



SEA-BIRD
SCIENTIFIC

User manual

SBE 56 Temperature recorder



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Section 1 Safety information

Please read this entire manual before this equipment is unpacked, set up, or operated. Pay attention to all danger, warning, and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to equipment. Information that requires special emphasis.

1.1 Hazard information

⚠ WARNING



If the user thinks that a sensor has water in the pressure housing: Disconnect the sensor from any power supply. Put on safety glasses and make sure that the sensor is pointed away from the body and other people. In a well ventilated area, use the purge port (if the sensor is so equipped), or very SLOWLY loosen the bulkhead connector to let the pressure release.

⚠ WARNING

This product can expose the user to chemicals with silica, crystalline (airborne particles of respirable size), which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect process during a possible equipment malfunction.

1.2 Equipment labels

Read all labels and tags attached to the equipment. Personal injury or damage to the equipment could occur if not observed. A symbol on the equipment is referenced in the manual with a precautionary statement.



Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer at no charge to the user.

Safety information

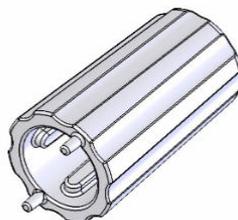


EFUP E: No hazardous material exists over the threshold of GB/T 26572-2011 standard, China's Requirements for Concentration Limits for Certain Hazardous Substances in Electrical and Electronic Products. This product should be recycled after its environmentally friendly use period.

Section 2 Quick start guide

This quick start guide gives the steps necessary to make sure that the SBE 56 Temperature recorder operates correctly and collects data before it is deployed. What's in the box:

- SBE 56 Temperature recorder
 - CD or USB drive with software, calibration files, documentation
 - USB cable for the internal connector
 - End flange removal tool to remove the SBE 56 end flange.
1. Install the software on the PC to be used with the SBE 56.
 2. Use the end flange removal tool to unscrew the end flange and pull the electronics out of the pressure housing.



End flange with electronics exposed



Electronics removed

3. Connect the USB cable to the internal USB connector of the sensor.
4. Connect the other end of the USB cable to a PC.
The SBE 56 LED flashes quickly two or three times to show that the cable is connected (Command mode).
5. Start the software, and select the SBE 56 Temperature Logger in the **Instruments** menu to start Seaterm USB.
6. If necessary, make sure that all data stored in the sensor is transmitted to the PC.
7. In the **Current Configuration** menu, look at "Memory remaining" and the calculated "Battery life remaining."
8. In the **Configuration Options** menu, change the settings as necessary:
9. Disconnect the USB cable from the sensor from the SBE 56.
The LED flashes slowly two times to show that the sensor is in Acquisition mode.
10. Install the pressure housing over the electronics again.
11. Deploy the SBE 56.

Section 3 Specifications

3.1 Electrical

Internal battery	3.6 V, 2.6 A-hr AA Saft LS14500 lithium cell
Current draw, low power	0.601 mA hours/day
Current draw, self-discharge	0.067 mA hours/day
Current draw, operation	0.371 μ A hours/sample, 0.44 sec/sample
Real-time clock	32,768 Hz TCXO accurate to ± 1 min/year
Data storage	15.9 million samples in flash memory
Data collection rate	Up to 2 Hz

3.2 Analytical

Parameter	Accuracy	Stability	Resolution
Temperature	± 0.002 at -5 to 35 $^{\circ}\text{C}$ ± 0.01 at 35 to 45 $^{\circ}\text{C}$	0.0002 $^{\circ}\text{C}/\text{month}$	0.0001 $^{\circ}\text{C}$

