BPR Bottom Pressure Recorder

SBE 53

SUMMARY

- Full ocean depth water level (to 7000 meters), with extremely high resolution, accuracy, and stability
- Precision thermometer, optional conductivity sensor
- RS-232 serial interface, internal memory, internal batteries
- Real-time data, as well as fast upload of all data in memory upon recovery
- Large memory and low power requirements – 1.2-year deployment with alkaline batteries for a typical sampling scheme of water level measurements every 30 minutes (integrating pressure for the entire 30 minutes)

DESCRIPTION

The SBE 53 BPR measures full ocean depth water level with extremely high resolution, accuracy, and stability. The BPR combines a uniquely precise and stable time base with low-power frequency-acquisition circuitry, Paroscientific Digiquartz® pressure transducer, non-volatile 32 MB FLASH memory, and a precision thermometer, to provide unprecedented bottom-pressure recording capability. An optional SBE 4M conductivity sensor can be added to provide salinity data.

The BPR integrates pressure measurements to obtain water levels (tides) unaffected by wave action. The interval between each water level measurement and the duration of the integration period are user-programmable. The interval is programmable over a range of 1 minute to 1 hour. The integration duration is programmable from 1 minute to the entire tide interval. The BPR can continuously power the pressure transducer and reference frequency oscillator, eliminating turn-on transients and providing the highest quality data. Alternatively, the BPR can be programmed to enter a power-down state between measurements to conserve battery power for very long deployments, with a user-specified warm-up period before each pressure measurement. Temperature data is recorded with each pressure integration. Logging (recording) can be programmed to start and stop at specified times after the instrument is deployed.

The pressure and internal temperature compensation signals (frequencies) from the transducer are integrated in parallel for the water level integration duration. The measurement times are set by a continuously powered, real-time clock with an accuracy of ±5 seconds/month. Long-term drift of the counter's reference frequency is on the order of 1 ppm/year. To allow for correction of drift, an ovenized crystal oscillator is programmed to periodically make a reference frequency measurement.

Large memory and low power requirements permit frequent water level recording. For example, with standard alkaline batteries, a 420-day deployment could include water level measurements every 30 minutes (integrating pressure for the entire 30 minutes); a 2-year deployment could be achieved if pressure integration is limited to 4 minutes for each water level measurement, with a 15-minute warm-up of the pressure sensor and reference frequency oscillator before each measurement. Alternatively, deployments approximately 3 times longer are possible with Electrochem DD lithium batteries. Fast binary upload of data in memory can be accomplished at up to 115,200 baud.

Firmware upgrades can be downloaded via the serial interface without opening the electronics compartment.

CONFIGURATION AND OPTIONS

A standard BPR is supplied with:
- Titanium housing for depths to 7000 meters (22,900 ft)
- Paroscientific Digiquartz temperature-compensated pressure sensor, in four ranges from 1300 to 6800 meters (2000-10,000 psia)
- Accurate temperature sensor – aged thermistor embedded in BPR end cap
- Frequency-input channel and bulkhead connector for optional SBE 4M conductivity sensor
- 32 MB FLASH memory and 12 alkaline D-cell batteries (Duracell MN1300, LR20)
- Impulse glass-reinforced epoxy bulkhead connectors

Options include:
- SBE 4M Conductivity sensor, interfaced via bulkhead connector and clamped to BPR housing
- High accuracy external temperature sensor
- Wet-pluggable (MCBH) connectors in place of standard connectors

SOFTWARE

The BPR is supplied with Seasoft© for Waves, a comprehensive package of Windows programs for instrument setup and data retrieval, data conversion, and plotting.

