

The Stress Engineering Services subsea vibration data logger (SVDL) was developed to service the emerging need to collect high-quality vibration data for extended periods under increasingly stringent subsea environments.

Housed inside the unit is a high-quality tri-axial accelerometer. The accelerometer is constructed using a state-of-the-art MEMS process to achieve unprecedented sensitivity and resolution. Signals are passed through an aggressive low-pass analog filter prior to being digitized by a high-resolution analog-to-digital converter. In addition to signal filtering, oversampling techniques are employed to maintain the highest digitized signal quality. The long battery life, low power consumption, and large memory storage are well-matched to maximize the deployed logging duration.

The data logger and clamping devices feature a low mass and high mechanical impedance structure. This ensures that the vibration signals collected by the logger are not distorted by the mechanical characteristics of the logger system itself, even at high measurement frequencies of 50 Hz or greater.

Mechanical - Aluminum (Al) and Stainless Steel (SS)

- Fully enclosed in a one-atmosphere aluminum subsea housing with redundant o-ring seals at each closure
- Depth rating: 10,000 feet sea water (Al); 13,000 feet sea water (SS)
- Exterior dimensions: 3.1" diameter x 18.25" long (24" long including ROV handle)
- Mass: Less than 10 lbm (Al); Less than 20 lbm (SS)
- Weight in seawater: Less than 6 lbf (Al); Less than 15 lbf (SS)
- All exposed aluminum surfaces hard-anodized
- Sensor is hard-mounted to housing end cap to maximize coupling stiffness to measured structure
- Ported for nitrogen back-fill; includes pressure relief valve

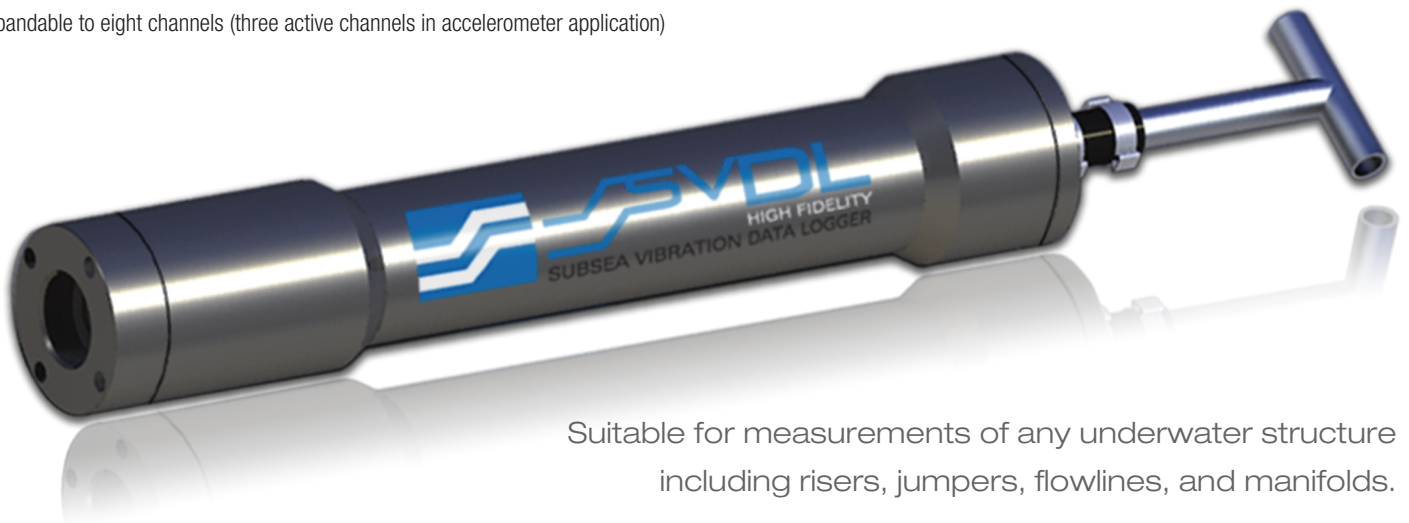
Analog Signal Processing (per channel)

- Differential instrumentation amplifier input for noise suppression
- Gain and level-shift amplifiers
- Integral low-pass anti-aliasing filter, 4th-order Butterworth type, with software-programmable cutoff frequency
- Expandable to eight channels (three active channels in accelerometer application)

Sensor

- High performance tri-axial (X, Y, Z) DC accelerometer
- Range: ± 2 g, each axis
- Sensitivity: 2000 mV/g
- Resolution: 350 μ g (0.000350 g)
- Bandwidth: 0 to 250 Hz
- Amplitude non-linearity: $\pm 1.0\%$ Fso
- Derived Measurements:
 - Tri-axial inclination
 - Velocity, displacement

Fully tested under subsea conditions including simultaneous temperature, pressure at full ocean depth, and vibration environments.



Suitable for measurements of any underwater structure including risers, jumpers, flowlines, and manifolds.