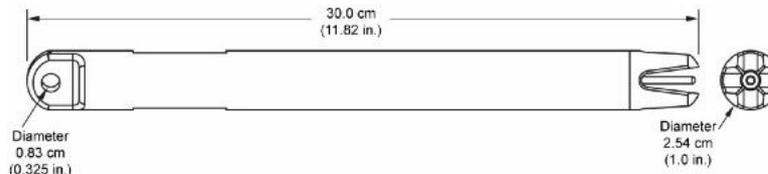
3.3 Communications

Memory	15.9 million samples in flash memory
Communication interface	Internal USB
Data collection rate	to 2 Hz (2 samples/second)
Sample interval	0.5 to 15 seconds
Data storage	5.3 million samples at 0.5-second intervals (31 days) 5.3 million samples at 1-second intervals (61 days) 4.9 million samples at 5-second intervals (284 days) 4.1 million samples at 15-second intervals (717 days)
Firmware version	0.96
Software version	Seaterm V2 v. 2.6.3

3.4 Mechanical

Depth rating	1500 m
Housing	Plastic
Weight in air, water	0.2, 0.05 kg
Temperature range, overall	-5 to 45 $^{\circ}\text{C}$
Calibrated temperature range	-5 to 35 $^{\circ}\text{C}$

3.4.1 Dimensions



Section 4 Overview

The SBE 56 is a high-accuracy temperature recorder with one internal AA lithium cell and non-volatile memory. The SBE 56 is used for moorings or other long-term, fixed-site applications, as well as short-term deployments on nets, towed vehicles, or ROVs. The sensor collects and records data at user-selected intervals of 0.5 seconds to 9 hours. Calibration coefficients are stored in FLASH, and the manufacturer-supplied software automatically converts raw uploaded data to ASCII engineering units (°C and date/time).

The external thermistor of the SBE 56 is in a pressure-protected sheath (time constant approximately 0.5 seconds), for fast data collection. This is the same sensor used in the SBE 16 plus V2 SeaCAT, SBE 37 MicroCAT, and SBE 39 Temperature Recorder. Measurement drift is typically less than 0.002 °C per year. The SBE 56 communicates with a computer via a standard USB 2.0 interface at approximately 240,000 bits per second. To set up the sensor or transmit data, open the pressure housing and connect the USB cable to the internal connector. Use Binary in the software to do a fast data transmit of large data sets: it takes approximately 40 minutes to transmit all the data the SBE 56 can store.

The SBE 56 has two modes of operation: Acquisition mode and Command mode.

- Acquisition mode: When the USB cable is disconnected from the sensor, the internal LED flashes slowly two times to show data collection, **or** that the sensor will start data collection at the user-selected start date and time.
- Command mode: When a USB cable is connected to the internal connector of the SBE 56, the sensor goes into command mode, and the internal LED flashes quickly three times. The SBE 56 power is now supplied through the USB port. While in command mode, data can be transmitted and changes can be made to the setup. When the cable is disconnected from the sensor, the LED flashes two times to show that it has automatically changed to Acquisition mode.

Time is stored with every block of 123 samples of temperature data; when transmitted, the software calculates and transmits the time of each sample.

4.1 Battery life

The size AA lithium battery cell has a nominal capacity of 2.45 A-hours. The manufacturer recommends that the user plans a deployment with a more conservative value of 2.0 A-hours. The Seaterm software calculates battery life, as does the "Deployment Endurance Calculator" software.

The orientation of the SBE56 for deployment is important. The manufacturer recommends that the SBE 56 is deployed horizontally, or with the thermistor end pointed down. If the SBE 56 is deployed with the thermistor (the + end of the battery) pointed up, the battery life may be reduced by up to 40%. Refer to the examples below for power consumption estimates.

0.5 second sample interval, 172,800 samples/day

Low power current draw = $[0.601 \times (0.5 - 0.44 \text{ sec})] \div 0.5 \text{ sec} = 0.072 \text{ mA hours/day}$

Self-discharge current draw = 0.67 mA hours/day

Operation current draw = $0.371 \mu\text{A hours/sample} \times 172,800 \text{ samples/day} \times 1 \text{ mA}/1000 \mu\text{A} = 64.109 \text{ mA hours/day}$

Total current draw = 64.248 mA hours/day

Battery life = $2000 \text{ mA hours} \div 64.248 \text{ mA hours/day} = 31 \text{ days}$

