



SOLE SOURCE JUSTIFICATION

YSI PROFILER

SYSTEM OVERVIEW

The profiling system shall be designed on a mobile, floating platform, such that it can be moved from one location to another with minimal effort, towed by a small boat. The system should be a proven robust data collection/data telemetry system. It should have the ability to collect both water quality data and meteorological data simultaneously. The system should have the ability to collect these parameters at independent intervals on dedicated data loggers and store this data in the system's internal memory then transmit this data via either cellular, satellite, or RF modem telemetry back to a base-station computer. The system must have a direct connection ability for system communication, data download, system setup, and trouble shooting. The system must be able to automatically compensate for varying water depths by automatically adjusting its program so as not to run the water quality instrument into the lakes bottom. They system should also have user-programmable sample intervals, redundant error recovery logic that detects unexpected activity and recovers automatically.

SYSTEMS SOFTWARE

The automated profiler shall be easily setup using 2 pieces of software. The first piece is a wizard that shall be capable of setting up the profiler's sampling parameters, user defined park depth, sampling depths (steps), and the sampling intervals. The second piece is a program that can communicate directly with the profiler system to upload the system's settings and download data. This piece of software should have the capability to automatically retrieve data from the system at a user defined schedule. There also must be an option for graphical display software, which can accept data files from the profiler for analysis and display in time-series format.

PROFILER SYSTEM SPECIFICS: WATER QUALITY

The automated profiling platform shall have the ability to meet the following specifications:

Minimum Profile Depth: 1 m

Maximum Profile Depth: 100 m

Depth Profile Setpoint Accuracy: ± 0.1 m

Maximum Profile Frequency: ~50% of duty cycle

Standard Payload: 1 Water Quality Sensor equipped with depth sensor

Cable Options: 50 m & 100 m

Profile Direction: Up or down and parks at any depth

Reference Point: Uses top and bottom reference points for software controlled positioning

Beyond these specifications the system must be equipped with submersible, watertight enclosures for all electronics. The cable reel/winch mechanism and drive mechanism must be manufactured of rugged, non-corrosive materials. The system must also incorporate a level-wind system to evenly distribute the systems sensor cable to prevent any fouling or tangling of the line. The winch mechanism must have a payload of at least 20lbs. The system shall have an onboard power supply that is self replenishing via solar recharging.

The system shall be equipped with meteorological devices capable of measuring wind speed and direction, barometric pressure, precipitation, solar radiation, and air temperature.



PROFILER SYSTEM SPECIFICS: WATER QUALITY

The system shall be capable of interfacing with a water quality sensor that is capable of measuring depth, temperature, conductivity, Salinity, Specific Conductance pH, pH/ORP, Total Dissolved Solids, Total Suspended Solids, optical dissolved oxygen, turbidity, chlorophyll, Blue Green Algae (PC & PE), fDOM. The water quality sensor may have the option to be equipped with copper/ brass based anti-fouling protection. The water quality sensor shall meet the following specifications:

- The instrument shall be capable of operating in water depths up to 100 meters.
- The instrument shall not exceed 3" in diameter, 28" in length and 5.83 lbs. in weight.
- The instrument shall be capable of operating in a self-powering mode from an internal power supply using a set of four (4) "D" cell batteries for 90 days or more with a full sensor payload at a 15 minute sampling interval.
- The instrument shall also have the capability of being powered by an external 12VDC-power supply through an interface cable. Batteries shall be removable via an external hatch without opening the Sonde.
- The battery compartment must be sealed and protected by a safety device that protects the operator from a gas pressure build-up in the battery compartment.
- The instrument shall have, as a standard, 512 megabytes of non-volatile flash disk memory capable of storing >1,000,000 individual readings as a standard. Loss of battery power shall not cause loss of memory, and a memory backup battery shall not be required.
- The instrument shall be capable of having connectorized, wet pluggable, field replaceable probes for the temperature, conductivity, optical dissolved oxygen, turbidity, chlorophyll, Blue Green Algae, fDOM. These sensors shall be capable of being removed without opening the Sonde or exposing the internal electronics to the environment.
- All sensors must be cleaned by a centralized mechanical wiper for anti-fouling protection and improved data quality.



