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.

Features

- Programmable sampling:
  - Continuous (begins when power applied or on command):
    interval between samples (sec) = (0.133 * NAvg) + 0.339  \(\text{where \ NAvg is number of acquisition cycles/sample.}\)
  - 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.

Options

- RS-232 or RS-485 output.
- XSG or wet-pluggable MCBH connector.
Calibration

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:  

\[ t_{\text{ sph }} = \left[ \frac{1}{a_0 + a_1 \ln(n) + a_2 \ln^2(n) + a_3 \ln^3(n)} \right] \times \text{Slope} + \text{Offset [°C]} \]

where \( n \) is SBE 38 output.

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

<table>
<thead>
<tr>
<th>Bath Temperature [°C]</th>
<th>Instrument Temperature [°C]</th>
<th>Instrument Temperature [°C]</th>
<th>Residual (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.52985</td>
<td>821612.7</td>
<td>-1.52983</td>
<td>0.00002</td>
</tr>
<tr>
<td>1.03198</td>
<td>736331.3</td>
<td>1.03106</td>
<td>-0.00002</td>
</tr>
<tr>
<td>4.60520</td>
<td>625541.1</td>
<td>4.60518</td>
<td>-0.00002</td>
</tr>
<tr>
<td>8.11169</td>
<td>538776.4</td>
<td>8.11169</td>
<td>0.00000</td>
</tr>
<tr>
<td>11.61553</td>
<td>462132.6</td>
<td>11.61536</td>
<td>0.00003</td>
</tr>
<tr>
<td>15.17575</td>
<td>398167.3</td>
<td>15.17574</td>
<td>-0.00001</td>
</tr>
<tr>
<td>18.69361</td>
<td>345476.6</td>
<td>18.6934</td>
<td>0.00003</td>
</tr>
<tr>
<td>22.14032</td>
<td>300170.8</td>
<td>22.1402</td>
<td>0.00001</td>
</tr>
<tr>
<td>25.66793</td>
<td>261276.6</td>
<td>25.6676</td>
<td>0.00000</td>
</tr>
<tr>
<td>29.13948</td>
<td>228549.1</td>
<td>29.1394</td>
<td>0.00004</td>
</tr>
<tr>
<td>32.61491</td>
<td>200420.3</td>
<td>32.6148</td>
<td>0.00003</td>
</tr>
</tbody>
</table>

\*NIST-traceable calibration applying over the entire range.  
\*Time to reach 63% of final value following a step change in temperature.

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 Signal**: 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

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