$31 \text{ days} \times 172800 \text{ samples/day} = 5.3 \text{ million samples}$

Overview

1 second sample interval, 86,400 samples/day

Low power current draw = $[0.601 \times (1 - 0.44 \text{ sec}) \div 1 \text{ sec}] = 0.336 \text{ mA hours/day}$

Self-discharge current draw = 0.67 mA hours/day

Operation current draw = $0.371 \mu\text{A hours/sample} \times 86,400 \text{ samples/day} \times 1 \text{ mA}/1000 \mu\text{A} = 32.054 \text{ mA hours/day}$

Total current draw = 32.457 mA hours/day

Battery life = $2000 \text{ mA hours} \div 32.457 \text{ mA hours/day} = 61 \text{ days}$

$61 \text{ days} \times 86,400 \text{ samples/day} = 5.3 \text{ million samples}$

15 second sample interval, 5,760 samples/day

Low power current draw = $[0.601 \times (15 - 0.44 \text{ sec}) \div 15 \text{ sec}] = 0.583 \text{ mA hours/day}$

Self-discharge current draw = 0.67 mA hours/day

Operation current draw = $0.371 \mu\text{A hours/sample} \times 5,760 \text{ samples/day} \times 1 \text{ mA}/1000 \mu\text{A} = 2.37 \text{ mA hours/day}$

Total current draw = 2.787 mA hours/day

Battery life = $2000 \text{ mA hours} \div 2.787 \text{ mA hours/day} = 717 \text{ days}$

$717 \text{ days} \times 5,760 \text{ samples/day} = 4.1 \text{ million samples}$

60 second sample interval, 1,440 samples/day

Low power current draw = $[0.601 \times (60 - 0.44 \text{ sec}) \div 60 \text{ sec}] = 0.597 \text{ mA hours/day}$

Self-discharge current draw = 0.67 mA hours/day

Operation current draw = $0.371 \mu\text{A hours/sample} \times 1,440 \text{ samples/day} \times 1 \text{ mA}/1000 \mu\text{A} = 0.534 \text{ mA hours/day}$

Total current draw = 1.198 mA hours/day

Battery life = $2000 \text{ mA hours} \div 1.198 \text{ mA hours/day} = 1669 \text{ days}$

$1660 \text{ days} \times 1,440 \text{ samples/day} = 2.4 \text{ million samples}$

The manufacturer recommends that the battery should not be used in the field more than two years.

Note

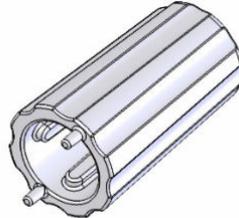
The SBE 56 has a back-up coin cell battery that supplies power to the real-time clock when the AA cell is depleted or is removed. A depleted coin cell can cause damage to the real-time clock and the processor chip when the main AA cell is removed. **Store and ship the SBE 56 with the AA cell installed. Replace the AA cell while the sensor is connected to a PC and power is supplied through the USB.**

Section 5 Verify operation and deploy sensor

5.1 Install software and test sensor

Make sure that the sensor is connected to the PC through the USB connector on the supplied cable.

1. If necessary, install the Seasoft V2 software from the manufacturer-supplied CD, USB drive or the from the website.
2. Make sure that the SBE 56 is dry and that any water at the seam between the housing and the end flange is removed.
3. Use the end flange removal tool to unscrew the end flange.



4. Carefully pull the end flange and attached electronics out of the housing.
5. Connect the USB cable to the internal connector on the SBE 56 and to a PC. The LED flashes quickly three times to show that the cable is plugged in.



