SBE 38

DIGITAL OCEANOGRAPHIC THERMOMETER

Overview

Sophisticated A/D acquisition electronics, ultra-stable thermistor, and state-of-the-art calibration provide the standards-level performance of an expensive AC bridge and platinum thermometer at a small fraction of the cost. The SBE 38 is unaffected by shock and vibration, has high accuracy and stability, and is easy to use. It has a rugged, 10,500 m titanium housing. Real-time temperature is transmitted via the RS-232 or RS-485 serial interface in ASCII characters (°C or raw counts). The SBE 38 must be externally powered, and its data logged or telemetered by a computer, data logger, or instrument.

Applications include calibration baths, oceanographic/aquatic research, and environmental monitoring. The SBE 38 is frequently integrated as a remote temperature sensor with an SBE 21 Thermosalinograph or SBE 45 MicroTSG, to provide accurate sea surface temperature. It can also be integrated as a secondary temperature sensor with an SBE 16plus, 16plus-IM, 16plus V2, 16plus-IM V2, 19plus V2, or 25plus CTD.

Options

- RS-232 or RS-485 output
- Wet-pluggable MCBH (default) or XSG connector

Features

- Programmable sampling:
  - Continuous (begins when power applied or on command); interval between samples (sec) = (0.133 * NAvg) + 0.339 where NAvg is number of acquisition cycles/sample
  - Polled
- Serial output:
  - RS-232 (full duplex) with one SBE 38 connected to the interface;
  - RS-485 (half duplex) with one SBE 38 connected to the interface; or
  - RS-485 (half duplex) with several RS-485 sensors sharing one pair of wires (cannot sample continuously)
- No batteries or memory.
- Compatible with Sea-Bird thermosalinographs and some Sea-Bird CTDs
- Titanium housing; depths to 10,500 m
- Seasoft© V2 Windows software package (instrument setup and data display)
- Five-year limited warranty

Calibration Equation

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The SBE 38 is calibrated in Sea-Bird's state-of-the-art calibration laboratory, which maintains primary temperature standards (water triple point [TPW] and gallium melting point [GaMP] cells), ITS-90 certified and standards-grade platinum resistance thermometers, and a low-gradient temperature bath. Temperature is computed using the Steinhart-Hart polynomial (Steinhart and Hart, 1968; Bennett, 1972). The equation characterizes the non-linear temperature versus resistance response of the sensor. Thermistors require individualized coefficients to the Steinhart-Hart equation, because the material is an individualized mix of dopants:

$$t_{90L} = \{[1.0 / (a0 + a1 * \ln(n) + a2 * \ln^2(n) + a3 * \ln^3(n))] - 273.15\} * Slope + Offset \ [°C] \quad \textit{where } n \textit{ is SBE 38 output}$$

Example Calibration Data (sensor serial number 80, 02 Sept 1997):

a0 = -2.809379e-05 a2 = -2.619655e-06 a1 = 2.783483e-04 a3 = 1.598734e-07

Bath Temperature [°C]	Instrument Output [n]	Instrument Temperature [°C]	Residual (Instrument Bath) [°C]
1.52985	824162.7	1.52983	0.00002
1.03108	733633.1	1.03106	-0.00002
4.60520	625547.1	4.60518	-0.00002
8.11169	536776.4	8.11169	-0.00000
11.61533	462132.6	11.61536	0.00003
15.17575	398167.3	15.17574	-0.00001
18.63931	345476.6	18.63934	0.00003
22.14032	300170.8	22.14031	-0.00001
25.66793	261276.6	25.66793	0.00000
25.66793	228549.1	29.13944	-0.00004
32.61481	200420.3	32.61484	0.00003
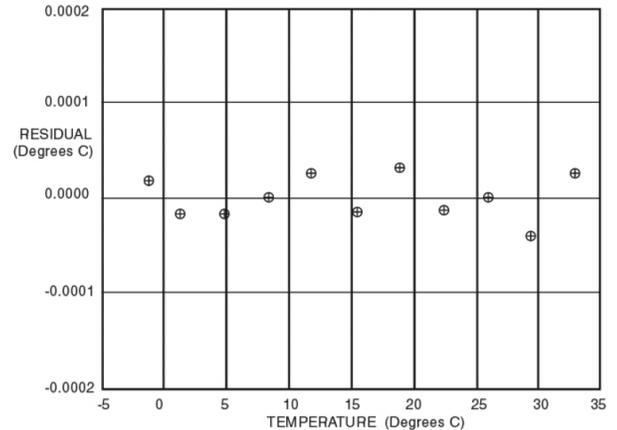
Field Specifications

The specifications below represent the expected performance of the instrument when deployed in the field. Under controlled circumstances in a lab, we would expect the instrument to outperform these specifications.

We have chosen to display field specifications to give our users a true measure of how Sea-Bird Scientific instruments perform in harsh environments and applications. It is critical to keep this in mind when comparing specifications with instruments from other manufacturers.

Performance	
Measurement Range	-5 to +35 °C
Initial Accuracy [1]	± 0.001 °C (1 mK)
Typical Stability	0.001 °C (1 mK) in six months, certified
Resolution	0.00025 °C (0.25 mK)
Response Time [2]	500 msec
Self-heating Error	< 200 µK
Electrical	
Output Power	RS-232 or RS-485 (half-duplex)
Input Power	8-15 VDC at 15 mA average for RS-232 output; 8-15 VDC at 10 mA average for RS-485 output
Mechanical	
Housing & Depth Rating	Titanium, 10,500 m
Weight	0.9 kg in air, 0.5 kg in water

[1] NIST-traceable calibration applying over entire oceanographic range.

[2] Time to reach 63% of final value following step change in temperature.

1   Common
2   RS-232 Receive or RS-485A
3   RS-232 Transmit or RS-485B
4   Power

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

XSG-4-BCL-HP-SS connector

44.45 mm (1.75 in.)

158.75 mm (6.25 in.)

53.34 mm (2.10 in.)

39.12 mm (1.54 in.)