid-state relays, 40V AC/DC max., rated 250mA with maximum frequency of 0.4 Hz. Relays shall be operator-programmable for flow proportionate pulse to a remote totalizer or sampler, high-low flow, velocity and/or level alarm, echo loss alarm.

4.11 The flow meter shall include an external breakout box for ancillary connections including relays, analog outputs and power input.

4.12 The flow meter shall include a built-in 2 million point Data Logger with USB output to flash drives or mass storage devices. The logger shall not require connection to a laptop or PC for data download. The data logger shall support time and date-stamped logging and generate formatted flow reports including total, average, minimum, maximum and times of occurrence which can be viewed on the flow meter display.

5. PC SOFTWARE

5.1 Shall include Windows™ software to retrieve, display, save and export log files from the Level-Velocity Logger. Shall support Windows versions including XP, Vista, 7 and 8. 5.2 Shall display, save, output to a printer and export log files in graph and tabular format. Exported log files shall be delimited for import to Excel™ spreadsheet or database programs. 5.3 Shall permit conversion of linear and volume units.

6. OPTIONAL FEATURES FOR INSERTION AS REQUIRED

6.1 Shall include 50 ft / 15 m length sensor cable extension with watertight connector plugs to permit sensor installation total distance of 75 ft / 23 m from the electronics enclosure. Cable extension shall be shielded and submersible with a durable polyurethane coating.

6. MANUFACTURER

Portable Area-Velocity Flow Monitor shall be Greyline MantaRay, manufactured by Pulsar Measurement, and warranted against defects in materials and workmanship for two years.