6. Double-click on **SeatermV2.exe** to start the launcher software. The software automatically tries to connect to the SBE 56.
7. At the **Instruments** menu item, select SBE 56. The SeatermUSB main screen shows. There are three areas: Connected Devices, Current Configuration, and Configuration Options. Refer to [SeatermUSB details](#) on page 12 for explanation of values and options.
8. If necessary, make sure to transmit all of the data stored in the SBE 56 before any further setup. Push **Upload** in the Configuration Options area. The manufacturer ships the SBE 56 with a sample interval of two hours.
9. In the Current Configuration area, look at the values for "Memory Remaining" and "Battery Life Remaining."
10. In the Configuration Options area, put a check in any of the option boxes as applicable:
 - If necessary, change the **Sample Period**.
 - If necessary, push **Time Options** to change the time. If a custom date/time is used, select **Synchronize** then Push **OK**.
 - Select **Set time to...** so that the real-time clock agrees with the time that shows.
 - Push **Clear Memory** to make the entire memory available. This also clears the event counters.
 - If necessary, install a new AA battery cell and push **New Battery Installed**.
 - To start data collection when the cable is removed, select **Start sampling on USB cable disconnect**. To start data collection at a later time, select **Start sampling at...** and select the start date and time on the calendar icon. Push **OK**.
 - Push **Update Configuration** to transmit the setup selections to the SBE 56.

Verify operation and deploy sensor

11. Select the preferred sample start time.
12. Disconnect the USB cable.
The LED flashes slowly two times to show that it is in Acquisition mode.
13. If the SBE 56 is to be deployed, replace the desiccant capsule. Refer to [Replace battery and desiccant](#) on page 17 for details.
14. Install the end flange again and close the housing:
 - a. Make sure there is no water on the O-rings or mating surfaces. Use a lint-free cloth to remove any moisture.
 - b. Examine the O-rings for any contamination and replace if necessary. O-rings must be pristine.
 - c. Apply a small amount of Parker Super O-Lube to the O-rings and mating surfaces.
 - d. Carefully push the end flange into the housing until the first O-ring is seated.
 - e. Use the end flange removal tool to screw the end flange into the housing again.

The SBE 56 is ready for deployment.

5.1.1 SeatermUSB details

Toolbar	Buttons for frequent tasks
Refresh	Refresh the connection to the SBE 56.
Cancel	Cancel the current action, such as data upload.
Upload All	Transmit all data from the SBE 56 memory to the connected PC.
Report	Save the current configuration to a .txt file to document the setup.
Diagnostics	Enable diagnostic output for troubleshooting, select the diagnostic log location, show the log, erase the log.

Connected Devices	Multiple SBE 56 sensors can be connected to a single PC. Each connected sensor shows in this area.
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Current Configuration	Shows the current settings for the SBE 56
Serial Number	SBE 56 serial number.
Firmware Version	SBE 56 firmware version.
Sample Period	Time between samples, 0.5–32,400 seconds (9 hrs)
Date/Time	SBE 56 real-time clock date and time. This is updated to time shown in Configuration Options each time the user selects "Set time to" or "New Battery Installed" then pushes Update Configuration .
Start sampling at	The option to start data collection when the USB cable is removed, OR when a start date and time are specified by the user.
Current temperature	Temperature measured by the SBE 56 the last time it was connected, or if the user selects Refresh . This shows whether the SBE 56 is functioning correctly.
Events Recorded	SBE 56 event counter can help identify the cause of a malfunction. It records the number of power-on resets, timeouts, and more, and is reset when the memory is erased.
Battery Changed	Last date that the user selected "New Battery Installed" and pushed Update Configuration .
Number of Samples in Memory	Number of stored samples available to transmit.
Memory Remaining	Calculated value from number of samples in memory, the current sample period, and memory capacity.

Battery life remaining	Calculated value from the estimated current draw, user input of when the AA battery was last changed, de-rated estimate of total capacity when the battery was new, and current sample period.
View Calibration Coefficients	Manufacturer-set coefficients. Cannot be changed by the user.

Configuration Options	Lets the user change the configuration
Change the sample interval. (Manufacturer-set to 2 hours when shipped)	
Set the real-time clock to current PC time or to a user-set time (Push Time Options to access this option.)	
Clear memory.	
Clear event counter.	
Identify if a new AA cell is installed; necessary to calculate how much battery life remains in Current Configuration	
Set start time, either when the USB cable is disconnected, or at a later date and time after the USB cable is disconnected.	

