SEA-BIRD SCIENTIFIC

Product Manual

SBE 39plus Temperature (P) Recorder

Temperature (pressure optional) Recorder with **RS-232** Interface

Shown with internal & external thermistor, no connector and external connector

Manual Version	04
Firmware Version	5.1.1 & later
Software Version	Seaterm V2 2.6.3 & later SBE Data Processing 7.26.7 & later

CE

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Limited Liability Statement

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Declaration of Conformity

DECLARATION OF CONFORMITY

Manufacturer's Name: Sea-Bird Electronics
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Device Description: Various data acquisition Devices and Sensors

Model Numbers:

39plus	39plus-IM	HydroCat-EP
16plusV2	16plusV2-IM	19pV2

NiMH Battery Charger and Battery Pack

Applicable EU Directives:
Machinery Directive 98 / 37/ EC
EMC Directive 2004 / 108 / EC
Low Voltage Directive (73 / 23 / EEC) as amended by (93 / 68 / EEC)

Applicable Harmonized Standards:
EN 61326-2-3 (2013) Class C Electrical Equipment for Measurement, Control, and Laboratory Use, EMC Requirement – Part 1: General Requirements (EN 55011:2007 Group 1, Class A)

EN 61010-1:2001, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements

I, the undersigned, herby declare that the equipment specified above conforms to the relevant sections of the above European Union Directives and Standards. The units comply with all applicable Essential Requirements of the Directives.

Authorized Signature / Date: 3/23/2016

Name: Casey Moore
Title: President
Place: Bellevue, WA

Table of Contents

Section 1: Introduction

This section includes a Quick Start procedure, photos of a typical SBE 39*plus* shipment, and battery shipping precautions.

About this Manual

This manual is to be used with the SBE 39*plus* Temperature (pressure optional) Recorder. It is organized to guide the user from installation through operation and data collection. We've included detailed specifications, command descriptions, maintenance and calibration information, and helpful notes throughout the manual.

Sea-Bird welcomes suggestions for new features and enhancements of our products and/or documentation. Please contact us with any comments or suggestions (seabird@seabird.com or 425-643-9866). Our business hours are Monday through Friday, 0800 to 1700 Pacific Standard Time (1600 to 0100 Universal Time) in winter and 0800 to 1700 Pacific Daylight Time (1500 to 0000 Universal Time) the rest of the year.

Quick Start

Follow these steps to get a Quick Start using the SBE 39*plus*. The manual provides step-by-step details for performing each task:

1. Test Power and Communications (see *Section 3: Preparing SBE 39plus for Deployment*).

2. Deploy the SBE 39*plus* (see *Section 4: Deploying and Operating SBE 39plus*):
   A. Install new AA cells if necessary (see *Replacing AA Cells and Desiccant* in *Section 5: Routine Maintenance and Calibration*).
   B. Ensure all data has been uploaded, and then send **InitLogging** to make entire memory available for recording if desired.
   C. Set date and time (**DateTime=**).
   D. Establish setup and sampling parameters.
   E. Check status (**DS**) and calibration coefficients (**DC**) to verify setup.
   F. Autonomous sampling: Set 39*plus* to start logging now (**StartNow**) or in the future (**StartDateTime=** and **StartLater**).
   G. Install new desiccant and close housing.
   H. **For 39*plus* with bulkhead I/O connector** - Install dummy plug or I/O cable, and locking sleeve.
   I. Deploy 39*plus*, using Sea-Bird mounting clamp or customer-supplied hardware.

Unpacking SBE 39*plus*

A typical SBE 39*plus* shipment is shown below (two of several available models are pictured).

SBE 39*plus* (with pressure) - Plastic housing, sheathed temperature sensor

SBE 39*plus* (with pressure) - Titanium housing, Embedded temperature sensor

I/O cable for internal USB connector

Spare parts kit – includes spare O-rings and spare desiccant

Software, and Electronic Copies of Software Manuals and User Manual

Shipping Precautions

DISCLAIMER / WARNING:
The shipping information provided in is a general overview of lithium cell shipping requirements; it does not provide complete shipping information. The information is provided as a courtesy, to be used as a guideline to assist properly trained shippers. These materials do not alter, satisfy, or influence any federal or state requirements. These materials are subject to change due to changes in government regulations. Sea-Bird accepts no liability for loss or damage resulting from changes, errors, omissions, or misinterpretations of these materials. **See the current edition of the *IATA Dangerous Good Regulations for complete information on packaging, labeling, and shipping document requirements*.**

For its main power supply, the SBE 39*plus* uses four 3.6-volt AA lithium cells (Saft LS14500). The SBE 39*plus* was shipped from the factory with the cells installed.

If the shipment does not meet the requirements below, the shipment is considered Dangerous/Hazardous Goods, and must be shipped according to those rules.

	1 SBE 39*plus* and associated cells, but no spares	**1-10 SBE 39*plus* and associated cells, plus up to 2 spare cell sets/SBE 39*plus***	**2-10 SBE 39*plus* and associated cells, but no spares**	**Spares (without SBE 39*plus*) Note new rules as of January 1, 2013**
UN #	UN3091	UN3091	UN3091	Must be shipped as **Class 9 Dangerous Goods**. If re-shipping spares, you must have your own Dangerous Goods program.
Packing Instruction (PI) #	970	970	970	
Passenger Aircraft	Yes	**No**	Yes	
Cargo Aircraft	Yes	Yes	Yes	
Labeling Requirement	-	1, 2 **	1 **	
Airway Bill (AWB) Requirement	No	Yes *	Yes *	

* AWB must contain following information in Nature and Quantity of Goods Box: “Lithium Metal Batteries”, “Not Restricted”, “PI #”
** Labels are defined below:

1 – Shipper must provide an emergency phone number

2

Note:
Remove the AA cells before returning the 39*plus* to Sea-Bird. Do not return the used cells to Sea-Bird when shipping the 39*plus* for calibration or repair. All setup information is preserved when the cells are removed.

If you will re-ship the SBE 39*plus* after testing, pack the SBE 39*plus* and/or spare AA cells properly for shipment, apply appropriate labels, and prepare appropriate shipping documentation.

Section 2: Description of SBE 39*plus*

This section describes the functions and features of the SBE 39*plus*, including:

- system description
- specifications
- dimensions
- connectors, cables, and wiring
- sample timing
- battery pack endurance
- external power
- real-time data acquisition

System Description

One of several configurations shown (external thermistor, internal connector, titanium housing)

The SBE 39*plus* is a high-accuracy temperature recorder (pressure optional) with internal battery pack and non-volatile memory. The 39*plus* is intended for moorings or other long-term, fixed-site applications, as well as shorter-term deployments on nets, towed vehicles, or ROVs. The 39*plus* is rated for operation to 600 meters (plastic housing) or 10,500 meters (titanium housing), or pressure sensor full-scale range. The optional cable clamp provides easy and secure attachment to a mooring cable. Calibration coefficients stored in EEPROM allow the 39*plus* to transmit data in engineering units.

The SBE 39*plus* retains the temperature sensor used in the SBE 16*plus* V2 SeaCAT and SBE 37 MicroCAT. The 39*plus* thermistor has a long history of exceptional accuracy and stability (typical drift is less than 0.002 °C per year). Two temperature sensor configurations are offered:

- Ruggedized model with the thermistor embedded in the titanium end cap (time constant approximately 25 seconds).
- (shown in photo) Model with external thermistor in a pressure-protected sheath (time constant approximately 0.5 seconds) for use when fast sampling is required.

The SBE 39*plus* is available with no pressure sensor, or with a strain-gauge pressure sensor in the following ranges: 20, 100, 350, 600, 1000, 2000, 3500, and 7000 meters. Compensation of the temperature influence on pressure offset and scale is performed by the 39*plus* CPU.

Commands can be sent to the SBE 39*plus* to provide status display, data acquisition setup, data retrieval, and diagnostic tests. User-selectable operating modes include:

- **Polled sampling** – The 39*plus* takes one sample and sends the data to the computer. Polled sampling is useful for integrating the SBE 39*plus* with satellite, radio, or wire telemetry equipment.
- **Autonomous sampling** – At pre-programmed 0.5-second to 6 -hour intervals, the 39*plus* wakes up, samples, stores data in memory, and powers off (enters quiescent state).
- **Serial Line Sync** – In response to a pulse on the serial line, the 39*plus* wakes up, samples, stores data in memory, and powers off. Serial line sync provides an easy method for synchronizing 39*plus* sampling with other instruments such as Acoustic Doppler Current Profilers (ADCPs) or current meters, without drawing on their internal power or memory resources.

Note:
The 39*plus* automatically stops autonomous sampling and/or exits serial line sync mode when you connect via USB.

SBE 39*plus* setup and data upload is via one of the following:

- **USB connector on electronics assembly** (requires opening housing) – Provides fast upload of large data sets.
- **RS-232 connector on electronics assembly** – baud rate of 600 to 115,200 is user-programmable.
- **Optional external bulkhead RS-232 connector (XSG or MCBH)** - Baud rate of 600 to 115,200 is user-programmable.

Deployment depth is dependent on the selected housing:

- PET plastic housing - depths to **600 m** (1960 ft)
- Titanium housing - depths to **10,500 m** (34,400 ft)

The SBE 39*plus* is available with optional mounting clamp(s) for mounting on a mooring wire. One clamp is used for typical applications; two clamps may be necessary if the mooring is subjected to high dynamic motion.

The SBE 39*plus* is also available with an optional net fender / fairing, with conical ends shaped to shed fishing lines and nets. When used with the net fender, one mounting clamp is required. The net fender is designed to retain half the mounting clamp. All hardware is captured within, guaranteeing no loss of nuts or bolts during deployment.

Future upgrades and enhancements to the SBE 39*plus* firmware can be easily installed in the field through a computer serial port and the internal or external bulkhead connector on the 39*plus*, without the need to return the 39*plus* to Sea-Bird.

Notes:

- Help files provide detailed information on the software.
- A separate software manual on CD-ROM contains detailed information on the setup and use of SBE Data Processing.
- Sea-Bird supplies the current version of our software when you purchase an instrument. As software revisions occur, we post the revised software on our website. See our website for the latest software version number, a description of the software changes, and instructions for downloading the software.

The SBE 39*plus* is supplied with a powerful Windows software package, **Seasoft V2**, which includes:

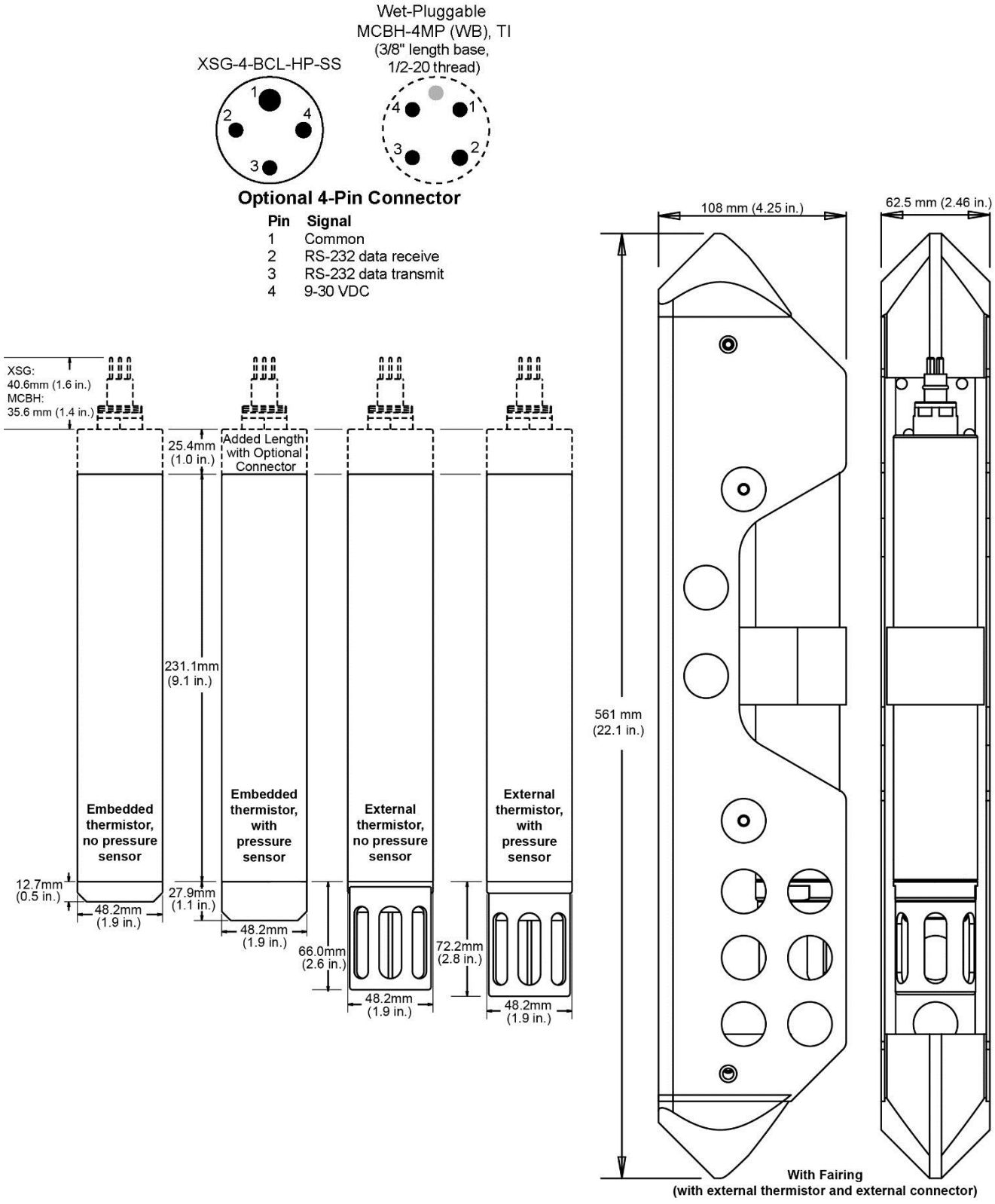
- **Deployment Endurance Calculator**– program for determining deployment length based on user-input deployment scheme, instrument power requirements, and battery capacity.
- **SeatermV2** - terminal program for easy communication and data retrieval. SeatermV2 is a launcher, and launches the appropriate terminal program for the selected instrument and communication method (Seaterm232 for RS-232 communications, SeatermUSB - SBE39plus for communication via 39*plus* internal USB connector).
- **Plot39** - program specifically for plotting SBE 39*plus* data.
- **SBE Data Processing** - SBE Data Processing includes many post-processing modules; modules applicable to the 39plus are ASCII Out (export files for other programs) and Sea Plot (plot data).