BPR Bottom Pressure Recorder

SPECIFICATIONS

Pressure

Range:	0 to 1300, 2000, 4000, or 6800 m (2000, 3000, 6000, or 10000 psia)
Accuracy *:	0.01% of full scale
Resolution:	0.045 ppm (0.3 mm for 10,000 psia range, 1-minute integration, continuously powered)
Calibration:	0 psia to full scale pressure
Repeatability:	0.005% of full scale
Hysteresis:	0.005% of full scale

Standard Temperature [°C]

Range:	-5 to +35
Accuracy:	0.01
Resolution:	0.001
Calibration:	+1 to +32 **

High Accuracy Temperature [°C] (optional)

Range:	-5 to +35
Accuracy:	0.002
Resolution:	0.0001
Calibration:	+1 to +32 **

Conductivity [S/m] (optional)

Range:	0 to 7
Accuracy:	0.001
Resolution:	0.00002
Calibration:	2.6–6 plus zero conductivity (air) **

Clocks

Counter Time Base (pressure & pressure temperature):
Quartz TCXO ± 3 ppm per year aging
(± 1 ppm/year typical), ± 0.1 ppm (0 - 20 °C)

Ovenized Crystal Oscillator (reference frequency drift correction):
Warm-up re-stabilization: less than $\pm 1 \times 10^{-7}$
Stability vs. temperature: ± 0.1 ppm (-20 °C to +70 °C)
Aging: $< 1 \times 10^{-7}$ per year, less than 1×10^{-6} /10 years

Real-time clock (time stamp and sample timing):
Quartz TCXO watch-crystal type 32,768 Hz;
accuracy ± 2 ppm (5 sec/month).
Battery-backed for minimum 2-year operation
without main batteries installed.

Conductivity Time Base:
Quartz TCXO ± 1 ppm per year aging;
± 15 ppm (-20 to +70 °C).

Memory: 32 MB Flash RAM

Data storage (per sample):
No conductivity: 17 bytes
With conductivity: 20 bytes

Power Supply:
Internal: 12 alkaline D cells, Duracell MN 1300, LR20 (standard) **or** 6 lithium DD cells (Electrochem BCX85-3B76-TC)
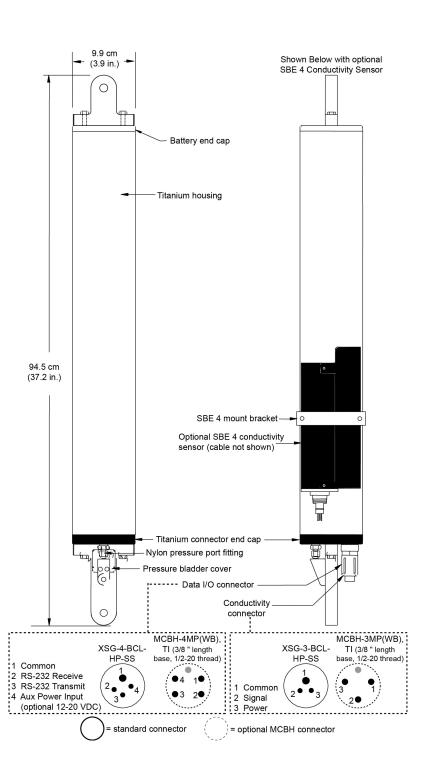*External:* 12 - 24 VDC

Housing: Titanium to 7000 m

Weight (with alkaline batteries):
14.5 kg (32 lbs) in air, 8.6 kg (19 lbs) in water

* Digiquartz residual temperature sensitivity is measured at Sea-Bird, and Digiquartz calibration coefficients are adjusted so that residual temperature sensitivity is less than 1 ppm over 0 – 20 °C (0.05 ppm/°C; 0.0005 psia for a 10,000 psia range sensor).

** Measurements outside specified calibration ranges at slightly reduced accuracy due to extrapolation errors.

Shown Below with optional SBE 4 Conductivity Sensor

9.9 cm (3.9 in.)

Battery end cap

Titanium housing

94.5 cm (37.2 in.)

SBE 4 mount bracket

Optional SBE 4 conductivity sensor (cable not shown)

Titanium connector end cap

Nylon pressure port fitting

Pressure bladder cover

Data I/O connector

Conductivity connector

XSG-4-BCL-HP-SS

MCBH-4MP(WB), TI (3/8 " length base, 1/2-20 thread)

1 Common
2 RS-232 Receive
3 RS-232 Transmit
4 Aux Power Input (optional 12-20 VDC)

XSG-3-BCL-HP-SS

MCBH-3MP(WB), TI (3/8 " length base, 1/2-20 thread)

1 Common
2 Signal
3 Power

= standard connector   = optional MCBH connector