Data Upload	
Upload	Transmit data from the SBE 56 memory. The file has a header that includes calibration coefficients and raw hex data. The file has an .xml extension.
Plot	Look at the data plot of transmitted data.
Export	Select the file type to export— .csv, compatible with MatLab or MS Excel; .cnv, compatible with SBE Data Processing software; .zip, compressed raw hex data.

5.2 Deployment

The AA lithium cell that powers the SBE 56 is affected by deployment orientation. The manufacturer recommends that the SBE 56 is deployed either horizontally, or vertically, with the thermistor end down.

If the SBE 56 is deployed with the thermistor end up, the battery life may be reduced by up to 40% from the value shown in the software. For most applications, however, the battery life is sufficient even with this reduced battery life.

Note that older sensors (serial number < 1088), vertical deployment with the thermistor up was recommended. Refer to Field Service Bulletin 25 (2012) for details.



Section 6 Recover sensor and transmit data

⚠ WARNING



If the user thinks that a sensor has water in the pressure housing: Disconnect the sensor from any power supply. Put on safety glasses and make sure that the sensor is pointed away from the body and other people. In a well ventilated area, use the purge port (if the sensor is so equipped), or very SLOWLY loosen the bulkhead connector to let the pressure release.

Recovery

After a deployment, flush the SBE 56 with fresh water and dry thoroughly.

Transmit data

1. Make sure that the SBE 56 is dry. Remove any water at the seam between the end flange and the rest of the pressure housing.
2. Use the end flange removal tool to unscrew the thermistor end of the sensor.
3. Pull the end out of the pressure housing.
4. Make sure to remove any water from the O-rings and mating surfaces with a lint-free cloth or tissue.
5. Connect the USB cable to the SBE 56 internal connector and a USB on the PC. The LED will flash quickly three times to show that the cable is connected.
6. Start the software. At the **Instruments** menu, select *SBE 56 Temperature Logger*. The Seaterm USB software starts and immediately tries to connect with the SBE 56.
7. Push **Upload** and go to the folder in which data will be transmitted. Push **Save**.
8. The **Upload Data** window shows, with the selected file name and location.
9. Select the preferred option for data to be transmitted: "All data," "By date range," or "By sample number range."
10. Push **Upload**.
The status bar at the bottom of the SeatermUSB software shows the transmit progress.
11. Push **Plot** to make a plot of the data and make sure that all data stored in the SBE 56 has been transmitted.
12. In the **Plot Data** window, *Plot Setup* tab, select the options to transmit data:
 - *Header View* tab—sensor serial number and setup information to verify the correct data for the plot.
 - *Input file*—select the file from which to transmit data.
 - *X-axis variable* and *Y-axis variable*—select the parameters for each axis.
 - *Time format*—select the format to use.
 - *Decimate Graph*—put a check in the box and enter the value for the "nth" plot, e.g. 10. For large data files, the plot will generate more quickly if not every data point is in the plot.
 - *Range*—select the range of data that will be in the plot.
 - *Title*—the title of the plot. Put a check in the box to add the file name to the title.
13. Push **Plot**. The Plot view shows.
The user can print, save, copy, zoom in or out, or change either axis. Select a point on the plot to see the x and y coordinates.
14. After all of the data is transmitted, push **Clear Memory**, then **Update Configuration**. The SBE 56 memory and event counter is erased. If the memory is not cleared, less storage is available because subsequent data will be appended to stored data.
15. Disconnect the USB cable. The LED on the sensor flashes slowly two times to show that the sensor is in Acquisition mode.
16. Replace the desiccant. Refer to [Replace battery and desiccant](#) on page 17.
17. Make sure that the O-rings are clean and do not have any nicks or cuts. Apply a light coat of silicone-based Parker Super O-Lube to the O-rings and mating surfaces.

18. Carefully push the electronics into the pressure housing. Push until the first O-ring is seated.
19. Use the end flange removal tool to screw the electronics into the pressure housing again.