Specifications

	Temperature (°C)	Strain-Gauge Pressure (optional)
Measurement Range	-5 to +45	0 to full scale range: 20 / 100 / 350 / 600 / 1000 / 2000 / 3500 / 7000 m *Pressure expressed in meters of deployment depth capability.*
Initial Accuracy	± 0.002 (-5 to 35 °C) ± 0.01 (35 to 45 °C)	± 0.1% of full scale range
Typical Stability	0.0002/month	0.05% of full scale range/year
Resolution	0.0001	0.002% of full scale range
Sensor Calibration	-1 to +32	Ambient pressure to full scale range in 5 steps
Memory	64 Mbyte non-volatile FLASH memory	
Data Storage	Per sample: temperature 3 bytes, time 4 bytes, pressure (optional) 5 bytes. **Recorded Parameters** — **Memory Space (total samples)** T and time — 9,500,000 T, P, and time — 5,500,000	
Real-Time Clock	32,768 Hz TCXO accurate to ±1 minute/year	
	mp-hour pack consisting of 4 AA Saft LS hium cells (3.6 V and 2.6 Amp-hours each) *Precautions* in *Section 1: Introduction*)	
	mmable 0.5-sec to 6-hour intervals	
Power Consumption	*uisition (per sample)*: mA, 280 msec): 0.00070 A-sec mA, 280 msec): 0.00084 A-sec *ata transmission:* 6 mA. Transmission time varies, depending on output format and baud (**shown at 9600 baud;** for other bauds, multiply by 9600/baud): T and Time: Raw – 62 msec, Converted decimal – 40 msec, XML – 250 msec T, P, and Time: Raw – 96 msec, Converted decimal – 50 msec, XML – 280 msec *Quiescent*: 25 µA	
Battery Pack Endurance (for 39*plus* with pressure sensor)	>12 million samples at 0.5 sec sampling rate; > 11 million samples at 5 sec sampling rate Notes: 1. This endurance is achieved if 39*plus* is deployed in **recommended orientation: thermistor end down or horizontal** (see *Deployment Orientation* in *Section 2: Description of SBE 39plus*). 2. **Deployment length may be limited by memory** (see Data Storage specification). 39*plus* continues sampling and transmitting real-time data after memory is full, and does not overwrite data in memory.	
Optional External Power (with external connector)	9-30 VDC	
Housing, Depth Rating	PET plastic, 600 meters (1960 feet) Titanium, 10,500 meters (34,400 feet)	
Weight (without external connector, clamp, or fairing/net fender)	*Plastic housing with embedded thermistor*: In water: 0.25 kg (0.6 lbs) In air: 0.6 kg (1.2 lbs) *Titanium housing with thermistor in sheath*: In water: 0.7 kg (1.6 lbs) In air: 1.2 kg (2.6 lbs)	

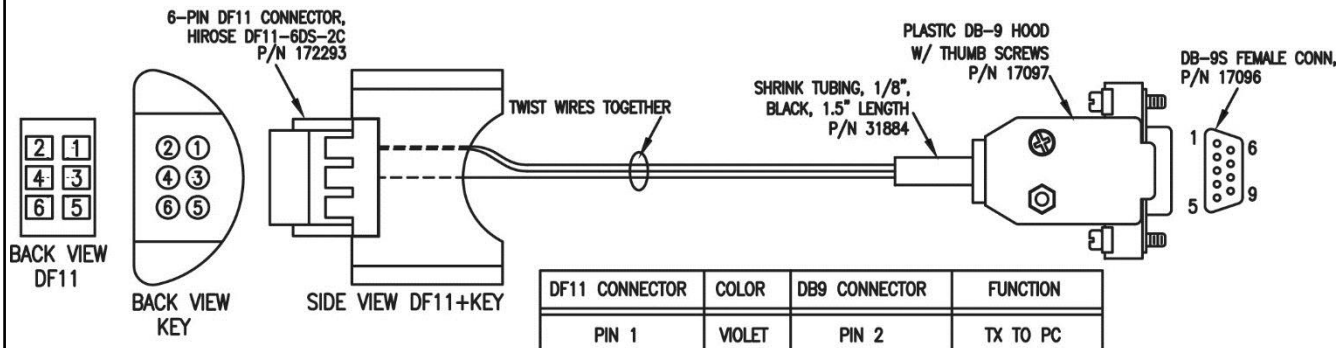
Note:
If the 39*plus* is logging data and the input voltage (main battery pack or optional external power) is less than 5 volts for 10 consecutive scans, the 39*plus* halts logging and displays a low battery indication in the data.

Dimensions and End Cap Connector



Optional Cables and Wiring

Internal RS-232 Connector Wiring -- DN 33406

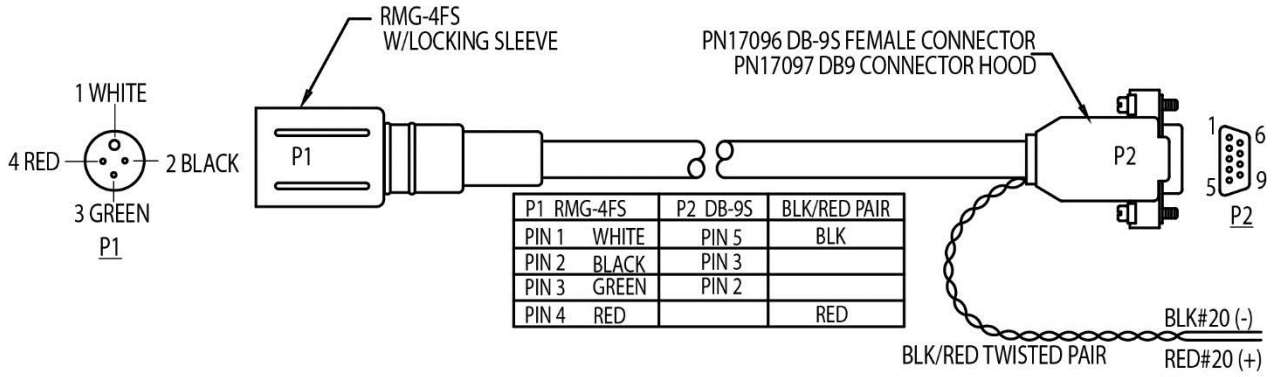


DF11 CONNECTOR	COLOR	DB9 CONNECTOR	FUNCTION
PIN 1	VIOLET	PIN 2	TX TO PC
PIN 2	BLACK	PIN 5	COMMON
PIN 3	YELLOW	PIN 3	RX FROM PC

Note: For 39*plus* without external connector, connect via internal RS-232 connector to verify operation before deploying (39*plus* will not sample autonomously or in serial line sync while USB is connected).

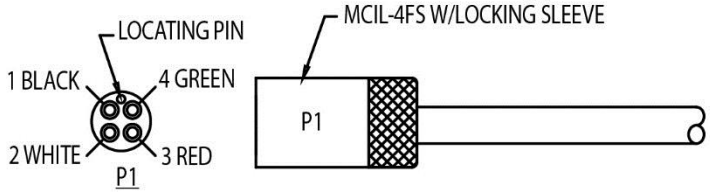
39*plus* with External Connector

RMG Connector Cable Wiring -- DN 32277



P1 RMG-4FS	P2 DB-9S	BLK/RED PAIR
PIN 1 WHITE	PIN 5	BLK
PIN 2 BLACK	PIN 3	
PIN 3 GREEN	PIN 2	
PIN 4 RED		RED

MCIL Wet-Pluggable Connector Cable Wiring -- DN 32366



P1 MCIL-4FS	P2 DB-9S	BLK/RED PAIR
PIN 1 BLACK	PIN 5	BLK
PIN 2 WHITE	PIN 3	
PIN 3 RED	PIN 2	
PIN 4 GREEN	---	RED

Sample Timing

Note:
Time to transmit real-time data is dependent on baud rate. Maximum baud rate is dependent on the data acquisition system and **cable length**; see *Real-Time Data Acquisition* below.

Sample timing is dependent on several factors, including sampling mode, whether real-time data is transmitted (**TxRealTime=**), and whether the 39*plus* includes a pressure sensor.

Power on time for each sample:
- Acquisition power-on time = 0.28 sec
- Real-time data transmission power-on time (**at 9600 baud**) =
  - (temperature and time only)
    0.04 sec (converted decimal), 0.062 sec (raw), or 0.25 sec (XML)
  - (temperature, pressure, and time)
    0.05 sec (converted decimal), 0.096 sec (raw), 0.28 sec (XML)

If transmitting real-time data at other baud rates, multiply the transmission time by (9600/baud rate). For example, if transmitting converted decimal temperature, pressure, and time at 2400, transmission time is (9600/2400) * 0.05 = 0.2 sec.

Total time for each sample =
(acquisition power-on time) + (real-time data transmission power-on time)

If transmitting real-time data, verify that the total time for each sample is less than the sample interval (**SampleInterval=**). Failure to set the sample interval appropriately can lead to inconsistent sampling.

Example:
What is the minimum sample interval if transmitting real-time temperature, pressure, and date and time in XML at 2400 baud?
Acquisition time = 0.28 sec
Real-time data transmission time = 0.28 sec * (9600/2400) = 1.12 sec
Total time for each sample = 0.28 + 1.12 = 1.4 sec (round up to 2 sec). Therefore, set **SampleInterval=2**.
Note that you can decrease the sample interval by changing the output format to converted decimal or raw data, and/or by increasing the baud (verify that baud is compatible with cable length; see *Real-Time Data Acquisition* below.

Battery Pack Endurance

Notes:
- If the 39*plus* is logging data and the input voltage (main battery pack or optional external power) is less than 5 volts for ten consecutive scans, the 39*plus* halts logging and displays a low battery indication in the data.
- **See *Specifications* above for data storage limitations.**

The SBE 39*plus* battery pack nominal capacity is 5.2 Amp-hours. For planning purposes, use a conservative value of 4.0 Amp-hours.

The battery pack capacity is achieved if the SBE 39*plus* is deployed in the **recommended orientation: thermistor end down or horizontal. If deployed vertically with thermistor end up, battery pack capacity may be reduced by up to 40%.** See *Deployment Orientation* below for details.

Power consumption is as follows:
- Sampling (acquisition) -
  0.00070 A-sec/sample for temperature and time, or
  0.00084 A-sec /sample for temperature, pressure, and time.
- Real-time data transmission current is 6 mA (0.006 A). Data transmission time varies, depending on whether the 39*plus* includes a pressure sensor, the user-selected output format, and the baud (see *Sample Timing* above).
- Quiescent current is 25 µA, and is drawn between samples. See *Sample Timing* above for sampling time and data transmission time.

Battery pack endurance is highly dependent on the application. An example is shown below for two sampling schemes. **You can use the Deployment Endurance Calculator** to determine the maximum deployment length, instead of performing the calculations by hand.

Example 1: SBE 39*plus* with pressure sensor is set up to sample autonomously every 5 sec (720 samples/hour) and transmit real-time converted decimal data at 9600 baud. How long can it be deployed?

Sampling = 0.00084 A-sec/sample
In 1 hour, sampling = 720 * 0.00084 A-sec/sample = 0.605 A-sec/hour
Communications = 0.006 A * 0.05 sec = 0.0003 A-sec/sample
In 1 hour, communications = 720 * 0.0003 A-sec/sample = 0.216 A-sec/hour
Quiescent current = 25 µA = 0.025 mA = 0.000025 A
In 1 hour, quiescent = 0.000025 mA * [3600 sec/hour – 720 * (0.28 sec + 0.05 sec)] = 0.084 A-sec/hour
Power consumption / hour = 0.605 + 0.216 + 0.084 = 0.905 A-sec/hour
Capacity = (4.0 A-hours * 3600 sec/hr) / (0.905 A-sec/hour) = 15,911 hours = 663 days = 1.8 years
Total number of samples = 15911 hours * 720 samples/hour = 11,455,920 samples
However, the memory can only hold approximately 5,500,000 samples; the 39plus will continue sampling and transmitting real-time data after the memory is full, and will not overwrite the data in the memory.

Example 2: SBE 39*plus* with pressure sensor is set up to sample autonomously every 0.5 sec (7200 samples/hour) and transmit real-time converted decimal data at 9600 baud. How long can it be deployed?

Sampling = 0.0008 A-sec/sample
In 1 hour, sampling = 7200 * 0.00084 A-sec/sample = 6.05 A-sec/hour
Communications = 0.006 A * 0.05 sec = 0.0003 A-sec/sample
In 1 hour, communications = 7200 * 0.0003 A-sec/sample = 2.16 A-sec/hour
Quiescent current = 25 µA = 0.025 mA = 0.000025 A
In 1 hour, quiescent = 0.000025 mA * [3600 sec/hour – 7200 * (0.28 sec + 0.05 sec)] = 0.03 A-sec/hour
Power consumption / hour = 6.05 + 2.16 + 0.03= 8.24 A-sec/hour
Capacity = (4.0 A-hours * 3600 sec/hr) / (8.24 A-sec/hour) = 1748 hours = 72 days
Total number of samples = 1748 hours * 7200 samples/hour = 12,585,600 samples
However, the memory can only hold approximately 5,500,000 samples; the 39plus will continue sampling and transmitting real-time data after the memory is full, and will not overwrite the data in the memory.

Deployment Orientation

Recommended Orientations

The AA lithium cells that power the SBE 39*plus* are affected by deployment orientation. **An SBE 39*plus* deployed with the thermistor end up (AA cell *button end* (+) down) exhibits reduced capacity**; battery pack endurance may be reduced by up to 40%. For most typical customer applications, the battery pack endurance is sufficient, even with the potential reduction. For example, the calculated endurance for a 39*plus* with pressure sensor and 0.5-second sample interval is 12.4 million samples (see example calculation above). With a potential 40% reduction in capacity, the SBE 39*plus* could be deployed for 7.4 million samples. The memory only holds 5.5 million samples, so memory would still control the deployment length, unless you are only interested in real-time data.

If you require the full battery pack capacity, Sea-Bird strongly recommends that you deploy the SBE 39*plus* in one of the following orientations:

- **Vertical**, with the thermistor end down (cell *button end* (+) up)
- **Horizontal**

External Power

The SBE 39*plus* can be externally powered during deployment if ordered with the external connector. The battery pack is diode-OR'd with the external source, so power is drawn from whichever voltage source is higher.

Note:
See *Real-Time Data Acquisition* below for baud rate limitations on cable length if transmitting real-time data.

Cable Length and External Power

There are two issues to consider if powering the SBE 39plus externally:

- Limiting the IR loss to 1 volt **if transmitting real-time data**; higher IR loss will prevent the instrument from transmitting real-time data because of the difference in ground potential.
- Supplying enough power at the power source so that sufficient power is available at the instrument after considering IR loss.

Looking at each issue separately:

Limiting IR Loss to 1 Volt if Transmitting Real-Time Data

The limit to cable length is typically reached when the maximum communication current times the power common wire resistance is more than 1 volt:

$V_{limit} = 1 \text{ volt} = IR_{limit}$

Maximum cable length = R_{limit} / wire resistance per foot

where I = 39*plus* communications current (6 mA; see Specifications).

