

## VMP 6000

### Deep-Sea Vertical Microstructure Profiler

The VMP-6000 is a full ocean-depth profiling system for measurement of turbulence microstructure, CTD, and other oceanographic parameters. The VMP-6000 operates autonomously (without connection to the ship) and records data on the downward portion of the profile. At a programmed depth, the VMP-6000 releases ballast and returns to the surface, where it can be located with the help of RF beacon, strobe, and ARGO positioning transmitter.

#### Features:

- Depth rating 6000 m;
- Up to 6 turbulence sensors (shear probes, thermistors, micro conductivity);
- WOCE accuracy CTD;
- High grade accelerometers (3x);
- Internal data acquisition 1 GB solid state disk, LINUX OS;
- Rechargeable battery pack;
- Ballast release mechanism with 5 time redundant release mechanism;
- Geo-electro magnetic current meter for fine-scale shear measurements;
- RF beacon, ARGO transmitter, and Xenon flasher.



#### Description:

The *VMP-6000* is an untethered microstructure profiling system for deployment to depths of 6000 meters. The profiler's nose cone holds up to 6 microstructure probes (any combination of shear probes, thermistors, or micro conductivity probes). The nose cone is separated from the main pressure case by a 38 mm thick bulkhead to prevent water penetration into the main pressure case in case of a broken probe. The main pressure case contains 3 accelerometers, and 1 pressure transducer as well as the electronics for signal conditioning, A/D conversion and data logging.

Syntactic foam is attached to an aluminium frame at the top end of the instrument to provide flotation. The profiler collects data on the downward profiling cycle. After reaching a pre-defined depth, the profiler releases ballast weights so that the instrument becomes positively buoyant. The instrument rises to the surface with a nominal speed of about 1.0 m/s. As a backup, there is a triple-redundancy emergency ballast release consisting of a corrosion trigger, time-out trigger, and pressure rate-of-change trigger.

The *VMP-6000* carries a strobe light and a radio frequency beacon and an ARGO positioning transmitter for locating the instrument after it has returned to the surface. A large ring at the top end makes it easy to recover the instrument. Data are downloaded from the profiler after recovery via a USB connection. A separate connector is provided for charging the internal battery and for switching the instrument on and off.

#### User Comments:

"The VMP data looked as good as, if not better, than the original HRP." – Kurt Polzin, Woods Hole Oceanographic Institution"

"I have to say the VMP is an impressive instrument, and it is always a pleasure to be involved at the detail level with instruments that are designed and supported well." – Jeff Benson, Southampton Oceanography Centre, UK

**Specifications:**

**General:**

Sampling rate 512 Hz nominal  
 (user configurable with software, up to 4096 Hz)  
 Depth rating 0 – 6000 m

**Velocity shear:**

Range  $5 \times 10^{-11}$  to  $10^{-4} \text{ W kg}^{-1}$   
 Accuracy 5%  
 Resolution  $2.5 \times 10^{-3} \text{ s}^{-1} \text{ rms}$  (1 – 10 Hz)

**Water temperature (SBE 3F):**

Range -5 – 35 °C  
 Accuracy  $1 \times 10^{-3} \text{ °C}$  (NIST traceable)  
 Resolution  $1 \times 10^{-4} \text{ °C}$   
 Stability  $2 \times 10^{-3} \text{ °C/year}$  typical  
 Time response  $0.070 \text{ s} \pm 0.010$

**Conductivity (SBE 4C):**

Range -0 – 7 S/m  
 Accuracy 0.0003 S/m  
 Resolution 0.00004 S/m  
 Stability 0.0003 S/m/per month  
 Time response 0.060 seconds (pumped)

**Pressure (Keller):**

Range 0 – 6000 dbar  
 Accuracy 0.1%  
 Resolution 0.005 dbar (using signal+derivative technique)

**Micro Temperature (FP07):**

Range -5 – 35 °C  
 Accuracy N / A  
 Resolution  $1 \times 10^{-5} \text{ °C}$  (using signal+derivative technique)  
 Stability N/A  
 Time response  $0.007 \text{ s} \pm 0.003$

