

Temperature & Pressure Recorder



The SBE 39 is a high-accuracy temperature (pressure optional) recorder with internal battery and non-volatile memory for deployment at depths up to 10500 meters (34,400 feet). The SBE 39 is intended for moorings or other long-term, fixed-site applications, as well as shorter-term deployments on nets, towed vehicles, or ROVs. Calibration coefficients are stored in EEPROM, and uploaded data is in ASCII engineering units ($^{\circ}\text{C}$ and decibars).

The SBE 39's thermistor, the same sensor used in the SBE 16 SEACAT and SBE 37 MicroCAT, has a long history of exceptional accuracy and stability; drift is typically less than 0.002°C per year. Two temperature sensor configurations are offered:

- Ruggedized model with thermistor embedded in titanium endcap (time constant approximately 25.0 seconds).
- Model with external thermistor in a pressure-protected sheath (time constant approximately 0.5 seconds), for use when fast sampling is required (shown in photo).

The SBE 39's optional pressure sensor, developed by Druck, Inc., has a superior new design that is entirely different from conventional 'silicon' types in which the deflection of a metallic diaphragm is detected by epoxy-bonded silicon strain gauges. The Druck sensor employs a micro-machined *silicon diaphragm* into which the strain elements are implanted using semiconductor fabrication techniques. Unlike metal diaphragms, silicon's crystal structure is perfectly elastic, so the sensor is essentially free of pressure hysteresis. Compensation of the temperature influence on pressure offset and scale is performed by the SBE 39's CPU.

COMMUNICATIONS AND INTERFACING

The SBE 39 communicates directly with a computer via a standard RS-232 interface, at a user-selectable baud rate of 1200 to 38,400. Setup and data extraction is dependent on the selected housing:

- Standard — open housing and plug data cable into connector on electronics assembly.
- Optional — plug data cable into external waterproof connector.

User-selectable operating modes include:

- **Polled Sampling** allows sampling and data transmission to be triggered by a command from a computer or satellite, radio, or wire telemetry equipment.
- **Autonomous Sampling** allows sampling at pre-programmed intervals, and can be set up to start at a future time and date. There are two types of Autonomous Sampling —
 - *Interval*: At pre-programmed 3-second (4-second if transmitting in real time) to 9-hour intervals, SBE 39 wakes up, samples, records, and powers off.
 - *Continuous*: SBE 39 continuously samples, and does not power off between samples. Time between samples varies from 0.8 to 1.5 seconds, depending on data format.
- **Serial Line Sync** allows sampling and data transmission to be triggered by a pulse on the serial line, which causes a sleeping SBE 39 to wake up, sample, transmit in real time (programmable option), record, and power-off automatically.

DATA STORAGE AND BATTERY ENDURANCE

The SBE 39 has 2 Mbytes of non-volatile FLASH memory, and includes a 9-volt, non-hazardous, lithium battery; an alkaline battery may be substituted for shorter deployments. Temperature (3 bytes/sample) and time (4 bytes/sample) are always stored. Optional pressure adds 2 bytes/sample. Using a lithium battery, the SBE 39 can acquire and store more than 150,000 samples of T, P, and Time. Because of the very low power consumption when not actually sampling, deployments of three years or more are possible.

CALIBRATION

The inherent accuracy, resolution, and stability of the SBE 39 design, combined with a rigorous 11-point temperature calibration, yields a true research-quality tool. Primary temperature standards (water triple point and gallium melting point cells) and state-of-the-art equipment maintained in Sea-Bird's NIST-traceable calibration facility are brought to bear on every temperature calibration. SBE 39 pressure calibrations are referenced to specially maintained (at Sea-Bird) Paroscientific Digiquartz sensors that trace to Paroscientific's pressure standard.

SOFTWARE

The SBE 39 is supplied with a powerful software package (Win 95/98/NT) for communication, data upload, data conversion, plotting, and export to other programs.



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Temperature & Pressure Recorder



SPECIFICATIONS

Measurement Range

Temperature: -5 to +35°C
 Optional Pressure*: 20/100/350/1000/2000/3500/7000 m
 *Expressed in meters of deployment depth capability.

Initial Accuracy

Temperature: ± 0.002°C
 Pressure (optional): 0.1% of full scale range

Typical Stability (per month)

Temperature: 0.0002°C
 Pressure (optional): 0.004% of full scale range

Resolution

Temperature: 0.0001°C
 Pressure (optional): 0.002% of full scale range

Clock Accuracy

15 seconds/month

Power Supply/Endurance

9V non-hazardous
 Lithium Battery: > 150,000 samples
 9V Alkaline Battery: > 50,000 samples

Quiescent Current

10 microamps

Current Consumption per Sample

T only: 0.015 amp-second
 T and P: 0.020 amp-second

Optional External Power

9 - 30 VDC
 (for SBE 39 with optional external I/O connector)