Note:
Common wire resistances:

Gauge	Resistance (ohms/foot)
12	0.0016
14	0.0025
16	0.0040
18	0.0064
19	0.0081
20	0.0107
22	0.0162
24	0.0257
26	0.0410
28	0.0653

Example 1 – For 24 gauge wire, what is the maximum distance to transmit power to 39*plus*?
For 6 mA communications current, $R_{limit} = V_{limit} / I = 1 \text{ volt}/0.006 \text{ A} = 166$ ohms
For 24 gauge wire, resistance is 0.0257 ohms/foot.
Maximum cable length = 166 ohms/0.0257 ohms/ft = 6485 ft = 1977 m

Example 2 – Same as above, but 4 SBE *39plus* are powered from same power supply.
For 6 mA communications current, $R_{limit} = V_{limit} / I = 1 \text{ volt}/(0.006 \text{ A} * 4) = 41$ ohms
For 24 gauge wire, resistance is 0.0257 ohms/ft.
Maximum cable length = 41 ohms/0.0257 ohms/ft = 1621 ft = 494 m (cable length to 39*plus* furthest from power source).

Supplying Enough Power to SBE 39*plus*

Another consideration in determining maximum cable length is supplying enough power at the power source so that sufficient voltage is available, after IR loss in the cable, to power the SBE 39*plus* (I = 6 mA maximum current). The power requirement varies, depending on whether *any* power is drawn from the battery pack:

- Provide at least 8 volts, after IR loss, to prevent the 39*plus* from drawing **any** power from the battery pack (if you do not want to draw down the battery pack): $V - IR \geq 8$ volts (I = 6 mA maximum current)
- Provide at least 5 volts, after IR loss, if allowing the 39*plus* to draw down the battery pack or if no AA cells are installed: $V - IR \geq 5$ volts

Example 1 – For 24 gauge wire, what is maximum distance to transmit power to 39*plus* if using a 9 volt power source to supply power and you do not want to draw down battery pack?
$V - IR \geq 8$ volts 9 volts – (0.006 A) * (0.0257 ohms/foot * 2 * cable length) $\geq$ 8 volts
Cable length = 3242 ft = 988 m
Note that 988 m < 1977 m (example above, so IR drop in power is controlling factor for this example. However, cable length limitations are also affected by baud rate; maximum cable length is 1600 m if transmitting at 600 baud, and less for higher baud rates).

Example 2 – Same as above, but 4 SBE *39plus* are powered from same power supply.
$V - IR \geq 8$ volts 9 volts – (0.006 A * 4 39*plus*) * (0.0257 ohms/foot * 2 * cable length) $\geq$ 8 volts
Cable length = 810 ft = 247 m (to 39*plus* furthest from power source. However, cable length limitations are also affected by baud rate; maximum cable length is 1600 m if transmitting at 600 baud, and less for higher baud rates).

Real-Time Data Acquisition

Notes:
- Set baud rate with **BaudRate=**. Set **TxRealTime=Y** to output real-time data for autonomous or serial line sync mode. See *Command Descriptions* in this section for command details.
- If using external power, see *External Power* above for power limitations on cable length.

The length of cable that the SBE 39*plus* can drive for transmitting real-time data is dependent on the baud rate. Check the capability of your computer and terminal program before increasing the baud; high baud requires a short cable and good PC serial port with an accurate clock. Allowable combinations are:

Maximum Cable Length (meters)	Maximum Baud Rate
1600	600
800	1200
400	2400
200	4800
100	9600
50	19200
25	38400
16	57600
8	115200

If acquiring real-time data with Seaterm232, click the Capture menu in Seaterm232; enter the desired file name in the dialog box, and click Save. Begin sampling. The data displayed in Seaterm232 will be saved to the designated file. Process the data as desired. This real-time data file **cannot be processed by Plot39 or SBE Data Processing, as it does not have the required headers and format**. To process data with Plot39 or SBE Data Processing, upload the data from the SBE 39*plus* memory.

Section 3: Preparing SBE 39*plus* for Deployment

This section describes software installation and the pre-check procedure for preparing the SBE 39*plus* for deployment.

The SBE 39*plus* can be setup up using one of the following methods:
- **RS-232** - With the computer connected to the optional external bulkhead connector or to the internal **RS-232** connector, use Seaterm232 to set up the 39*plus*.
- **USB** - With the computer connected to the internal **USB** port, use SeatermUSB – SBE39plus to set up the 39*plus*.

Software Installation

Notes:
- Help files provide detailed information on the software. A separate software manual on the CD-ROM contains detailed information on SBE Data Processing.
- It is possible to use the SBE 39*plus* without the SeatermV2 terminal program by sending direct commands from a dumb terminal or terminal emulator, such as Windows HyperTerminal.
- Sea-Bird supplies the current version of our software when you purchase an instrument. As software revisions occur, we post the revised software on our website. See our website for the latest software version number, a description of the software changes, and instructions for downloading the software.

Seasoft V2 was designed to work with a PC running Windows XP service pack 2 or later, Windows Vista, or Windows 7 (32-bit or 64-bit).

If not already installed, install Sea-Bird software programs on your computer using the supplied software CD:

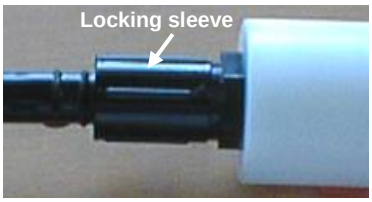
1. Insert the CD in your CD drive.
2. Install software: Double click on **SeasoftV2.exe**. Follow the dialog box directions to install the software. The installation program allows you to install the desired components. Install all the components, or just install Deployment Endurance Calculator (battery endurance calculator), SeatermV2 (terminal program *launcher* for the SBE 39*plus*), Plot39 (plotting software), and SBE Data Processing (data processing).

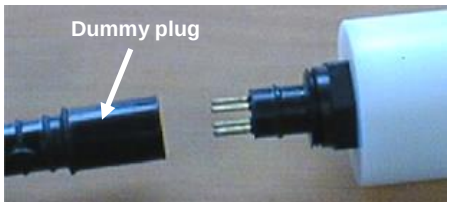
The default location for the software is c:\Program Files\Sea-Bird. Within that folder is a sub-directory for each program.

If you will be using a USB-to-Serial Port adapter to connect the SBE 39*plus* to a USB port on your computer: You must install the driver for the adapter. The driver should have been provided when you purchased the adapter, or you should be able to download it from the adapter manufacturer's website.

Power and Communications Test – Using RS-232 Communications

Notes:
- Sea-Bird ships the 39*plus* with four AA lithium cells installed. See *Replacing AA Cells and Desiccant* in *Section 5: Routine Maintenance and Calibration* to replace the cells.
- For 39*plus* without external connector, go to Step 2 to connect to internal RS-232 connector, or go to *Power and Communications Test – Using USB Communications* below.

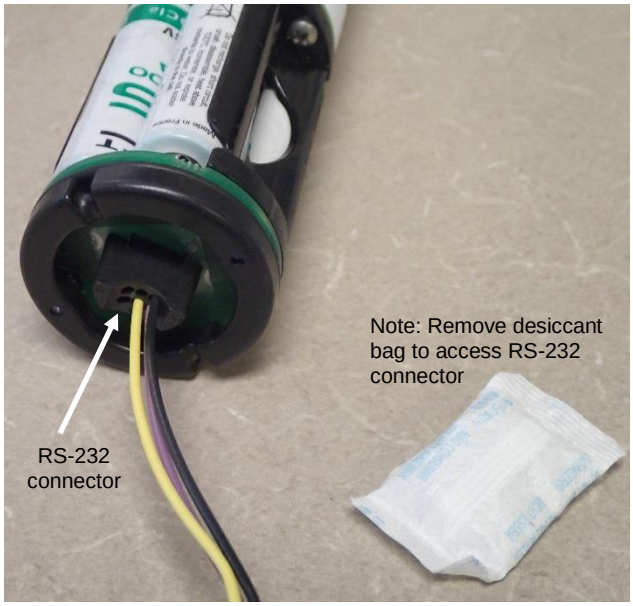




Test Setup

1. **For 39*plus* with external connector - connect to bulkhead connector:**
   A. By hand, unscrew the locking sleeve from the 39*plus* bulkhead connector. **If you must use a wrench or pliers, be careful not to loosen the bulkhead connector instead of the locking sleeve**.
   B. Remove the dummy plug from the 39*plus* bulkhead connector by pulling the plug firmly away from the connector.
   C. Install the Sea-Bird I/O cable connector:
   XSG Connector (shown in photos and illustration) - Align the raised bump on the side of the connector with the large pin (pin 1 - ground) on the 39*plus*. **OR**
   MCBH Connector – Align the pins.
   D. Connect the I/O cable connector to your computer's serial port.

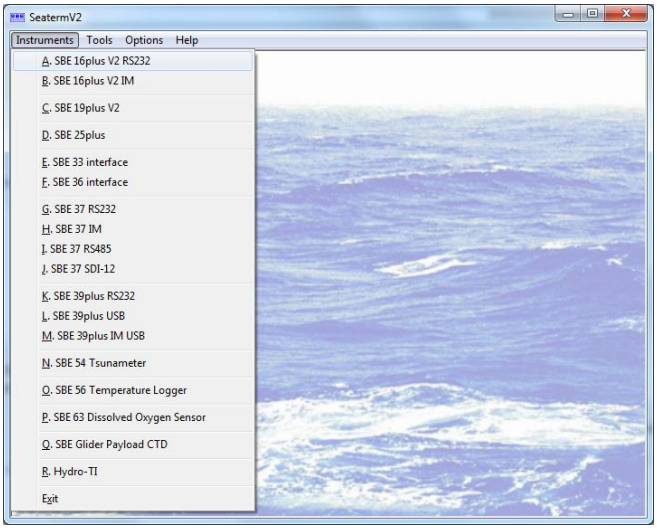
2. **For 39*plus* without external connector - connect to internal RS-232 I/O connector:**
   A. Wipe the outside of the titanium end cap and housing dry, being careful to remove any water at the seam between them.
   B. Using a wrench on the end cap's wrench flats, unscrew the end cap.
   C. Pull the end cap and attached electronics out of the housing.
   D. Remove any water from the end cap O-rings and mating surfaces inside the housing with a lint-free cloth or tissue.
   E. Remove the desiccant bag from the top of the battery pack.
   F. Install the data I/O cable's 6-pin connector on the pins.
   G. Connect the I/O cable connector to your computer's serial port.



Test

Note:
See SeatermV2's Help files.

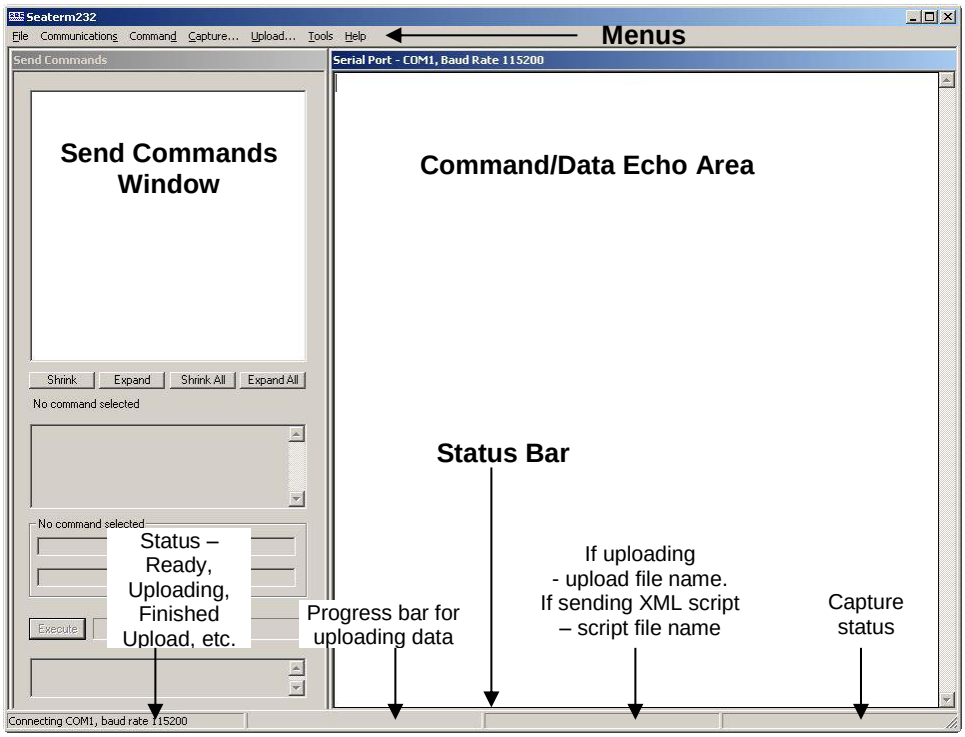
1. Double click on **SeatermV2.exe**. The main screen looks like this:



SeatermV2 is a *launcher*, and launches the appropriate terminal program for the selected instrument.

Notes:
- See Seaterm232's Help files.
- If the 39*plus* is connected to the computer by both RS-232 and USB, the USB connection prevents RS-232 communication. Either disconnect the USB cable, or select *SBE 39plus USB* in the Instruments menu (see *Power and Communications Test – Using USB Communications* below).

2. In the Instruments menu, select *SBE 39plus RS232*. **Seaterm232** opens; the main screen looks like this:



- Menus – Tasks and frequently executed instrument commands.
- Send Commands window – Contains commands applicable to your 39*plus*. The list appears after you connect to the 39*plus*.
- Command/Data Echo Area – Title bar shows Seaterm232's current comm port and baud rate. Commands and the 39*plus* responses are echoed here. Additionally, a command can be manually typed or pasted (ctrl + V) here. Note that the 39*plus* must be *connected* and *awake* for it to respond to a command.
- Status bar – Provides connection, upload, script, and capture status information.