6.1 Data formats

The transmitted .xml file has a header that includes calibration coefficient information and data in a raw Hex format. The SeatermUSB software can make a plot of the .xml file and it can also be exported as a .csv, .cnv, .zip file for use in other software.

Export to .csv file

The .csv file format is compatible with MatLab and MS Excel. Each line of data output is followed by a carriage return and line feed. Only one zero to the left of the decimal point shows. The format is:

sample, dated, hh:mm:ss, ttt.tttt, *where*:

sample = the sample number, if *Output sample number* was selected

date = output will vary with the user-selected format—yyyy-mm-dd, dd-mmm-yyyy, mm/dd/yyyy, or dd/mm/yyyy

hh:mm:ss = hour, minute, second

ttt.tttt = temperature, degrees Celsius, ITS-90

Other options in the **Export Data** window:

Output informational header—if selected, the data is preceded by a header that lists the sensor type, serial number, firmware version, conversion date, the transmitted .xml data file, and calibration date and coefficients.

Split file into multiple parts for use by Excel—if selected, the maximum number of scans per .csv file is 64,000, for compatibility with Excel. Multiple files are created as necessary, to export all of the data. The files are numbered 1, 2, etc.

Export to .cnv file

The .cnv file format is compatible with the SBE Data Processing Sea Plt module. Each line of data output is followed by a carriage return and line feed. Only one zero to the left of the decimal point shows. The format is:

sample time ttt.tttt flag, *where*:

sample = the sample number, if *Output sample number* was selected

date = output will vary with the user-selected format—yyyy-mm-dd, dd-mmm-yyyy, mm/dd/yyyy, or dd/mm/yyyy

time = seconds since 1-January-2000 or Julian days. User-selected.

ttt.tttt = temperature, degrees Celsius, ITS-90

flag = error flag column. Always set to 0

Export to .zip file

The .zip file has the same information as the transmitted .xml file, with the data in raw hex. The manufacturer may request this file to troubleshoot.

6.2 Export data options

In the SeatermUSB software, push **Export** to show the **Export Dialog** window. Select options from the File Type, Upload Data File, Export File, Date Format, and Miscellaneous areas. Then push **Export**. The Status bar at the bottom of the window shows the export status.

Section 7 Maintenance

⚠ WARNING



If the user thinks that a sensor has water in the pressure housing: Disconnect the sensor from any power supply. Put on safety glasses and make sure that the sensor is pointed away from the body and other people. In a well ventilated area, use the purge port (if the sensor is so equipped), or very SLOWLY loosen the bulkhead connector to let the pressure release.

The manufacturer recommends that the user returns the sensor for calibration at regular intervals. The measurement accuracy of the sensor may decrease if the sensor is stored unused for long periods of time.

7.1 Replace battery and desiccant

The SBE 56 includes a back-up coin cell and a main lithium AA battery. The coin cell supplies power to the real-time clock in the SBE 56 when the main AA cell is at end-of-life or has been removed to be replaced. A depleted coin cell can cause damage to the real-time clock and the processor chip when the main AA cell is removed.

The manufacturer ships the SBE 56 with a Saft 3.6-volt AA lithium cell installed. Store and ship the SBE 56 with the AA cell in place. Replace the AA cell at least every two years, even when the SBE 56 has not been used.

Note: Dispose of used cells in accordance with federal, state, and local regulations.

1. Wipe the outside of the housing dry, being careful to remove any water at the seam between end flange and the rest of the pressure housing.
2. Use the end flange removal tool to unscrew the thermistor end.
3. Carefully pull the attached electronics out of the housing.
4. Remove any water from O-rings and mating surfaces inside the housing with a lint-free cloth or tissue.
5. Connect the USB cable to the internal connector on the electronics and to a USB port on the PC. The SBE 56 LED flashes quickly three times to show that the cable is connected (Command mode).
6. Replace the cell: hold the electronics holder and use a pen or key to push on the back of the cell to pop it out.
7. Install a new Saft 3.6-volt AA lithium cell. The SBE 56 LED flashes slowly two times to show that it is in data collection mode or is in standby to start data collection at the user-selected start date and time.