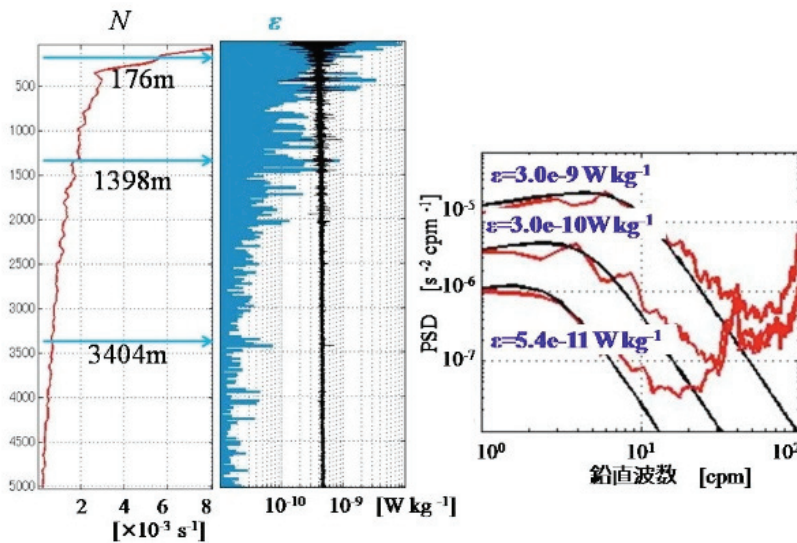
**Accelerometers (IC Sensors):**

Range  $\pm 2 \text{ g}$   
 Accuracy 0.5%  
 Resolution  $3 \times 10^{-5} \text{ g}$  (1 – 20 Hz)  
 Noise  $1 \times 10^{-8} (\text{ms}^{-2})^2 \text{ Hz}^{-1}$   
 Stability / Linearity  $\pm 0.5\%$ ,  $\pm 0.01\text{g}$   
 Frequency response 0 – 300 Hz

**Analog/Digital Converter:**

Number of channels 16  
 Resolution 16 bits (true)  
 Linearity 15 part per million

**観測例 (170.5W51N)**



## Optional components

### SBE7 Micro-Conductivity Sensor

The SBE 7 Microstructure Conductivity Sensor is a reliable and proven sensor intended for use in marine profiling applications where its high speed and spatial resolving power offer the ability to characterize small scale ocean conductivity features. Where salinity variations are minimal, the conductivity signal offers unexcelled resolution of temperature structure. Used in conjunction with the VMP turbulence sensors (shear probes and thermistors), the SBE 7 can provide comparably sensitive resolution of salinity and density fields.



### Seapoint Deep Sea Turbidity Sensor

The Seapoint Turbidity Meter detects light scattered by particles suspended in water, generating an output voltage proportional to turbidity or suspended solids. The low power requirements make it ideal for applications where battery drain is a concern. Range is selected by two digital lines which can be hard wired or

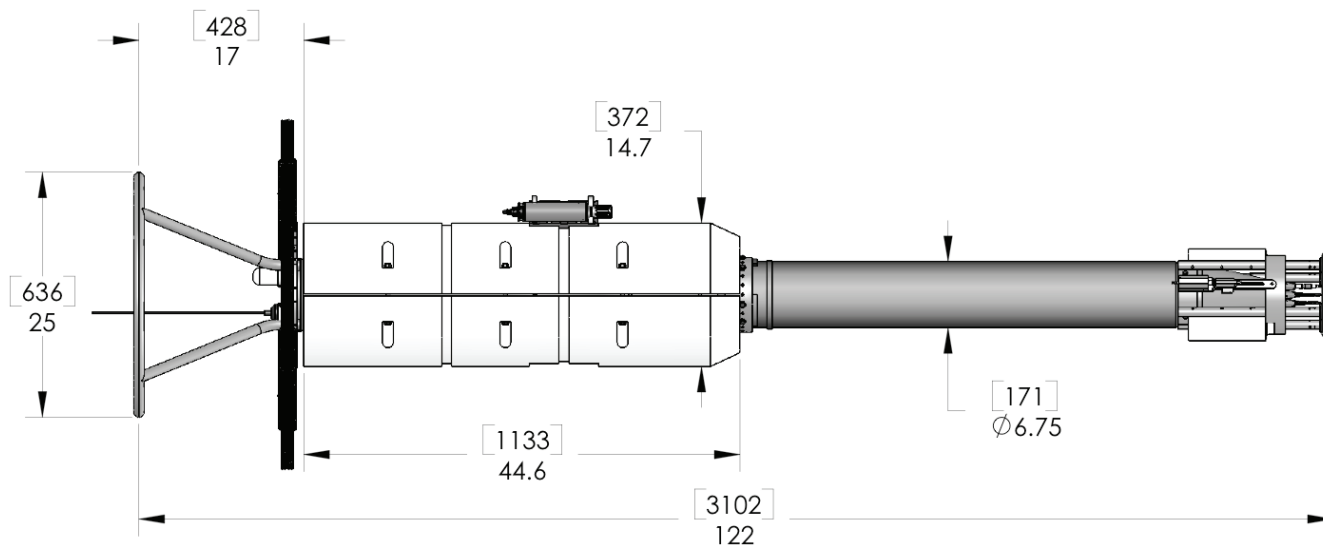
microprocessor controlled, thereby choosing the appropriate range and resolution for measurement of extremely clean to very turbid waters. The offset voltage is within 1 mV of zero and requires no adjustment across gains. The unique optical design confines the sensing volume to within 5 cm of the sensor allowing near-bottom measurements and minimizing errant reflections in restricted spaces. On the VMP-6000 the sensor will be mounted on the rear floatation collar.

#### SPECIFICATIONS

- Output Time Constant: 0.1 sec.
- RMS Noise: < 1 mV
- Light Source Wavelength: 880 nm
- Sensing Distance (from windows): < 5 cm (approx.)
- Linearity : < 2% deviation 0-750 FTU
- Sensitivity/Range : 1000 mV/NTU, 5 NTU
- Temperature Coefficient : < 0.05%/°C
- Depth Capability 6000 m



## VMP-6000 Outline Drawing



VMP-6000 outline drawing showing dimensions (in inches), approximate and subject to final specifications