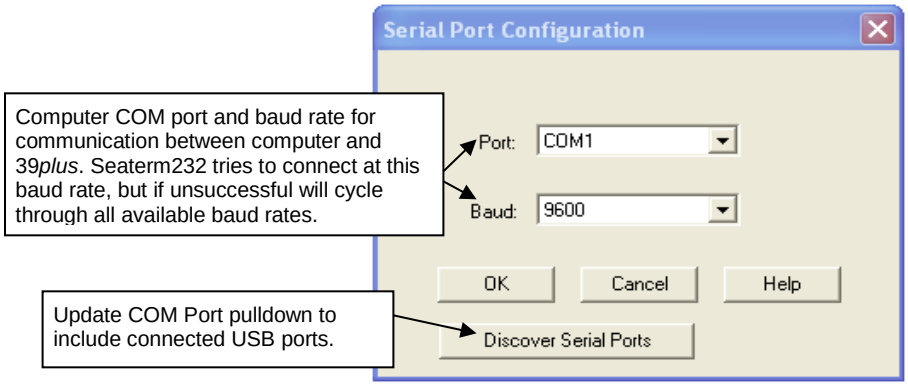
Following is a description of the menus:

Menu	Description	Equivalent Command*
File	• Load command file – opens selected .XML command file, and fills Send Commands window with commands. • Unload command file – closes command file, and removes commands from Send Commands window. • Exit - Exit program.	-
Communications	• Configure – Establish communication parameters (comm port and baud rate). • Connect – connect to comm port. • Disconnect – disconnect from comm port. • Disconnect and reconnect – may be useful if instrument has stopped responding.	-
Command	• Abort – interrupt and stop 39*plus*' response. • Send 5 second break (for use with Serial Line Sync mode). • Send stop command. • Set local time– Set date and time to time sent by timekeeping software on your computer; accuracy ± 25 msec of time provided by computer. • Set UTC Time (Greenwich Mean Time) – Set date and time to time sent by timekeeping software on your computer; accuracy ± 25 msec of time provided by computer.	• (press Esc key three times for Abort) • **Stop** • **DateTime=** • **DateTime=**
Capture	Capture instrument responses on screen to file, to save real-time data or use for diagnostics. File has .cap extension. Click Capture menu again to turn off capture. Capture status displays in Status bar.	—
Upload	Upload data stored in memory, in a format that Plot39 software can use. Uploaded data has .xml extension, and is then automatically converted to a .asc file that can be used in Plot39. Before using Upload: **stop logging** by sending **Stop**.	Several status commands and appropriate data upload command as applicable to user selection of range of data to upload (use Upload menu if you will be processing data with Plot39 or SBE Data Processing)
Tools	• Diagnostics log - Keep a diagnostics log. • Convert .XML data file – Converts uploaded .xml file to .asc file (for plotting in Plot39) and .cnv file (for use in SBE Data Processing). Note that using Upload menu automatically converts uploaded .xml file to .asc file; tool is available if there was a problem with automatic conversion. • Send script – Send XML script to 39*plus*. May be useful if you have a number of 39*plus* to program with same setup.	-

Note:
Set local time and *Set UTC time* are disabled if the baud rate in Seaterm232 is set to 115200, because the software cannot reliably set the time at that baud. Additionally, use of those commands at bauds of 38400 or 57600 may be unreliable.

*See *Command Descriptions* in *Section 4: Deploying and Operating SBE 39plus*.

3. If this is the first time Seaterm232 is being used, the configuration dialog box displays:



Make the desired selections, and click OK.

Note:
Seaterm232's baud rate must be the same as the 39*plus* baud rate (set with **BaudRate=**). Baud is factory-set to 9600, but can be changed by the user (see *Command Descriptions* in *Section 4: Deploying and Operating SBE 39plus*). Other communication parameters – 8 data bits, 1 stop bit, and no parity – cannot be changed.

4. Seaterm232 tries to automatically connect to the 39*plus*. As it connects, it sends **GetHD** and displays the response, which provides factory-set data such as instrument type, serial number, and firmware version. Seaterm232 also fills the Send Commands window with the correct list of commands for your 39*plus*.

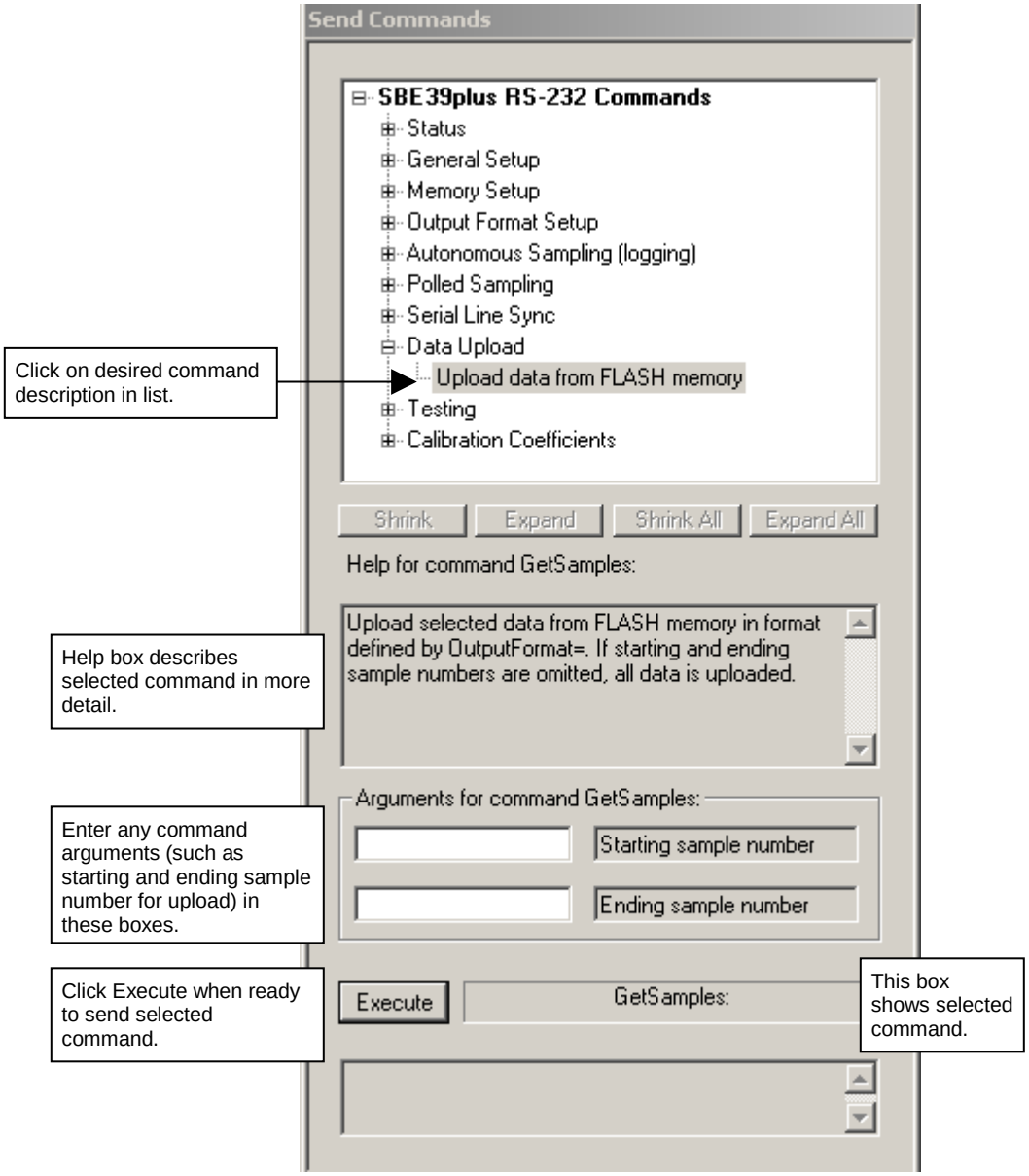
   If there is no communication:

   A. In the Communications menu, select *Configure*. The Serial Port Configuration dialog box appears. Select the Comm port and baud rate for communication, and click OK. Note that the factory-set baud rate is documented on the Configuration Sheet.
   B. In the Communications menu, select *Connect* (if *Connect* is grayed out, select *Disconnect and reconnect*). Seaterm232 will attempt to connect at the baud specified in Step A, but if unsuccessful will then cycle through all other available baud rates.
   C. If there is still no communication, check cabling between the computer and 39*plus*, and try to connect again.
   D. If there is still no communication, repeat Step A with a different comm port, and try to connect again.

Note:
If **OutputExecutedTag=Y**, the 39*plus* does **not** provide an `S>` prompt after the `<Executed/>` tag at the end of a command response.

After Seaterm232 displays the **GetHD** response, it provides an S> prompt to indicate it is ready for the next command.

Taking a look at the Send Commands window:



You can use the Send Commands window to send commands, or simply type the commands in the Command/Data Echo area if desired.

5. Display 39*plus* status information by typing **DS** and pressing the Enter key. The display looks like this:

Note:
The 39*plus* automatically enters quiescent (sleep) state after 2 minutes without receiving a command. This timeout algorithm is designed to conserve battery pack energy if the user does not send **QS** to put the 39*plus* to sleep. If the 39*plus* does not appear to respond, select *Connect* in the Communications menu to reestablish communications.

```
SBE 39plus V 4.2.0  SERIAL NO. 03909999  26 Jul 2015 08:49:08
battery voltage = 6.40, back-up voltage = 3.20
not logging: received stop command
sample interval = 1 seconds
samplenumber = 0, free = 5592405
serial sync mode disabled
real-time output enabled
configuration = temperature and pressure
data format = converted engineering
output temperature, Celsius
output pressure, Decibar
output sample number
temperature =19.48 deg C
```

Verify that the status is **`not logging.`**

6. Command the 39*plus* to take a sample by typing **TS** and pressing the Enter key. The display looks like this if pressure sensor installed, data format = converted engineering (**OutputFormat=1**), outputting temperature in Celsius (**OutputTemp=Y**, **SetTempUnits=0**), and outputting pressure in decibars (**OutputPress=Y**, **SetPressUnits=0**):

```
19.5058, 0.062, 26 Jul 2015, 08:50:43
```

where 19.5058 = temperature in degrees Celsius
0.062 = pressure in dbars
26 Jun 2014 = date
08:50:43 = time

These numbers should be reasonable; i.e., room temperature, barometric pressure (gauge pressure), current date and time (factory-programmed to Pacific Daylight or Standard Time; can be changed by user).

7. Command the 39*plus* to go to sleep (quiescent state) by typing **QS** and pressing the Enter key.

8. **(if you connected to internal RS-232 I/O connector)** Reinstall the end cap and close the housing.
   A. Remove the RS-232 cable from the internal connector.
   B. Install a new desiccant bag on the top of the battery pack (see *Replacing AA Cells and Desiccant* in *Section 5: Maintenance and Calibration*).
   C. Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to O-ring and mating surfaces.
   D. Carefully fit the end cap into the housing, pushing in until the first O-ring is seated.
   E. Using a wrench, screw the end cap into the housing.

CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

The SBE 39*plus* is ready for programming and deployment.

Power and Communications Test – Using USB Communications

Notes:
- Sea-Bird ships the 39*plus* with four AA lithium cells installed. See *Replacing AA Cells and Desiccant* in *Section 5: Routine Maintenance and Calibration* to replace the cells.
- The 39*plus* automatically stops autonomous sampling and/or exits serial line sync mode when you connect via USB.

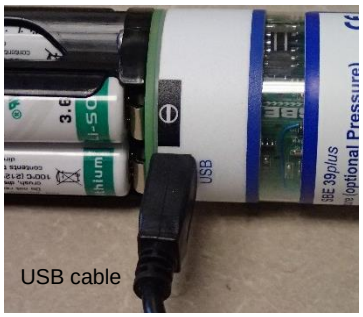
Test Setup

1. **Connect to Internal USB connector:**
   A. Wipe the outside of the titanium end cap and housing dry, being careful to remove any water at the seam between them.
   B. Using a wrench on the end cap's wrench flats, unscrew the end cap.
   C. Pull the end cap and attached electronics out of the housing.
   D. Remove any water from the end cap O-rings and mating surfaces inside the housing with a lint-free cloth or tissue.
   E. Connect the USB cable to the USB connector below the battery pack.
   F. Connect the USB cable to your computer's USB port.

Shown with external thermistor; detail similar for 39*plus* with embedded thermistor

Wrench flat (both sides)

39*plus* with embedded thermistor and external RS-232 connector; detail similar for other configurations

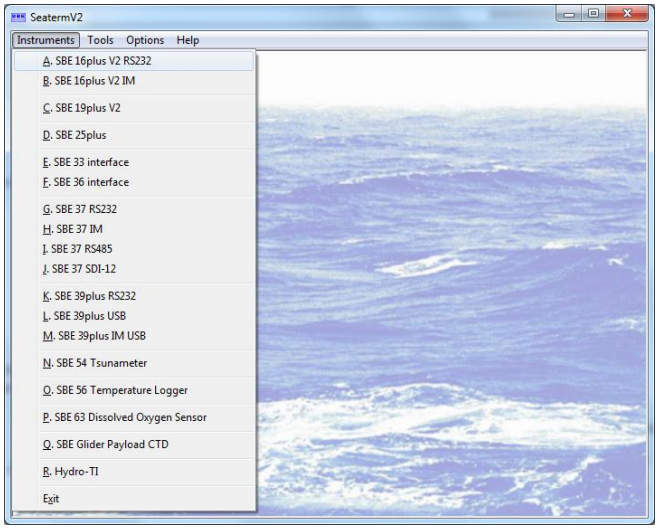


USB cable

Note:
See SeatermV2's Help files.

Test

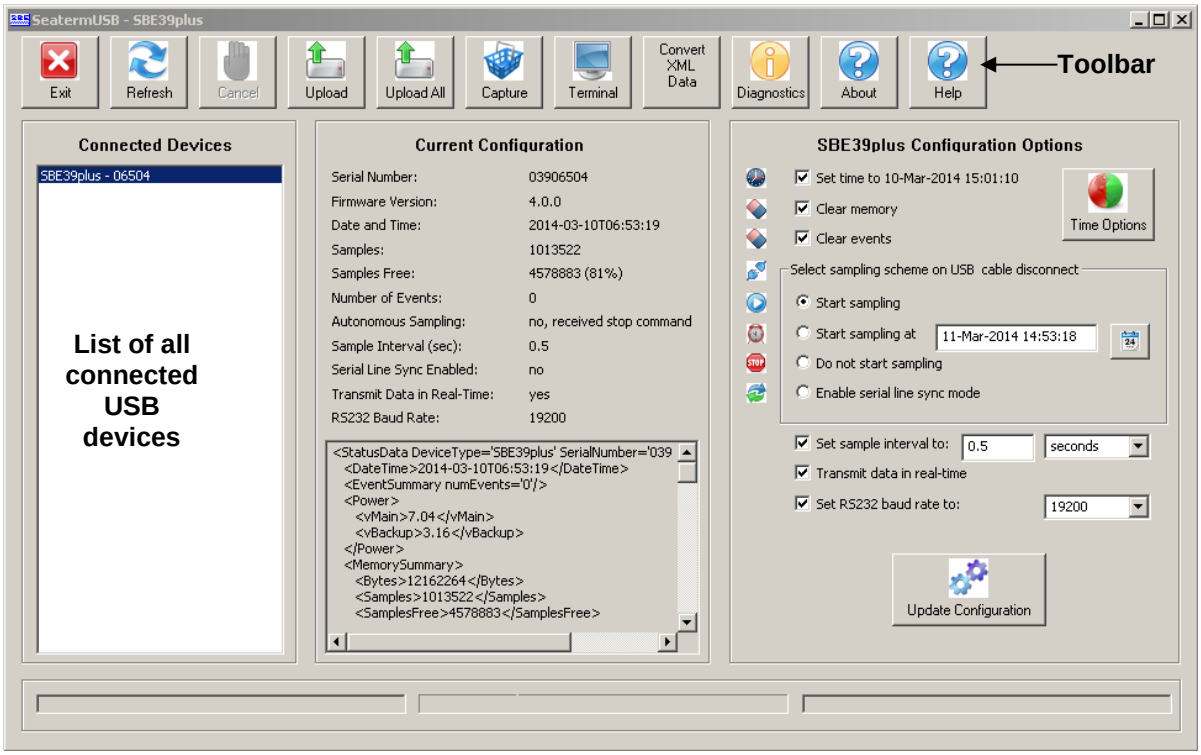
1. Double click on **SeatermV2.exe**. The main screen looks like this:



SeatermV2 is a *launcher*, and launches the appropriate terminal program for the selected instrument.