8. Remove and replace the desiccant pack.



9. Disconnect the USB cable from the internal connector.
10. Make sure there is no water around the O-rings and mating surfaces.
11. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean or replace as necessary. Apply a light coat of silicone-based O-ring lubricant (Parker Super O Lube) to O-ring and mating surfaces.
12. Carefully push the electronics into the pressure housing until the first O-ring is seated.
13. Use the end flange removal tool to screw the electronics end into the pressure housing again.

7.2 Maintain plastic sensor

Sensors with plastic or acetyl pressure housings are lighter and less expensive than the more durable titanium or aluminum housings, but require extra care.

- Plastic can become brittle in cold environments. It is possible for cracks to form around screw holes. Make sure that screws are tightened to 15 in-lbs., or finger-tight, then 45 degrees more.
- Plastic scratches easily. Do not use screwdrivers or metal tools to remove the end flange. Monitor the pressure housing for deep scratches that can become a point of weakness during deep deployments or very cold temperatures. Make sure that the O-ring surfaces are clean.

7.3 Examine O-rings

NOTICE

Do not use petroleum-based lubricants on O-rings. It will cause damage to the O-rings. Damaged O-rings can cause the sensor to flood and make it unserviceable.

Examine the O-rings on the sensor every time they are exposed—on the connector end flange and other parts. O-rings must be pristine. If there is any question about whether an O-ring is clean and undamaged, replace it with a new one.

1. Dry the O-rings and O-ring grooves with a lint-free cloth or tissue.
2. Examine each O-ring to make sure there is no damage, dirt, lint or hair on it.
3. Replace an O-ring if necessary.
4. Apply a small quantity of silicone-based Parker Super O Lube® or Dow Corning® high vacuum grease to each O-ring.
 - The lubricant helps the O-ring move into its groove with no twist, which can compromise the seal.
 - Do NOT use petroleum-based lubricants on any O-ring.

7.4 Sensor calibration

SBE 56 sensors are subjected to known physical conditions where the responses from the sensor are measured. The coefficients are then calculated, which may be used with appropriate algorithms to get engineering units. The temperature sensor on the SBE 56 is supplied fully calibrated and the coefficients are stored in the memory of the sensor and printed on the Calibration Certificate that ships with the SBE 56. The primary source of temperature sensor calibration drift is the aging of the thermistor element. Sensor drift will usually be a few thousandths of a degree during the first year, and less in subsequent intervals. Sensor drift is not substantially dependent upon the environmental conditions of use, and—unlike platinum or copper elements—the thermistor is insensitive to shock.

Section 8 General information

Revised editions of this user manual are on the manufacturer's website.

8.1 Warranty

Refer to the manufacturer's website for warranty information (seabird.com/warranty).

8.2 Service and support

The manufacturer recommends that sensors be sent back to the manufacturer annually to be cleaned, calibrated, and for standard maintenance.

Refer to the website for FAQs and technical notes, or contact the manufacturer for support at support@seabird.com. Do the steps below to send a sensor back to the manufacturer.

1. Complete the online Return Merchandise Authorization (RMA) form or contact the manufacturer.
Note: The manufacturer is not responsible for damage to the sensor during return shipment.
2. Remove all anti-fouling treatments and devices.
Note: The manufacturer will not accept sensors that have been treated with anti-fouling compounds for service or repair. This includes AF 24173 devices, tri-butyl tin, marine anti-fouling paint, ablative coatings, etc.
3. Use the sensor's original ruggedized shipping case to send the sensor back to the manufacturer.
4. Write the RMA number on the outside of the shipping case and on the packing list.
5. Use 3rd-day air to ship the sensor back to the manufacturer. Do not use ground shipping.
6. The manufacturer will supply all replacement parts and labor and pay to send the sensor back to the user via 3rd-day air shipping.

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