Digital Data Acquisition and Storage

- High-performance 24-bit analog-to-digital converter (ADC)
- Precision low-drift, low-noise, temperature-compensated voltage reference
- Up to 10,000 Hz sampling rate per channel
- Expandable to eight channels (three active channels in accelerometer application)
- Data storage: Data stored in raw format on a 16 GB MicroSDHC card; upgradable to 32 GB
- SDHC memory address pointer stored in non-volatile memory for recovery after power interruption
- Four channels of digital I/O available

Host Interface

- Plug-in adapter between data logger and host PC, containing:
 - Primary USB interface to host PC
 - External power supply, bypassing internal batteries
- Memory card may be removed from the logger and downloaded directly to the host PC via a card reader and translator software

Software Interface

- Custom ActiveX control allows easy portability to LabVIEW, MATLAB, Visual BASIC, Visual C++, and other applications
- Direct programming of microcontroller also available via open-source C compiler

Software Operating Modes

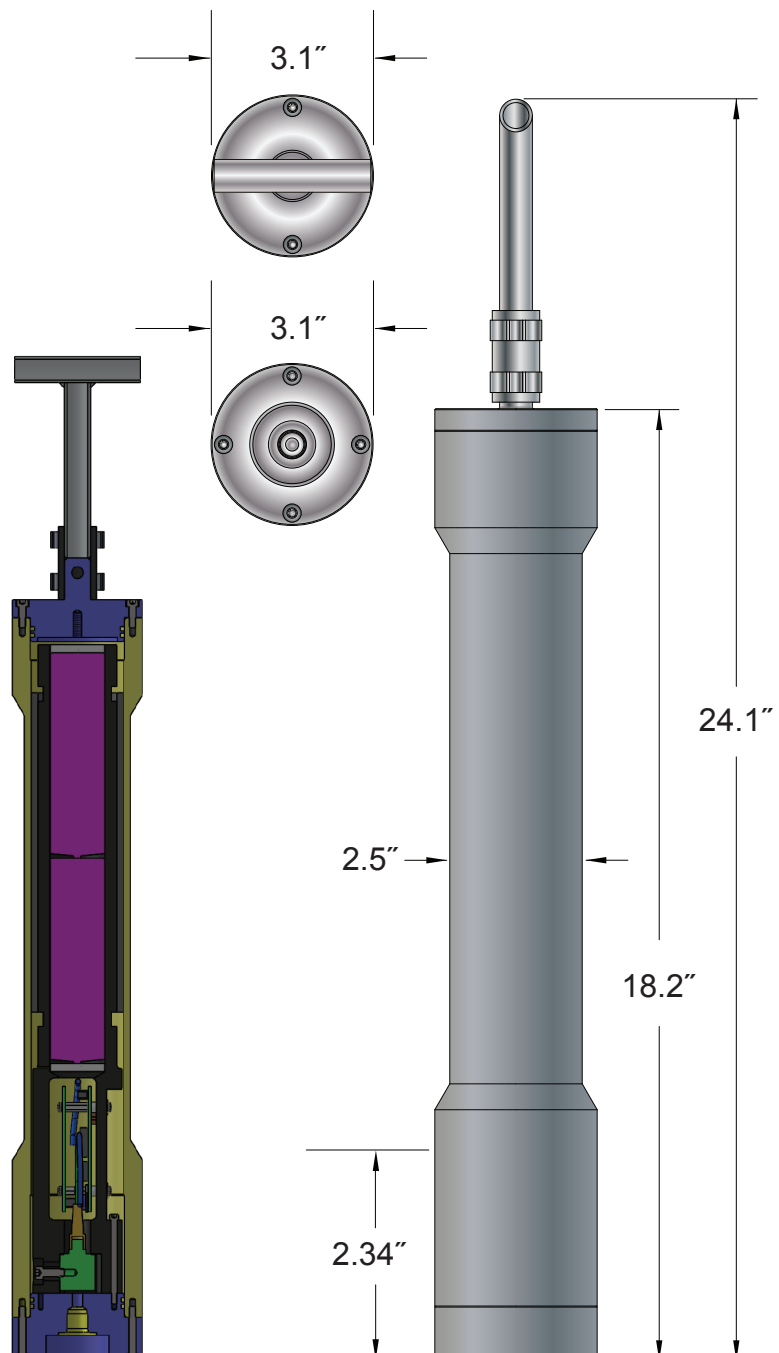
- Parameter Setup:
 - Clock Set
 - Delay Start Set
 - Channel Select
 - Set Sampling Rate
 - Set Analog Filter Cutoff Frequency
 - Memory Card Setup
 - Intermittent Setup (define duty cycle)—if applicable
- Signal Calibration
- Data Logging Mode:
 - Continuous / Intermittent
 - Data Transfer
 - Data Stream

Microcontroller

- Low-power design; up to 18 MHz clock frequency (1 MHz nominal)
- 16-bit RISC architecture
- Low-power 32 kHz real-time precision clock
- Dynamic Memory controller allows memory read / write operations without invoking CPU
- Internal watchdog timer
- Brown-out reset, power-on reset, power-up-clear restart modes

Power and Life

- Batteries: 2x high-performance lithium batteries @ 3.6 VDC; 35,000 mAh capacity (over 14 days continuous logging).
- Logger life depends on sampling rate and duty cycle
- In most circumstances, memory card capacity will exceed battery life



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