Notes:
- See SeatermUSB – SBE39plus Help files.
- If your SBE 39*plus* does not connect, see *Appendix V: USB Driver Installation*.

2. In the Instruments menu, select *SBE 39plus USB*.
SeatermUSB – SBE39plus opens. If there is only one USB device connected, SeatermUSB – SBE39plus should automatically connect to the device (you may need to click Refresh). If there are multiple USB devices, click on the desired device and click Refresh. The main screen looks like this:



- **Toolbar** – Buttons for frequently executed tasks.
  - Refresh – Refresh connection to 39*plus*.
  - Cancel – Cancel current action, such as data upload.
  - Upload – Upload selected data from 39*plus* memory.
  - Upload All – Upload all data from memory from all 39*plus* connected via USB to computer.
  - Capture – Capture instrument setup to a .cap file.
  - Terminal – Open terminal program (SeatermUSB Terminal), allowing you to send most commands to 39*plus*.
  - Convert XML Data – Convert uploaded .xml data file to .asc and/or .cnv file (used by other Sea-Bird software to plot data).
  - Diagnostics – Enable diagnostic output for troubleshooting, select diagnostic log location, display log, and/or erase log.
- **Connected Devices** – Lists each USB instrument cabled to computer; selected instrument is highlighted.
- **Current Configuration** – Indicates current setup; results of **GetSD**, **GetHD**, **GetCD**, **GetCC**, and **GetEC** status commands.
- **SBE 39plus Configuration Options** – Reconfigure 39*plus* setup, providing easy access to commonly changed setup parameters.
  - Reset clock to computer or user-set time (click Time Options).
  - Clear memory (after you have uploaded data).
  - Clear event counter.
  - Set action for when USB cable is disconnected.
  - Set interval for autonomous sampling.
  - Enable/disable real-time RS-232 data transmission when sampling.
  - Set baud rate for RS-232 communications.

  After selections are entered, **click the Update Configuration button to send setup commands to the 39*plus*.**
- **Status bar** – At bottom of screen, information such as whether 39*plus* successfully connected, data upload progress, etc.

Note:
For a list of commands that can be sent from SeatermUSB Terminal, see *Command Descriptions* in *Section 4: Deploying and Operating SBE 39plus*.

3. Ensure all data has been uploaded.

Note:
Changes made in SBE 39plus Configuration Options do not take effect until you click the Update Configuration button.

4. In **SBE 39plus Current Configuration Options**, modify the setup if desired:
   A. If desired, click the **Time Options** button to change the date and time tracked by the program. Options include UTC time, local time, or selection of an offset from UTC time. After you click OK, the time shown in Configuration Options reflects your selection.
   B. Click **Set time to . . .** to reset the real-time clock in the 39*plus* to match the time shown.
   C. Click **Clear memory** to make the entire memory available for recording.
   D. Click **Clear events** to clear the event counter.
   E. Select desired behavior for when you disconnect the USB cable:
      - To start autonomous sampling when you remove the cable, select **Start sampling.**
      - To set a delayed date and time to start autonomous sampling, select **Start sampling at . . .** , and click the calendar icon. Select the desired start date and time in the calendar, and click OK.
      - To do nothing, select **Do not start sampling**.
      - To enable serial line sync sampling, select **Enable serial line sync mode**.
   F. Modify the sample interval for autonomous sampling.
   G. Enable/disable transmission of real-time data for autonomous sampling or serial line sync mode sampling.
   H. Modify the baud rate for RS-232 communication.
   I. **Click the Update Configuration button** to program the setup into the 39*plus*.
      - If you selected *Clear memory* and / or *Clear events*, the software requires confirmation before sending the command to the 39*plus*, to prevent accidental erasing of data.

5. Unplug the USB cable from the 39*plus*.

6. Install new desiccant (see *Replacing AA Cells and Desiccant* in *Section 5: Maintenance and Calibration*).

CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

7. Reinstall the end cap and close the housing:
   A. Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to O-ring and mating surfaces.
   B. Carefully fit the end cap into the housing, pushing in until the first O-ring is seated.
   C. Using a wrench, screw the end cap into the housing.

The SBE 39*plus* is ready for deployment.

Section 4: Deploying and Operating SBE 39plus

This section provides instructions / discussions on:
- system operation
- example sets of operation commands for each operating mode
- detailed command descriptions
- data formats
- deployment
- uploading data
- processing data

Sampling Modes

The SBE 39*plus* has three basic sampling modes for obtaining data:
- Polled Sampling – On command, the 39*plus* takes one sample and transmits data.
- Autonomous Sampling – At pre-programmed intervals, the 39*plus* wakes up, samples, stores data in memory, and goes to sleep. Data is transmitted real-time if **TxRealTime=Y**.
- Serial Line Synchronization – In response to a pulse on the serial line, the 39*plus* wakes up, samples, stores data in memory, and goes to sleep. Data is transmitted real-time if **TxRealTime=Y**.

Commands can be used in various combinations to provide a high degree of operating flexibility.

Descriptions and examples of the sampling modes follow. Note that the SBE 39*plus*' response to each command is not shown in the examples. Review the operation of the sampling modes and the commands described in *Command Descriptions* before setting up your system.

Polled Sampling

On command, the SBE 39*plus* takes a measurement and sends the data to the computer. Storing of data in the 39*plus*' FLASH memory is dependent on the particular command used.

Example: **Polled Sampling** (user input in bold)
Wake up SBE 39*plus*. Set up to send data in converted decimal format. Command 39*plus* to take a sample and send data to computer (do not store data in memory). Send power-off command.

(Select *Connect* in Seaterm232's Communications menu to connect and wake up.)
```
OUTPUTFORMAT=1
GETCD       (to verify setup)
TS
QS
```

When ready to take a sample (repeat as desired): wake up 39*plus*, command it to take a sample and output data, and send power-off command.
(Before first sample, click Capture menu to capture data to a file – Seaterm232 requests file name for data to be stored.)
(Select *Connect* in Seaterm232's Communications menu to connect and wake up.)
```
TS
QS
```

Notes:
- If the FLASH memory is filled to capacity:
  - If **TxRealTime=Y**: Sampling continues, but excess data is not saved in memory (i.e., the SBE 39*plus* does not overwrite the data in memory).
  - If **TxRealTime=N**: Sampling stops.
- Use **Stop** to:
  - stop logging.
  - stop waiting to start logging (after **StartLater** has been sent).

  Once **Stop** is sent, the 39*plus* will accept all commands again.
- An alternate method to stop logging is to send three Esc characters.
- The 39*plus* automatically stops autonomous sampling if you connect via USB.

Autonomous Sampling (Logging commands)

At pre-programmed intervals, the SBE 39*plus* wakes up, samples data and stores it in FLASH memory, and powers-off (enters quiescent state). The sampling interval is set with **SampleInterval=**.

Logging is started with **StartNow** or **StartLater**, and is stopped with **Stop**. Transmission of real-time data is dependent on **TxRealTime=**.

The SBE 39*plus* has a *lockout* feature to prevent unintended interference with sampling. If the 39*plus* is logging or is waiting to start logging (**StartLater** has been sent, but logging has not started yet), the 39*plus* will only accept the following commands: **GetCD**, **GetSD**, **GetCC**, **GetEC**, **GetHD**, **DS**, **DC**, **DNx**, **SL**, **TS**, **TSR**, **QS**, **Stop**, and **Help**. If you wake the 39*plus* while it is sampling (for example, to send **DS** to check on progress), it temporarily stops sampling. Autonomous sampling resumes at the next scheduled time, after it finishes processing and responding to the command. You may see a gap in the real-time and uploaded data if you are sampling at a small sample interval, or if you send a command as the 39*plus* is about to take the next sample. To minimize gaps in the data, send the desired command as soon as the previous sample is transmitted.

Example: SBE 39*plus* is sampling at 30 second intervals.
Sample 1 at 30 sec.
Sample 2 at 60 sec.
Sample 3 at 90 sec.
(send **DS** at 119 sec, 39plus is responding when it should have taken next sample at 120 sec)
Sample 4 at 150 sec. (resumes logging at next scheduled interval)

Additionally, if the SBE 39*plus* is logging, **it cannot be interrupted during a measurement** to accept any commands. If the 39*plus* is logging and appears unresponsive, it may be in the middle of taking a measurement; continue to try to establish communications.

If transmitting real-time data, keep the signal line open circuit or within ± 0.3 V relative to ground to minimize power consumption when not trying to send commands.

Example: ***Autonomous Sampling*** (user input in bold)
Establish communication. Initialize logging to overwrite previous data in memory. Set up to sample every 10 sec, and not transmit real-time data to computer. Set up to automatically start on 15 September 2013 at 12:00:00. Send power-off command after all parameters are entered - system will automatically wake up and power down for each sample.

(Select *Connect* in Seaterm232's Communications menu to connect and wake up.)
INITLOGGING
SAMPLEINTERVAL=10
TXREALTIME=N
STARTDATETIME=09152013120000
STARTLATER
GETCD (to verify setup)
QS

After logging begins, look at data from last sample to check results, and then go to sleep:

(Select *Connect* in Seaterm232's Communications menu to connect and wake up.)
SL
QS

When ready to upload data to computer, establish communication, stop sampling, upload data, and then go to sleep.

(Select *Connect* in Seaterm232's Communications menu to connect and wake up.)
(Press Enter key)
STOP
(Click Upload menu – Seaterm232 leads you through screens to define data to be uploaded and where to store it.)
QS

Serial Line Sync

Serial Line Sync allows a simple pulse (a single character) on the RS-232 line to initiate a sample. This mode provides easy integration with ADCPs or current meters, which can synchronize SBE 39*plus* sampling with their own without drawing on their internal power or memory resources.

Serial line sync mode is enabled by sending **SyncMode=Y** and then putting the SBE 39*plus* in sleep state (automatically in 2 minutes or by sending **QS**). Once in sync mode, sending a pulse causes the 39*plus* to wake up, take a sample, and store the data in FLASH memory. Transmission of real-time data is dependent on **TxRealTime**.

Notes:
- Use **GetCD** or **DS** to view Serial Line Sync enable/disable status.
- The 39*plus* automatically exits serial line sync mode if you connect via USB.
- *Send 5 second break* holds the RS-232 RX line in space state (greater than 3 volts) for 5 seconds.

Keep the signal line open circuit or within ± 0.3 V relative to ground to minimize power consumption when not trying to send a pulse to take a sample.

To disable serial line sync, the SBE 39*plus* must be in the space state when the sample is finished. Disable serial sync mode using one of the following methods:
- Send three Esc characters, or
- In Seaterm232's Command menu, select *Send 5 second break*.

This sets sync mode to no in the 39*plus*. Then press any key to wake up the 39*plus*. Once sync mode is disabled (**SyncMode=N**), you can communicate with the 39*plus* using the full range of commands (polled sampling, logging, upload, etc.).

Example: ***Serial Line Sync Mode*** (user input in bold)
Establish communication. Initialize logging to overwrite previous data in memory. Set current date and time to May 1, 2013 9 am. Set up to transmit real-time data, in converted decimal format. Enable serial line sync mode. Send power off command.

(Select *Connect* in Seaterm232's Communications menu to connect and wake up.)
INITLOGGING
DATETIME=05012013090000
OUTPUTFORMAT=1
TXREALTIME=Y
SYNCMODE=Y
GETCD (to verify setup)
QS (39plus responds with message confirming that it is now in sync mode)

When ready to take a sample:

(To save real-time data, click Capture menu to capture data to a file – Seaterm232 requests file name for data to be stored.)
Send a pulse – press any key – to wake up, take and transmit 1 sample, store in memory, and go to sleep. Repeat as desired.

When ready to upload data to computer, disable sync mode, and then upload data and go to sleep:

(Press Esc key 3 or more times; 39*plus* disables sync mode [sets **SyncMode=N**]. Then press any key to wake up 39*plus*.)
GETCD (to verify 39*plus* is communicating, and that sync mode is set to no)
(Click Upload menu – Seaterm232 leads you through screens to define data to be uploaded and where to store it.)
QS

Factory Defaults

Sea-Bird ships the SBE 39*plus* with the following factory defaults:

Command	Effect
BaudRate=9600	Set baud to 9600 for RS-232 communications.
OutputExecutedTag=1	Output Executing and Executed tags.
TxRealTime=y	Output real-time data for autonomous sampling and serial line sync sampling.
InitLogging	Initialize memory (start storing data at beginning of memory when start sampling).
OutputFormat=1	Output converted data in engineering units.
OutputTemp=y	Output temperature with converted data.
SetTempUnits=0	Output converted temperature in °C.
OutputPress=y	Output pressure with converted data (if pressure sensor installed).
SetPressUnits=0	Output converted pressure in decibars.
TxSampleNum=y	Output sample number with real-time samples.
Legacy=0	Allow all commands.
SampleInterval=10	When commanded to sample autonomously (**StartNow** or **StartLater**), sample every 10 sec.
SyncMode=n	Disable serial line sync mode.

Command Descriptions

This section describes commands and provides sample outputs.
See *Appendix II: Command Summary* for a summarized command list.

When entering commands:

- Input commands to the 39*plus* in upper or lower case letters and register commands by pressing the Enter key. Note that commands are shown with a mix of upper and lower case for ease in reading (for example, **BaudRate=**), but do not need to be entered that way.
- Commands to enable a parameter (such as **TxSampleNum=**) can be entered with the *argument* as Y or 1 for yes, and N or 0 for no (for example, **TxSampleNum=y** and **TxSampleNum=1** are equivalent; both enable output of the sample number with real-time data.
- The 39*plus* sends an error message (`<Error type='INVALID COMMAND' msg='Cmd not recognized'/>`) if an invalid command is sent.
- If a new command is not received within two minutes after the completion of a command, the 39*plus* returns to the quiescent (sleep) state.
- If in quiescent (sleep) state, re-establish communications by selecting *Connect* in Seaterm232's Communications menu or pressing the Enter key.
- While sampling autonomously (**StartNow** has been sent), the 39*plus* responds only to **GetCD**, **GetSD**, **GetCC**, **GetEC**, **GetHD**, **DS**, **DC**, **DNx**, **TS**, **TSR**, **SL**, **QS**, **Stop**, and **Help**. If you send any other command, the 39*plus* responds `<Error type='NOT ALLOWED' msg='Inactive command'/>`. If you wake the 39*plus* while it is sampling (for example, to send **DS** to check on progress), it temporarily stops sampling. Autonomous sampling resumes at the next scheduled time, after it finishes processing and responding to the command. You may see a gap in the real-time and uploaded data if you are sampling at a small sample interval, or if you send a command as the 39*plus* is about to take the next sample. To minimize gaps in the data, send the desired command as soon as the previous sample is transmitted.