Memory Capacity*

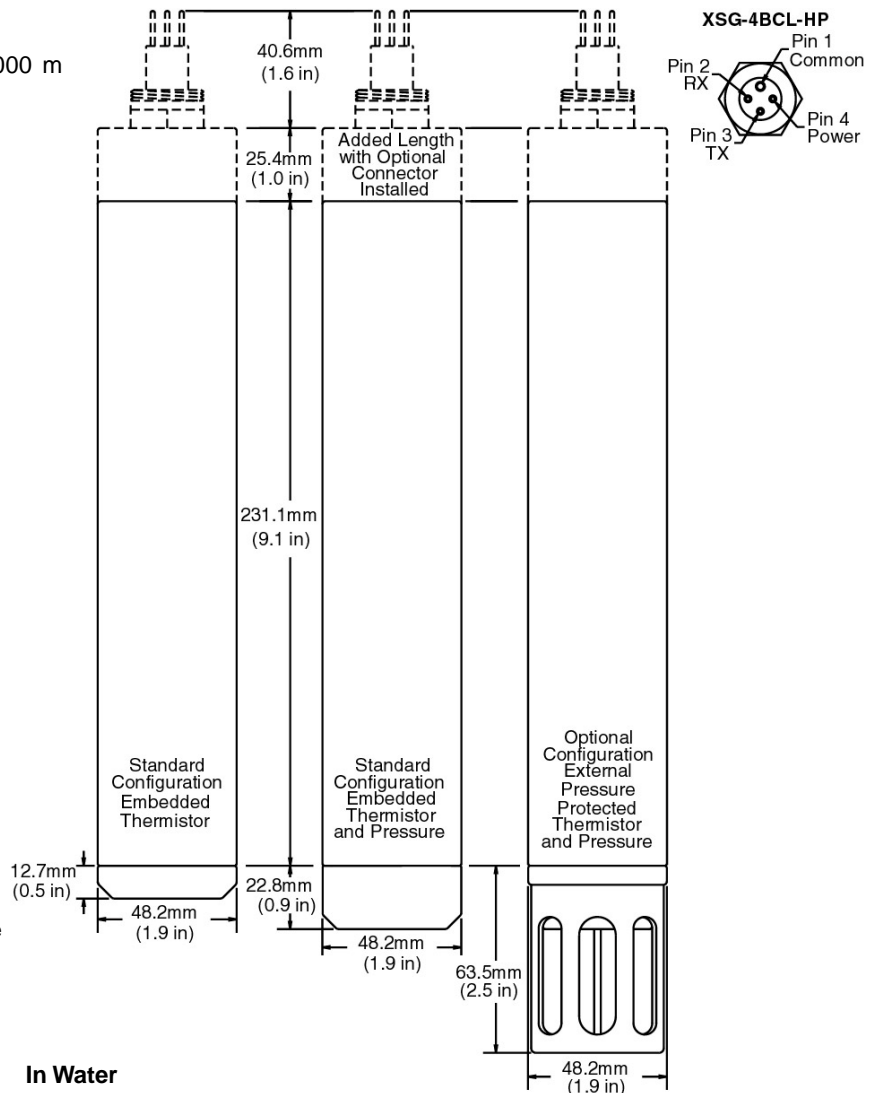
T and time: 276,000 samples
 T, P, and time: 211,000 samples
 *T=3 bytes/sample; time=4 bytes/sample; P=2 bytes/sample

Housing/Depth

Celcon plastic: 350 meters (1150 ft)
 Titanium: 10500 meters (34,400 ft)

Weight (without external connector)	In Air	In Water
Plastic housing, embedded thermistor:	0.6 kg (1.2 lbs)	0.25 kg (0.6 lbs)
Titanium housing, thermistor in sheath:	1.2 kg (2.6 lbs)	0.7 kg (1.6 lbs)

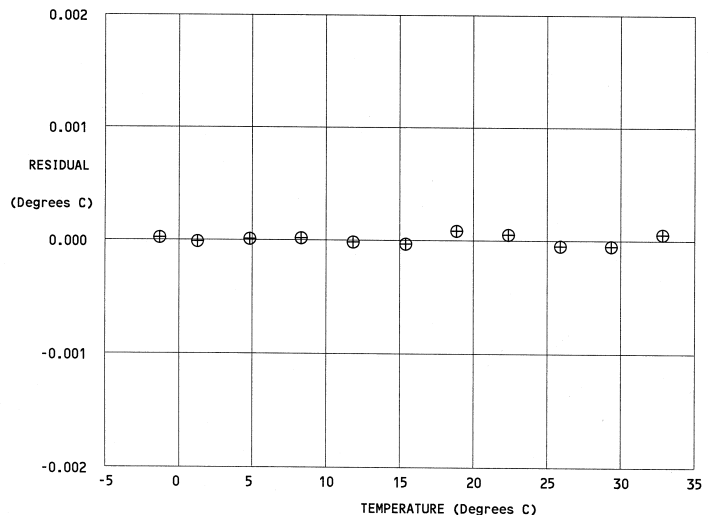
(Other configurations vary slightly).



Actual Calibration Data For Sensor # 204

Calibration Date: 19 May 2000
 a0= -1.661595e-04 a2= -4.625199e-06
 a1= 3.079553e-04 a3= 2.075766e-07

Bath Temp (deg C)	Inst Output (n)	Inst Temp (deg C)	Residual (deg C)
-1.5115	786460.1	-1.5115	0.0000
1.0482	700444.0	1.0482	-0.0000
4.6236	597614.7	4.6236	0.0000
8.1305	513142.6	8.1305	0.0000
11.6344	442083.3	11.6344	-0.0000
15.1949	381161.9	15.1949	-0.0000
18.6590	330948.6	18.6590	0.0001
22.1592	287767.8	22.1592	0.0000
25.6867	250672.7	25.6866	-0.0001
29.1579	219443.9	29.1579	-0.0001
32.6336	192584.6	32.6337	0.0000



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