PROFILER SYSTEM SPECIFICS: WATER QUALITY

- The instrument shall have the capability of being supplied with a dissolved oxygen sensor that employs the Luminescent “Life Time” Dissolved Oxygen measurement technique. This sensor shall be capable of measuring dissolved oxygen in the range of 0-50 mg/l; range of 0 - 500% saturation with a response time $T_{63} < 5\text{sec}$ under all or zero flow conditions without the use of a stirring device. In addition the sensor must be able to measure dissolved oxygen in the range of 0 - 50 mg/l with an accuracy spec at this range of **0 to 200%: $\pm 1\%$ of reading or 1% saturation**, w.i.g.; **200 to 500%: $\pm 5\%$ of reading**, **0 to 20 mg/L: ± 0.1 mg/L or 1% of reading**, w.i.g.; **20 to 50 mg/L: $\pm 5\%$ of reading**.
- The instrument shall be capable of having a non-vented characterized depth sensor capable of measuring in the range of 0 - 100 meters of water with an accuracy of $\pm 0.04\%$ FS (± 0.04 m or ± 0.13 ft)
- The output shall be capable of being displayed in Feet or Meters.
- The instrument shall be capable of measuring temperature using a Thermistor in the range of -5 to 35°C, 35 to 50°C with an accuracy of $\pm 0.01^\circ\text{C}$, $\pm 0.05^\circ\text{C}$
- The output shall be capable of being displayed in Celsius, Fahrenheit, or Kelvin.
- The instrument shall be capable of measuring conductivity using a four nickel electrode cell in the range of 0 to 200 mS/cm with an accuracy of **0 to 100: $\pm 0.5\%$ of reading or 0.001 mS/cm**, w.i.g.; **100 to 200: $\pm 1\%$ of reading** and a resolution of 0.001 to 0.1 mS/cm.
- The output shall be capable of being displayed in mS/cm or $\mu\text{S/cm}$.
- The conductivity sensor shall be capable of measuring over the entire range (0-200 mS/cm) without changing the cell constant.
- The instrument shall be capable of measuring pH in the range of 0-14 with an accuracy of ± 0.1 and a resolution of 0.01 using a combination electrode with a gel filled reference electrode.
- The instrument shall have the capability of being supplied with Nephelometric-type turbidity probe capable of measuring turbidity in the 0 - 4000 NTU range with an accuracy of $\pm 2\%$ of reading or 0.3 NTU's (whichever is greater) in YSI AMCO-AEPA Polymer standards. Resolution of 0.01 NTU's. 0 to 999 FNU = 0.01 FNU; 1000 to 4000 FNU = 0.1 FNU.



PROFILER SYSTEM SPECIFICS: WATER QUALITY

- The instrument shall be supplied with a user-friendly software program providing communication and data processing. The software program shall be capable of exporting data in comma and quote delimited and ASCII formats.
- All sensor ports shall be equipped with Impulse style, wet-mateable connectors.
- The instrument shall include as standard RS-485 and SDI-12 communication interface.
- The system shall be equipped with Blue-tooth communications for bench-top and lab calibrations, data download, setup, and real-time data viewing.

The profiling system must be proven technology with a minimum of 10 referenced systems with at least 2 years in service.

PROFILER SYSTEM SPECIFICS: METEOROLOGICAL

The automated profiling system shall have the capability to interface with Meteorological Sensors. It shall be able to setup sampling of these sensors via the supplied Wizard software.

- Anemometer:
 - Range: Wind speed: 0-100 m/s (224 mph) Azimuth: 360° mechanical, 355° electrical (5° open)
 - Accuracy: Wind speed: ± 0.3 m/s (0.6 mph) or 1% of reading Wind direction: ± 3 degrees
- Barometer:
 - Range: 500 to 1100 hPa (mBar)
 - Accuracy: ± 0.3 mb (@ +20°C); ± 0.6 mb (@ 0° to 40°C); ± 1.0 mb (@ -20° to +45°C); ± 1.5 mb (@ -40° to +60°C)
 - Linearity: ± 0.25 mb
 - Hysteresis: ± 0.03 mb
 - Repeatability: ± 0.03 mb



PROFILER SYSTEM SPECIFICS: METEOROLOGICAL

- Relative Humidity/Temperature:
 - Range Temp: -40° to +60°C
 - Accuracy Temp @ +23c: $\pm 0.2^{\circ}\text{C}$
 - Range RH: 0 to 100% RH (non-condensing)
 - Accuracy RH at -15° to +40°C: $\pm (1.3 + 0.003 \cdot \text{RH reading}) \% \text{ RH}$ (0 to 90% RH) $\pm 2.3\%$ RH (90 to 100% RH)
 - Accuracy RH at -25° to +60°C: $\pm (1.4 + 0.01 \cdot \text{RH reading}) \% \text{ RH}$
 - Accuracy RH at -40° to +60°C: $\pm (1.5 + 0.015 \cdot \text{RH reading}) \% \text{ RH}$
- Pyranometer:
 - Sensitivity: Typically 75 μA per 1,000 W m⁻²
 - Linearity: Maximum deviation of 1% up to 3,000 W m⁻²
 - Response Time: Less than 1 μs (2 m cable terminated into a 147 Ohm load)

PROFILER SYSTEM SPECIFICS: SCADA INTEGRATION

The profiler system shall be capable to have an option to integrate into a customer's existing SCADA system via MODBUS RTU or TCP/IP. The profiling system shall be capable to have the feature added to be able to either directly communicate or remotely transmit data via telemetry to a customer's SCADA system utilizing either of the before mention protocols. The data should have the ability to be transmitted to customer define registers at a customer defined interval.