Note:
The 39*plus* automatically stops autonomous sampling and/or exits serial line sync mode when you connect via USB.

Example: SBE 39*plus* is sampling at 30 second intervals.

Sample 1 at 30 sec.
Sample 2 at 60 sec.
Sample 3 at 90 sec.
(send **DS** at 119 sec, 39plus is responding when it should have taken next sample at 120 sec)
Sample 4 at 150 sec. (resumes logging at next scheduled interval)

- While waiting to start autonomous sampling (**StartLater** has been sent), the 39*plus* responds only to **GetCD**, **GetSD**, **GetCC**, **GetEC**, **GetHD**, **DS**, **DC**, **DNx**, **TS**, **TSR**, **SL**, **QS**, **Stop**, and **Help**. If you send any other command, the 39*plus* responds `<Error type='NOT ALLOWED' msg='Inactive command'/>`. To send any other commands, send **Stop**, send the desired commands to modify the setup, and then send **StartLater** again.

Status Commands

Notes:
- **GetCD** output does not include calibration coefficients. To display calibration coefficients, use the **GetCC** command.
- Lines describing what parameters to output only appear if **Output Format=1** or **2**. Raw output (**OutputFormat=0**) is not affected by enabling / disabling parameter outputs.

GetCD

Get and display configuration data, which includes parameters related to 39*plus* setup. Most of these parameters can be user-input/modified. List below includes, where applicable, command used to modify parameter:
- Device type, Serial number.
- Pressure sensor installed (factory set)?
- Output data format [**OutputFormat=**].
- Output temperature with each sample [**OutputTemp=**]?
- Temperature units [**SetTempUnits=**].
- Output pressure with each sample [**OutputPress=**]? Only appears if 39*plus* includes pressure sensor.
- Pressure units [**SetPressUnits=**]. Only appears if 39*plus* includes pressure sensor.
- Output sample number with real-time autonomous or serial line sync data [**TxSampleNum=**]?
- Transmit autonomous and serial line sync data real-time [**TxRealTime=**]?
- Interval between samples for autonomous sampling [**SampleInterval=**].
- Serial sync mode state [**SyncMode=**].
- RS-232 baud rate [**BaudRate=**]; appears only if communicating with 39*plus* via USB.

Example: 39*plus* with a pressure sensor (user input in bold, command used to modify parameter in parenthesis).

```
GETCD
<ConfigurationData DeviceType = 'SBE39plus' SerialNumber = '03909999'>
   <PressureInstalled>yes</PressureInstalled>                          [factory set]
   <SampleDataFormat>converted engineering</SampleDataFormat>         [OutputFormat=]
   <OutputTemperature>yes</OutputTemperature>                          [OutputTemp=]
   <TemperatureUnits>Celsius</TemperatureUnits>                        [SetTempUnits=]
   <OutputPressure>yes</OutputPressure>                                [OutputPress=]
   <PressureUnits>Decibar</PressureUnits>                              [SetPressUnits=]
   <TxSampleNumber>yes</TxSampleNumber>                                [TxSampleNum=]
   <TxRealTime>yes</TxRealTime>                                        [TxRealTime=]
   <SampleInterval>0.5</SampleInterval>                                [SampleInterval=]
   <SyncMode>no</SyncMode>                                             [SyncMode=]
</ConfigurationData>
```

Status Commands (*continued*)

GetSD

Get and display status data, which contains data that changes while deployed.
List below includes, where applicable, command used to modify parameter:

- Device type, Serial number
- Date and time [**DateTime=**] in ISO8601-2000 extended format (yyyy – mm-ddThh:mm:ss)
- Number of recorded events in event counter [reset with **ResetEC**]
- Voltages – main battery pack voltage and back-up cell voltage
- Memory – [reset with **InitLogging**]
  - Number of bytes in memory
  - Number of samples in memory
  - Number of additional samples that can be placed in memory
  - Length (number of bytes) of each sample
- Autonomous sampling status – yes (if logging), waiting to start at (if programmed to start logging at a user-set date and time), waiting to start on USB disconnect (if **StartNow** has been sent while communicating via USB), no (if not logging) and reason that logging stopped such as received stop command, low battery pack power, etc.)

Notes:

- The **DS** response contains similar information as the combined responses from **GetSD** and **GetCD**, but in a different format.
- If the 39*plus* is logging data and the input voltage (main battery pack or optional external power) is less than 5 volts for 10 consecutive scans, the 39*plus* halts logging and displays a low battery indication in the data.
- Replace the back-up cell if it drops below 2.5 V.

Example: (user input in bold, command used to modify parameter in parentheses)

```
getsd
<StatusData DeviceType = 'SBE39plus' SerialNumber = '03909999'>
   <DateTime>2013-12-26T00:48:32</DateTime>                                  [DateTime=]
   <EventSummary numEvents = '0'/>                                  [can clear with ResetEC=]
   <Power>
      <vMain>6.49</vMain>
      <vBackup>3.20</vBackup>
   </Power>
   <MemorySummary>
      <Bytes>0</Bytes>
      <Samples>0</Samples>                                          [can clear with InitLogging]
      <SamplesFree>5592405</SamplesFree>
      <SampleLength>12</SampleLength>
   </MemorySummary>
   <AutonomousSampling>no, received stop command</AutonomousSampling>    [StartNow or StartLater, Stop]
</StatusData>
```

Status Commands (*continued*)

Note:
Dates shown are when calibrations were performed.

GetCC

Get and display calibration coefficients, which are initially factory-set and should agree with Calibration Certificates shipped with 39*plus*. Pressure sensor coefficients appear only if 39*plus* includes pressure sensor.

Example: 39*plus* with a pressure sensor (user input in bold, command used to modify parameter in parentheses)

```
getcc
<CalibrationCoefficients DeviceType = 'SBE39plus' SerialNumber = '03909999'>
   <Calibration id = 'Temperature' format = 'TEMP1'>
      <SerialNum>03909999</SerialNum>
      <CalDate>08-Aug-2013</CalDate>                                  [TCalDate=]
      <A0>-7.007217e-04</A0>                                             [TA0=]
      <A1>3.188206e-04</A1>                                              [TA1=]
      <A2>-5.225219e-06</A2>                                             [TA2=]
      <A3>1.904071e-07</A3>                                              [TA3=]
   </Calibration>
   <Calibration id = 'Pressure' format = 'STRAIN0'>
      <SerialNum>2478619</SerialNum>
      <CalDate>07-Aug-2013</CalDate>                                  [PCalDate=]
      <PA0>7.100211e-02</PA0>                                            [PA0=]
      <PA1>9.469036e-05</PA1>                                            [PA1=]
      <PA2>2.307353e-14</PA2>                                            [PA2=]
      <PTHA0>3.306013e+02</PTHA0>                                       [PTHA0=]
      <PTHA1>-8.324027e-03</PTHA1>                                      [PTHA1=]
      <PTHA2>-1.962407e-08</PTHA2>                                      [PTHA2=]
      <PTCA0>1.569027e+04</PTCA0>                                       [PTCA0=]
      <PTCA1>6.280573e+01</PTCA1>                                       [PTCA1=]
      <PTCA2>-1.315252e+00</PTCA2>                                      [PTCA2=]
      <PTCB0>2.506650e+01</PTCB0>                                       [PTCB0=]
      <PTCB1>-1.000000e-04</PTCB1>                                      [PTCB1=]
      <PTCB2>0.000000e+00</PTCB2>                                       [PTCB2=]
      <POFFSET>0.000000e+00</POFFSET>                  [POffset= (decibars)]
      <PRANGE>5.080000e+02</PRANGE>                        [PRange= (psi)]
   </Calibration>
</CalibrationCoefficients>
```

Status Commands (*continued*)

GetEC

Get and display event counter data, which can help to identify root cause of a malfunction. Event counter records number of occurrences of common timeouts, power-on resets, etc. Can be cleared with **ResetEC**. Possible events that may be logged include:

- PowerOnReset - power cycled on; occurs each time AA lithium cells are removed and replaced.
- OutOfMemory – memory is full; user should upload all data
- LowBatteryVoltage – low battery voltage detected while sampling
- WatchdogReset – unexpected reset that occurs if microcontroller is unresponsive; resets 39*plus* and continues operation.
- LoggingRestartPON – power cycled while logging, logging restarted
- LoggingRestartNoAlarm – no sample taken for 8 hours while logging, restart logging
- SyncModeRestartPON – power cycled while in serial line sync mode
- HardReset – processor reset; instrument re-booted
- BufWrOflow – write buffer overflow which may corrupted internal or user-programmable variables; contact Sea-Bird
- BufRdOflow – read buffer overflow which may cause corrupted uploaded data
- ThermistorError – thermistor wiring may be damaged; contact Sea-Bird
- Other – Contact Sea-Bird if you receive any other codes

Example: (user input in bold, command used to modify parameter in parentheses)

```
getec
<EventCounters DeviceType = 'SBE39plus' SerialNumber = '03909999'>
   <EventSummary numEvents = '2'/>                          [can clear with ResetEC]
        <Event type = 'PowerOnReset' count = '2'/>
   </EventSummary>
</EventCounters>
```

ResetEC

Delete all events in event counter (number of events displays in **GetSD** response, and event details display in **GetEC** response).

Status Commands (*continued*)

GetHD

Get and display hardware data, which is fixed data describing 39*plus*:
- Device type, Serial number
- Manufacturer
- Firmware version
- Firmware date
- Command set version
- PCB serial numbers and assembly numbers
- Manufacture date
- Firmware loader software version (used to load firmware into 39*plus* at Sea-Bird)
- Sensor types and serial numbers

Example: (user input in bold, command used to modify parameter in parentheses)

```
gethd
<HardwareData DeviceType = 'SBE39plus' SerialNumber = '03909999'>
   <Manufacturer>Sea-Bird Electronics, Inc.</Manufacturer>
   <FirmwareVersion>4.2.0</FirmwareVersion>
   <FirmwareDate>Jul 18 2014 12:47:12</FirmwareDate>
   <CommandSetVersion>1.0</CommandSetVersion>
   <PCBAssembly PCBSerialNum='59268' AssemblyNum='41770d'/>
   <PCBAssembly PCBSerialNum='59280' AssemblyNum='41769b'/>
   <MfgDate>10 Feb 2014</MfgDate>
   <FirmwareLoader>Loader_PD002_V1.0.3</FirmwareLoader>
   <InternalSensors>
      <Sensor id = 'Temperature'>
         <type>temperature-1</type>
         <SerialNumber>03909999</SerialNumber>
      </Sensor>
      <Sensor id = 'Pressure'>
         <type>strain-0</type>
         <SerialNumber>2478619</SerialNumber>
      </Sensor>
   </InternalSensors>
</HardwareData>
```

Help

Display list of currently available commands, which may be useful if you do not have access to 39*plus* manual and/or are not using SeatermV2. Command list depends on logging state. Many commands are not available while 39*plus* is sampling autonomously or waiting to start autonomous sampling (**StartLater** has been sent).

Status Commands (*continued*)

Notes:
- The **DS** response contains similar information as the combined responses from **GetSD** and **GetCD**, but in a different format.
- Lines describing what parameters to output (temperature, pressure, sample number) only appear if they are enabled and if **OutputFormat=1** or **2**. Raw output (**OutputFormat=0**) is not affected by enabling / disabling parameter outputs.
- The **DS** response is also affected by the **Legacy=** command. See the Output Format Setup Commands below.
- If the 39*plus* is logging data and the input voltage (main battery pack or optional external power) is less than 5 volts for 10 consecutive scans, the 39*plus* halts logging and displays a low battery indication in the data.
- Replace the back-up cell if it drops below 2.5 V.

DS

Display status and setup parameters.

List below includes, where applicable, command used to modify parameter.
- Firmware version, serial number, date and time [**DateTime=**]
- Voltages – main battery pack voltage and back-up cell voltage
- Autonomous sampling status (logging, waiting to start at . . ., or not logging, etc.), and (if applicable) reason that logging stopped (such as received stop command, low battery pack power, etc.)
- Sample interval time [**SampleInterval=**]
- Number of samples in memory and available sample space in memory
- Serial line sync mode status [**SyncMode=**]
- Real-time output status [**TxRealTime=**]
- Configuration (temperature only or temperature with pressure); factory set
- Output data format [**OutputFormat=**]
- Output temperature [**OutputTemp=**]? Temperature units [**SetTempUnits=**]
- Output pressure [**OutputPress=**]? Pressure units [**SetPressUnits=**]. Only appears if 39*plus* includes pressure sensor.
- Output sample number with real-time autonomous or serial line sync data [**TxSampleNum=**]?
- RS-232 baud rate [**BaudRate=**]; only appears if communicating via USB
- Current temperature (always in °C, regardless of setting for **SetTempUnits=**)

Example: (user input in bold, command used to modify parameter in parentheses).

```
DS
SBE39plus V 4.2.0  SERIAL NO. 03909999  26 Jul 2015  08:49:08          [DateTime=]
battery voltage = 6.40, back-up voltage = 3.20      [main battery pack and back-up cell voltage]
not logging: received stop command
sample interval = 1 seconds                                          [SampleInterval=]
samplenumber = 0, free = 5592405                        [reset with InitLogging]
serial sync mode disabled                                            [SyncMode=]
real-time output enabled                                             [TxRealTime=]
configuration = temperature and pressure                             [factory set]
data format = converted engineering                                  [OutputFormat=]
output temperature, Celsius                                [OutputTemp=, SetTempUnits=]
output pressure, Decibar                                   [OutputPress=, SetPressUnits=]
output sample number                                                 [TxSampleNum=]
temperature = 19.48 deg C
```

Notes:
- The **DC** and **GetCC** responses contain the same information, but in different formats.
- Dates shown are when calibrations were performed.

Status Commands (*continued*)

DC Display calibration coefficients, which are initially factory-set and should agree with Calibration Certificates shipped with 39*plus*. Pressure sensor coefficients appear only if 39*plus* includes pressure sensor.

Example: 39*plus* with pressure sensor (user input shown in bold, command used to modify parameter in parentheses).

DC

```
SBE39plus V 4.2.0  03909999
temperature:  08-Dec-14                                          [TCalDate=]
    TA0 = -7.007217e-04                                          [TA0=]
    TA1 = 3.188206e-04                                           [TA1=]
    TA2 = -5.225219e-06                                          [TA2=]
    TA3 = 1.904071e-07                                           [TA3=]
pressure S/N 123, range = 508 psia:  07-Dec-14
    PA0 = 7.100211e-02                                           [PA0=]
    PA1 = 9.469036e-05                                           [PA1=]
    PA2 = 2.307353e-14                                           [PA2=]
    PTHA0 = 3.306013e+02                                         [PTHA0=]
    PTHA1 = -8.324027e-03                                        [PTHA1=]
    PTHA2 = -1.962407e-08                                        [PTHA2=]
    PTCA0 = 1.569027e+04                                         [PTCA0=]
    PTCA1 = 6.280573e+01                                         [PTCA1=]
    PTCA2 = -1.315252e+00                                        [PTCA2=]
    PTCB0 = 2.506650e+01                                         [PTCB0=]
    PTCB1 = -1.000000e-04                                        [PTCB1=]
    PTCB2 = 0.000000e+00                                         [PTCB2=]
    POFFSET = 0.000000e+00                                       [POffset= (decibars)]
```

General Setup Commands

DateTime=mmddyyyyhhmmss Set real-time clock month, day, year, hour, minute, second.

