

BRIEF DESCRIPTION OF THE RAPID SILTPROFILER SYSTEM

Primary purpose of the SiltProfiler is to rapidly acquire detailed profile data of silt concentration and salinity in surface water. The SiltProfiler is operated without electrical cables; all communication is wireless. Have no cables there much more operational freedom and less risk of failure due to cables getting entangled in the propeller. While being dropped on a hoisting cable the SiltProfiler acquires data, upon return to the water surface the acquired data are transferred to the operator's PC whereupon the SiltProfiler is ready to acquire a new profile. In this way hundreds of detailed profiles can be acquired in a single day.

The SiltProfiler comprises two hardware segments, viz.

- wet segment consisting of a frame with sensors and electronics and
- a dry segment consisting of a PC with a wireless communication unit.

The segments are interconnected by wireless communication.



1. frame

The base of the frame is a heavy hexagonal mild steel ring, while on deck or touching the bottom the SiltProfiler will rest in this ring. Three mild steel beams constitute a tripod like support for the frame body. The body is a stainless steel cylinder containing a PVC pot with the electronics. The hexagonal ring and the support beams are rather thick to make them sturdy and also to obtain a low centre of gravity. The lower end of the stainless steel cylinder is closed with a perforated cap; on the one hand the cap protects the electronics pot against external hazards, on the other hand allow the perforations the sensor cables to pass.

The wet segment, i.e. the actual SiltProfiler instrument

2. electronics pot

The sensor cables are connected to waterproof connectors at the bottom of the electronics pot. The electronics pot contains all the sensor electronics, data communication interfaces and a power supply system including a rechargeable battery pack. A special connector at the top of the electronics pot has two functions. Primary function, using a power-signal cable, is to deliver power to the electronics and to charge the internal battery. Further the same connector supports direct communication between the operator's PC and the electronics while in on-line mode. Secondary, the connector acts as a switch, that is, the power-signal cable is replaced by a special dummy connector to put the SiltProfiler in battery power mode. This is the normal operation mode; the SiltProfiler operates without cable and communicates via a fast bidirectional radio link.

The electronics pot can be easily removed to get access to the sensor cables. While the pot is inserted in the stainless steel cylinder, the connectors are protected against external hazards. There is no need to open the electronics pot except to replace the battery pack and there are no adjustments to the electronics hardware required. All operational access to the system is via communication.

3. sensors

The standard SiltProfiler version is equipped with the following sensors.

- Pressure

The pressure sensor is of the absolute type; its purpose is to establish the instrument depth. The standard measuring range is 50 kPa; taking the barometric air pressure into account the effective measuring range is equivalent to 40 m water depth. The measuring resolution is 1 cm water column.

- **Conductivity**

The conductivity sensor is included to assess sediment concentration profiles in relation to conductivity and salinity. The response of the conductivity sensor is fast (less than 10 ms). The standard sensor measures resistance and converts the readings to conductivity, this makes the sensor relatively accurate at low conductivity, the performance at high conductivity is moderate. A new conductivity sensor is under development.

- **Optical Backscatter**

The optical backscatter sensor covers the low concentration range from 0 to about 500 mg/L.

- **Optical Extinction**

Two optical extinction sensors, integrated in a single unit, cover medium and high concentration ranges. The medium concentration range ends at about 4 g/L, the high concentration range ends at about 35 g/L. The mentioned measuring ranges are indicative only, the actual measuring range depends upon the grain size distribution and the optical properties of the sediment. The relationship between instrument reading and concentration has to be established by calibration. The extinction sensors have fast response, i.e. the response time is less than 10 ms. The extinction sensors have a well defined measuring volume, zero stability is moderate. During post processing the collected data can be corrected for zero shift by combination with the optical backscatter data. Under certain conditions qualitative information about flocculation can be derived from the extinction profiles.

- **Temperature**

The temperature sensor is included to assess sediment concentration profiles in relation to temperature and salinity. The standard sensor is rather robust and not fast.

4. datalogger, interface electronics and battery package

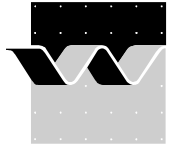
The analogue sensor output signals are acquired by a datalogger; the resolution is 12 bits (1 to 4096). The datalogger is programmable via serial communication (RS232), either by direct cable or by radio. This allows the operator, assisted by a PC based user interface, to adjust a number of operational parameters to optimise the operation of the SiltProfiler for specific applications. Further, the standard datalogger program can be replaced by flashing a new program; this requires assistance by the manufacturer, though.

A profile measurement is initiated by the pressing the Start button on the user interface. Where needed the datalogger configures the power distribution system and starts monitoring the depth of the SiltProfiler. Upon reaching the operator programmed start-profiling-depth data recording is activated and continued until the SiltProfiler reaches the bottom and is recovered again. The data acquisition rate can be tuned to the dropping velocity, e.g. 100 Hz at a dropping velocity of 1 m/s; in that case every 1 cm depth the sensor signals are acquired.

While the SiltProfiler is below the water surface wireless communication is not possible, however, upon return to the surface communication is re-established and automatically the acquired data is transferred to the operator's PC. In less than 1 minute the SiltProfiler is ready for next profile.

5. deck box

The deck box connects to the operator's PC by serial connection (RS232 57600 baud). Further the deck box connects to a wall adapter power supply to operate the internal communication interface and data radio. Should the power communication cable be connected to the SiltProfiler instrument and to the deck box then the SiltProfiler is operated from the wall adapter supply. The communication



hardware allows for a long cable between the SiltProfiler and the deck box, the default length is 10 m, a length of 100 m supported. In the latter case on-line measurements can be taken while submerged, e.g. while the SiltProfiler is towed behind a ship or left submerged.

A fast battery charger unit can recharge the power pack in the SiltProfiler, independent of the operational use of the SiltProfiler. The charger supports fast charging mode and maintenance charging.

6. user interface on PC

The user interface supports all normal operations with the SiltProfiler, viz.: setting up of a measurement, performance monitoring, retrieval of acquired data, assembling of ASCII (text) profile data tables. The acquired data is recorded in files, a separate file for each profile. The raw data format is 16 bits binary (the measuring resolution is 12 bits), the converted data in text files is formatted in comma separated fixed point values. The binary data cannot be altered. Optionally, the text file starts with a header containing start date and time as well as a description of each of the data columns, the description includes name, dimension, conversion formula (up to third order). The converted time series data can be displayed as a function of depth (profiles) as well as a function of sample number (time).