Example: Set current date and time to 15 November 2013 12:00:00 (user input in bold).
DATETIME=11152013120000

Notes:
- **If transmitting real-time data, verify that the total acquisition plus transmission time for each sample is less than the sample interval (SampleInterval=).** Setting **SampleInterval=** inappropriately can lead to inconsistent sampling. See *Sample Timing* in *Section 2: Description of SBE 39plus*.
- The 39*plus* baud (set with **BaudRate=**) must be the same as Seaterm232's baud (set in Communications menu).
- **BaudRate=** must be sent twice. After the first entry, the 39*plus* waits for the command to be sent again **at the same baud** (if it does not receive the command again, it does not change baud).
  - **If communicating via RS-232:** After you receive confirmation that it changed the baud, in the Communications menu select *Configure*. In the dialog box, select the new baud and click OK. Click the Enter key to reconnect at the new baud.

BaudRate=x

x= baud rate for RS-232 communications (600 *, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200). ***Default 9600.*** Check capability of your computer and terminal program before increasing baud; high baud requires short cable and good PC serial port with accurate clock. **Command must be sent twice to change rate.**

** 600 baud is not compatible with SeatermUSB – SBE 39plus.*

Length of cable that 39*plus* can drive is dependent on baud. See *Real-Time Data Acquisition* in *Section 2: Description of SBE 39plus*.

Example: Change baud to 19200 while communicating via RS-232 (user input in bold).
Baudrate=19200
<!--Repeat command to confirm 19200 baud-->
<Executed/>
Baudrate=19200
<!--Baud rate changed to 19200. Hit 'Enter' at new baud rate to confirm-->
(In Communications menu, select *Configure*. In dialog box, select 19200; click OK.)
(Click Enter to reconnect at new baud.)

OutputExecutedTag=x

x=Y: Display XML Executing and Executed tags. Executed tag displays at end of each command response; Executing tag displays one or more times if 39*plus* command response requires more time. ***Default.***

x=N: Do not. Note that tags always output when communicating via USB, regardless of this setting.

Example: Set 39*plus* to output Executed and Executing tags (user input in bold).
outputexecutedtag=y
<Executed/>**getcd**
. . . (**GetCD** response)
<Executed/>
(Note: <Executed/> tag at end of command response takes place of S> prompt.)

Notes:
- The 39*plus* always outputs real-time data for polled sampling.
- **TxRealTime=y** does not affect storing data to memory, but increases power consumption and time needed to sample (and then transmit) data. **Verify that the total acquisition plus data transmission time for each sample is less than the sample interval (SampleInterval=).** Failure to set **SampleInterval=** appropriately can lead to inconsistent sampling. See *Sample Timing* in *Section 2: Description of SBE 39plus*.
- To capture real-time data to a file, do the following *before* starting logging:
  1. Click Seaterm232's Capture menu.
  2. Enter the desired file name in the dialog box. The *capture* status displays in the status bar at the bottom of the screen.

TxRealTime=x

x=Y: Output real-time data for autonomous or serial line sync sampling. Data is transmitted immediately after it is sampled. ***Default.***

x=N: Do not.

General Setup Commands ***(continued)***

QS

Quit session and place 39*plus* in quiescent (sleep) state. Main power is turned off. Autonomous sampling and memory retention are unaffected. Cannot be sent if communicating via USB.

Example: Set 39*plus* to sleep state (user input in bold).

```
QS
<Executed/>
```

Memory Setup Commands

InitLogging

Initialize logging – after all data has been uploaded, initialize logging before starting to sample again to make entire memory available for recording. **InitLogging** sets sample number (**SampleNumber=**) to 0 (sampling will start with sample 1). If not set to 0, data will be stored after last recorded sample. **Do not send InitLogging until all data has been uploaded.** This command requires confirmation, to prevent accidental reset.

Notes:

- **Do not send InitLogging or SampleNumber=0 until all data has been uploaded.** These commands do not delete the data; they just reset the data pointer. **If you accidentally send one of these commands before uploading**, see *Memory* in *Appendix I: Functional Description* for data recovery.
- If memory is filled to capacity:
  - If **TxRealTime=Y**: Sampling continues, but excess data is not saved (i.e., the 39*plus* does not overwrite data in memory).
  - If **TxRealTime=N**: Sampling stops.

Example: Make entire memory available for recording (user input in bold).

```
INITLOGGING
<WARNING>
   Memory will be re-initialized
   Sample number will be reset
   All recorded data will be lost
</WARNING>
<!--Repeat command to confirm-->
INITLOGGING      (enter command again to confirm)
<Executed/>
```

SampleNumber=x

x= sample number for first sample when sampling begins. **SampleNumber=0** is equivalent to **InitLogging**. After all data has been uploaded, set sample number to 0 before starting to sample to make entire memory available for recording. If not set to 0, data will be stored after last recorded sample. **Do not send SampleNumber= until all data has been uploaded.** This command requires confirmation, to prevent accidental reset.

Example: Make entire memory available for recording (user input in bold).

```
SAMPLENUMBER=0
<WARNING> Memory pointers will be modified </WARNING>
<!--Repeat command to confirm-->
SAMPLENUMBER=0      (enter command again to confirm)
<Executed/>
```

Notes:
- See *Data Formats* after the command descriptions.
- If **TxRealTime=Y**: Output format affects the time required to transmit real-time data. **Verify that the total acquisition plus transmission time for each sample is less than the sample interval (SampleInterval=).** Failure to set **SampleInterval=** appropriately can lead to inconsistent sampling. See *Sample Timing* in *Section 2: Description of SBE 39plus*.
- The pressure sensor is an absolute sensor, so its **raw** output (**OutputFormat=0**) includes the effect of atmospheric pressure (14.7 psi). However, when outputting pressure in **psi** or **decibars**, the 39*plus* outputs pressure relative to the ocean surface (i.e., at the surface the output pressure is 0 psi or 0 dbar). The 39*plus* uses the following equations to convert psia:
  P (psi) = P (psia) – 14.7
  P (dbar) = [P (psia) - 14.7] * 0.689476

Output Format Setup Commands

OutputFormat=x

x=0: output raw decimal data.

x=1: output converted decimal data. ***Default***.

x=2: output converted decimal data in XML.

OutputTemp=x

x=Y: Output temperature (units defined by **SetTempUnits=**) with each sample if **OutputFormat=1** or **2**. ***Default.***

x=N: Do not.

SetTempUnits=x

x=0: Temperature output °C, ITS-90 if **OutputFormat=1** or **2**. ***Default.***

x=1: Temperature output °F, ITS-90 if **OutputFormat=1** or **2**.

OutputPress=x

x=Y: Output pressure (units defined by **SetPressUnits=**) with each sample if **OutputFormat=1** or **2**. ***Default for 39plus with pressure sensor.***

x=N: Do not.

SetPressUnits=x

x=0: Pressure output decibars if **OutputFormat=1** or **2**. ***Default.***

x=1: Pressure output psi (gauge) if **OutputFormat=1** or **2**.

TxSampleNum=x

x=Y: If **OutputFormat=1** or **2**, output sample number with each *real-time* sample from autonomous or serial line sync sampling, or using polled sampling commands that store data in FLASH memory or retrieve last sample from FLASH memory. ***Default***.

x=N: Do not.

Note:
The parameters reset by **SetCoastal=** can be individually set using **SetTempUnits=**, **SetPressUnits=**, **OutputTemp=**, **OutputPress=**, and **TxSampleNum=**.

SetCoastal=x

x=0: Reset output units to °C and dbar, and enable output of temperature and pressure (disable output of sample number).

x=1: Reset output units to °C and psi, (typical for coastal applications), and enable output of temperature and pressure (disable output of sample number).

Note:
Legacy=1 forces the 39*plus* to act like older 39 (firmware < 4.0), which did not have as many user output selections; it is intended for use by customers who have a mix of old and new instruments. However, note that the **DS** response has some small changes from the older SBE 39.

Legacy=x

x=0: Allow all commands documented in this manual. ***Default***.

x=1: Reset output units to °C and dbar, and enable output of temperature and pressure (disable sample number). Do not allow user to disable temperature or pressure, or to change output units. Modify **DS** response to more closely match firmware < 4.0, for consistency with older instruments.

Autonomous Sampling (Logging) Commands

Autonomous sampling commands direct the SBE 39*plus* to sample data at pre-programmed intervals and store the data in its FLASH memory.

Notes:
- **If transmitting real-time data (TxRealTime=Y), verify that the total acquisition plus transmission time for each sample is less than the sample interval (SampleInterval=).** Failure to set **SampleInterval=** appropriately can lead to inconsistent sampling. See *Sample Timing* in *Section 2: Description of SBE 39plus*.
- If the 39*plus* is logging data and the input voltage (main battery pack or optional external power) is less than 5 volts for ten consecutive scans, the 39*plus* halts logging and sets the logging status to low battery.
- The 39*plus* automatically stops autonomous sampling when you connect via USB.

SampleInterval=x

x= interval (sec) between samples (0.5, and 1 to 21600). When commanded with **StartNow** or **StartLater**, 39*plus* takes a sample, stores data in FLASH memory, transmits real-time data (if **TxRealTime=Y**), and powers down at **x** second intervals. ***Default 10***.

StartNow

Start logging now, at rate defined by **SampleInterval=**. Data is stored in FLASH memory. Data is transmitted real-time if **TxRealTime=Y**. If communicating via USB, will start sampling after USB cable is removed.

StartDateTime=mmddyyyyhhmmss

Set delayed logging start month, day, year, hour, minute, second.

Notes:
- After receiving **StartLater**, the 39*plus* displays `not logging: waiting to start at` in the **DS** reply. Once logging has started, the **DS** reply indicates `logging`.
- If the delayed start time has already passed when **StartLater** is received, the 39*plus* executes **StartNow**.
- If the delayed start time is more than 90 days in the future, the 39*plus* executes **StartNow**.

StartLater

Start logging at time set with delayed start date and time command, at rate defined by **SampleInterval=**. Data is stored in FLASH memory. Data is transmitted real-time if **TxRealTime=Y**.
If you need to change 39*plus* setup after **StartLater** has been sent (but before logging has started), send **Stop**, change setup as desired, and then send **StartLater** again.
If communicating via USB, will start sampling after USB cable is removed AND **StartDateTime=** is reached.

Example: Program SBE 39*plus* to start logging on 15 Dec 2013 12:00:00 (user input in bold).

```
STARTDATETIME=12152013120000
STARTLATER
```

DNx

Upload last **x** scans from memory **while sampling autonomously** to retrieve data periodically from 39*plus* while it is deployed. Maximum of 250 samples can be uploaded at one time with **DNx**.
As data uploads, screen first displays
`start time =`
`start sample number = .`
These are start time and starting sample number for requested data.

Examples: Upload data from memory (user input in bold).
(Click Capture menu and enter desired filename in dialog box.)
`DN200` (Upload last 200 scans)

Notes:
- You may need to send **Stop** several times to get the 39*plus* to respond. This is most likely to occur if sampling with a small **SampleInterval=** and transmitting real-time data (**TxRealTime=Y**).
- An alternate method to stop logging is to send three Esc characters.

Stop

Stop logging (started with **StartNow** or **StartLater**) or stop waiting to start logging (if **StartLater** was sent but logging has not begun yet). Press Enter key before entering **Stop**. **Stop** must be sent before uploading data from memory.

Polled Sampling Commands

Note:
The 39*plus* has a buffer that stores the most recent data sample. Unlike data in the FLASH memory, data in the buffer is erased upon removal of AA cells or failure of the battery pack.

These commands are used to request one or more samples from the SBE 39*plus*. **Unless noted otherwise, the 39*plus* does not store the data in FLASH memory.** If sampling autonomously (**StartNow** or **StartLater** has been sent), the 39*plus* ignores all polled sampling commands except **SL**. Unless noted otherwise, data is output in the format defined by **OutputFormat=**.

TS	Take sample and transmit data.
TSR	Take sample and transmit **raw** data.
TSS	Take sample, **store in FLASH memory**, transmit data, and **turn power off**. If communicating via USB, will not turn power off.
TSSOn	Take sample, **store in FLASH memory**, transmit data.
TSN:x	Take **x** samples (1 – 1000) and output data. To interrupt this sampling, press Esc key.
SL	Transmit data from last sample stored in buffer. **SL** can be sent while 39*plus* is sampling data, to look at last data sample.
SLT	Transmit data from last sample stored in buffer, and then take new sample.

Serial Line Sync Commands

Notes:
- The 39*plus* automatically exits serial line sync mode if you connect via USB.
- See *Sampling Modes* above for details on serial line sync mode.

SyncMode=x	**x=Y:** Enable Serial Line Sync Mode. When a simple pulse (a single character) is transmitted, 39*plus* takes a sample, stores data in FLASH memory, and goes to sleep. Data is transmitted real-time if **TxRealTime=Y**. If communicating via RS-232 when sync mode is enabled, enters sync mode after 39*plus* goes to sleep (either by sending **QS** or after 2-minute timeout). If communicating via USB when sync mode is enabled, enters sync mode after USB cable is removed. **x=N:** Disable serial line sync. ***Default.***

Notes:
- **Use Seaterm232's Upload menu to upload data that will be processed by Plot39 or SBE Data Processing**. Manually entering a data upload command does not produce data with the required header information for processing by those programs.
- **If not using the Upload menu** - To save data to a file, click Capture before entering a data upload command.
- See *Data Formats* after these *Command Descriptions*.

Data Upload Commands

Stop sampling (send **Stop** or send 3 Esc characters) before uploading data.

GetSamples:b,e — Upload data from scan **b** to scan **e**, in format defined by **OutputFormat=**. First sample is number 1. As data is uploaded, screen first displays
`start time =`
`start sample number =`
These are start time and starting sample number for requested data.

Testing Commands

Data obtained with these commands is **not** stored in FLASH memory.

TT — Measure temperature for 100 samples or until Esc key is pressed, output **converted data**.

TP — Measure pressure for 100 samples or until Esc key is pressed, output **converted data**.

TTR — Measure temperature for 100 samples or until Esc key is pressed, output **raw data**.

TPR — Measure pressure and pressure temperature for 100 samples or until Esc key is pressed, output **raw data**.

Calibration Coefficients Commands

Individual Coefficient Commands listed below modify a particular coefficient or date:

Note:
F = floating point number
S = string with no spaces

Temperature

TCalDate=S	**S**=Temperature calibration date
TA0=F	**F**=Temperature A0
TA1=F	**F**=Temperature A1
TA2=F	**F**=Temperature A2
TA3=F	**F**=Temperature A3

Pressure

PCalDate=S	**S**=Pressure calibration date
PA0=F	**F**=Pressure A0
PA1=F	**F**=Pressure A1
PA2=F	**F**=Pressure A2
PTHA0=F	**F**=Thermistor coefficient A0
PTHA1=F	**F**=Thermistor coefficient A1
PTHA2=F	**F**=Thermistor coefficient A2
PTCA0=F	**F**=Pressure ptca0
PTCA1=F	**F**=Pressure ptca1
PTCA2=F	**F**=Pressure ptca2
PTCB0=F	**F**=Span TC b0
PTCB1=F	**F**=Span TC b1
PTCB2=F	**F**=Span TC b2
POffset=F	**F**=Pressure offset (decibars)

Data Formats

Notes:
- Time is the time at the **start** of the sample.
- When **TxRealTime=Y**, real-time autonomous data and real-time serial line sync data transmitted to the computer is preceded by a # sign.
- If **TxRealTime=Y**: Output format affects the time required to transmit real-time data. **Verify that the total acquisition plus transmission time for each sample is less than the sample interval (SampleInterval=).** Failure to set **SampleInterval=** appropriately can lead to inconsistent sampling. See *Sample Timing* in *Section 2: Description of SBE 39plus*.
- The 39*plus*' pressure sensor is an absolute sensor, so its **raw** output includes the effect of atmospheric pressure (14.7 psi). As shown on the Calibration Sheet, Sea-Bird's calibration (and resulting calibration coefficients) is in terms of psia. However, when outputting pressure in **decibars**, the 39*plus* outputs pressure relative to the ocean surface (i.e., at the surface the output pressure is 0 decibars). The 39*plus* uses the following equation to convert psia to decibars:
  pressure (db) =
  [pressure (psia) - 14.7] * 0.689476

See *Appendix III: Old-Style Compatible Commands and Data Format* for the data format when **Legacy=Y**, emulating the old SBE 39 (firmware < 4.0).

Each scan ends with a carriage return <CR> and line feed <LF>.

- **OutputFormat=0**: raw decimal data, intended for diagnostic use at Sea-Bird
  tttttt, ppppppp, vvvvv, dd mmm yyyy, hh:mm:ss

  where
  - tttttt = temperature A/D counts.
  - ppppppp = pressure sensor pressure A/D counts; sent if pressure sensor installed.
  - vvvvv = pressure sensor pressure temperature compensation A/D counts; sent if pressure sensor installed.
  - dd mmm yyyy, hh:mm:ss = day month year, hour minute second.

  All data is separated with a comma and at least one space. Note that sample number is not sent, regardless of the setting for that parameter.

Example: Sample data output when pressure sensor is installed, **OutputFormat=0**:
`1793375, 6381465, 34181, 27 Oct 2013, 09:43:01`
(temperature, pressure sensor pressure, pressure sensor temperature compensation, date, time)

- **OutputFormat=1** (default): converted decimal data
  tttt.tttt, pppp.ppp, dd mmm yyyy, hh:mm:ss, n

  where
  - tttt.tttt = temperature (sent if **OutputTemp=Y**; units defined by **SetTempUnits=**).
  - pppp.ppp = pressure (sent if pressure sensor installed and **OutputPress=Y**; units defined by **SetPressUnits=**).
  - dd mmm yyyy, hh:mm:ss = day month year, hour minute second.
  - n = sample number in FLASH memory (sent if **TxSampleNum=Y**, and transmitting real-time data while autonomous sampling, using serial line sync mode, or using polled sampling commands that store data in FLASH memory or retrieve last sample from FLASH memory).

  Leading zeros are suppressed, except for one zero to the left of the decimal point. All data is separated with a comma and at least one space.

Example: Sample data output when transmitting real-time data while autonomous sampling. Pressure sensor is installed, **OutputFormat=1**, **OutputTemp=Y**, **SetTempUnits=0**, **OutputPress=Y**, **SetPressUnits=0**, and **TxSampleNum=Y**:
`#  23.1258,   -0.051, 27 Oct 2013, 09:43:01, 78`
(temperature, pressure, date, time, sample number)

Note:
For ease in reading, the data structure is shown with each XML tag on a separate line. However, there are no carriage returns or line feeds between tags (see example below).

OutputFormat=2: converted decimal data in XML

```
<?xml version=”1.0”?>
<datapacket>
<hdr>
<mfg>Sea-Bird</mfg>
<model>SBE39plus</model>
<sn>ssssssss</sn>
</hdr>
<data>
<t1>tttt.tttt</t1>
<p1>pppp.ppp </p1>
<smpl>n</smpl>
<dt>yyyy-mm-ddThh:mm:ss</dt>
</data>
</datapacket>
```

where

- ssssssss = 39*plus* serial number.
- tttt.tttt = temperature (sent if **OutputTemp=Y**; units defined by **SetTempUnits=**).
- pppp.ppp = pressure (sent if pressure sensor installed and **OutputPress=Y**; units defined by **SetPressUnits=**).
- n = sample number in FLASH memory (sent if **TxSampleNum=Y**, and transmitting real-time data while autonomous sampling, using serial line sync mode, or using polled sampling commands that store data in FLASH memory or retrieve last sample from FLASH memory).
- yyyy-mm-ddThh:mm:ss = year- month-dayT-hour-minute-second.

Leading zeros are suppressed, except for one zero to the left of the decimal point.

Example: Sample data output when transmitting real-time data while autonomous sampling. Pressure sensor is installed, **OutputFormat=2**, **OutputTemp=Y**, **SetTempUnits=0**, **OutputPress=Y**, **SetPressUnits=0**, and **TxSampleNum=Y**:

```
<?xml version="1.0"?><datapacket><hdr><mfg>Sea-Bird</mfg><model>SBE 39plus</model>
<sn>03909999</sn></hdr><data><t1>23.1258</t1><p1>-0.051</p1><smpl>78</smpl>
<dt>2013-10-27T09:43:01</dt></data></datapacket> CRLF
```

Setup for Deployment

1. Install new AA cells (see *Replacing AA Cells and Desiccant* in *Section 5: Routine Maintenance and Calibration*) or ensure the existing cells have enough capacity to cover the intended deployment.

2. Program the 39*plus* for the intended deployment (see *Section 3: Preparing SBE 39plus for Deployment* for connection information; see information in this section on commands and sampling modes):

   A. Set the date and time (**DateTime=**).

   B. Establish the setup and sampling parameters.

   C. Ensure all data has been uploaded, and then send **InitLogging** to make the entire memory available for recording. If **InitLogging** is not sent, data will be stored after the last recorded sample.

   D. Use **one** of the following sequences to initiate logging:
   - **StartNow** to start logging now, taking a sample every **SampleInterval=** seconds.
   - **StartDateTime=** and **StartLater** to start logging at the specified date and time, taking a sample every **SampleInterval=** seconds.
   - **SyncMode=Y** to place the 39*plus* in serial line sync mode, so that a simple pulse on the RS-232 line will initiate a sample.

3. Close the housing if it was opened to install new AA cells or program the 39*plus* via the internal RS-232 or USB connector -
   Reinsert the electronics in the housing and close the housing, as described in *Replacing AA Cells and Desiccant* in *Section 5: Routine Maintenance and Calibration*.

Note:
The 39*plus* will not sample autonomously or in serial line sync while connected via USB. We recommend verifying operation before deploying (e.g., for autonomous sampling, connect via RS-232 to verify that sampling started). For a 39*plus* without external connector, connect via the internal RS-232 connector to verify operation.

Note:
Before delivery, desiccant is placed in the housing, and the electronics chamber is filled with dry Argon gas. These measures help prevent condensation.
To ensure proper functioning:
1. Install new desiccant each time you open the housing.
2. If possible, dry gas backfill each time you open the housing. If you cannot, wait at least 24 hours before redeploying, to allow the desiccant to remove any moisture from the chamber.

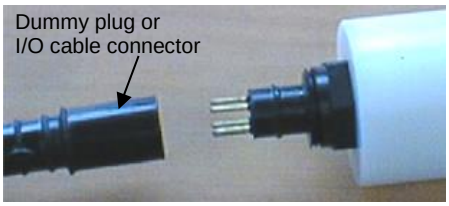
Deployment

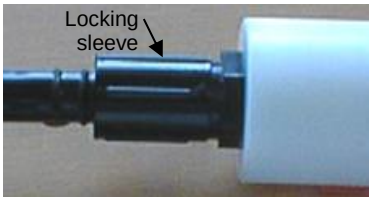
For an SBE 39*plus* with an embedded (internal) thermistor, there is a *depression* in the end cap around the thermistor. **Do not deploy the 39*plus* with the end cap up**, as sediment and/or non-flushing water can get trapped in this space, affecting the response of the thermistor.

To achieve maximum battery pack endurance, recommended deployment orientation for all SBE 39*plus* is thermistor end down or horizontal. See *Deployment Orientation* in *Section 2: Description of SBE 39plus*.

The SBE 39*plus* can be ordered with one or more Sea-Bird mounting clamps for mounting on a mooring cable; two clamps are recommended if the mooring is subjected to high dynamic motion (one Sea-Bird mooring clamp is required if installing with the optional net fender/fairing). Alternatively, the 39*plus* can be mounted with customer-supplied hardware.

CAUTIONS:
- **Do not use WD-40** or other petroleum-based lubricants, as they will damage the connectors.
- For wet-pluggable MCBH connectors: **Silicone lubricants in a spray can** may contain ketones, esters, ethers, alcohols, or glycols in their propellant. **Do not use these sprays, as they will damage the connector.**



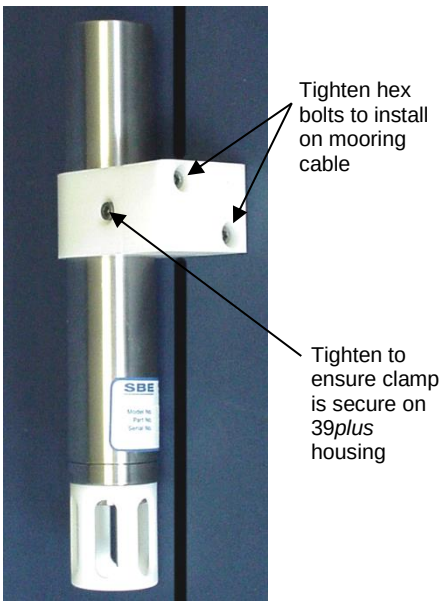


1. Install the dummy plug or I/O cable for **39*plus* with bulkhead I/O connector**:
   A. Lightly lubricate the inside of the dummy plug or cable connector with silicone grease (DC-4 or equivalent).
   B. **XSG Connector** (shown in photo) - Install the dummy plug or cable connector, aligning the raised bump on the side of the plug/connector with the large pin (pin 1 - ground) on the 39*plus*. Remove any trapped air by *burping* or gently squeezing the plug/connector near the top and moving your fingers toward the end cap. **OR**
   MCBH Connector – Install the plug/cable connector, aligning the pins.
   C. Place the locking sleeve over the plug/connector. Tighten the locking sleeve finger tight only. **Do not overtighten the locking sleeve and do not use a wrench or pliers.**

2. Mount the 39*plus*, using customer-supplied hardware. If using Sea-Bird's optional mounting clamp(s), or Sea-Bird's optional fairing / net fender, see below.

3. Verify that the hardware and external fittings are secure.

SBE 39*plus* with Optional Mounting Clamp(s)



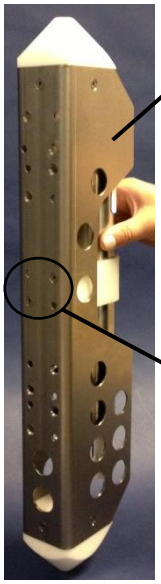
SBE 39plus with optional Sea-Bird clamp – use 1 or 2 clamps

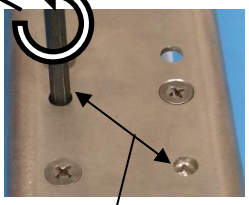
Use one or two clamps; two clamps are recommended if the mooring is subjected to high dynamic motion.

1. Attach the mounting clamp(s) to the mooring cable.
   A. Open the mounting clamp(s) by unthreading the two large titanium hex bolts.
   B. Place the mooring cable inside the clamps' grooves.
   C. Reinstall each clamp half with the hex bolts.

2. Verify that the hardware and external fittings are secure.

SBE 39plus with Optional Net Fender / Fairing





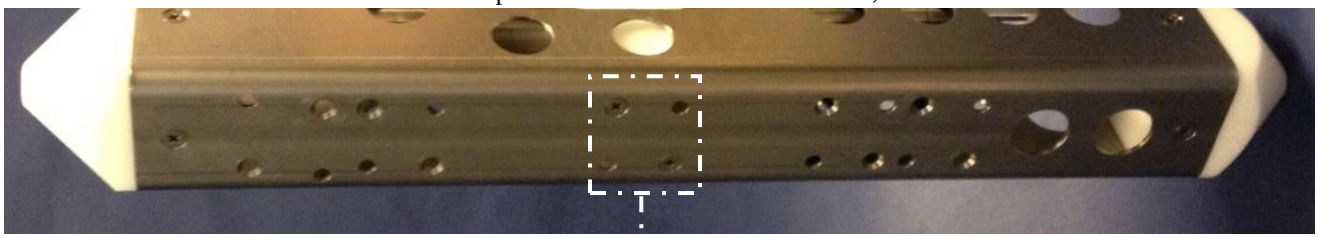
The optional net fender requires the use of a Sea-Bird mounting clamp.

1. Remove the 39*plus* from the net fender:

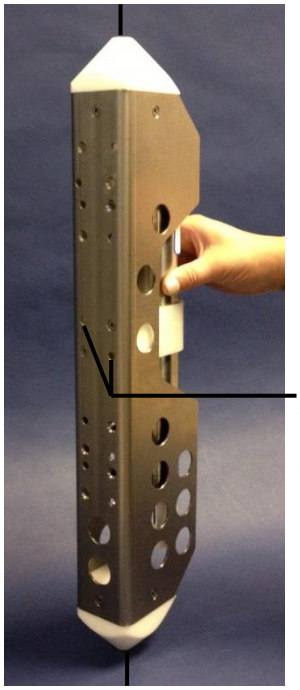
   A. Insert a 3/16 inch Allen wrench through the **countersunk** holes in the back of the net fender to **loosen** the two mounting clamp bolts. ***Note:*** **Do not remove the other bolts**, which are used to retain the clamp halves in the net fender.
   B. When both bolts are **loosened**, remove the 39*plus* from the net fender. ***Note:*** The other half of the mounting clamp remains attached to the net fender, and the mounting bolts remain attached to the retained portions of the clamp.

2. Install the 39*plus* and net fender on the mooring cable:

Note: If desired, you can adjust the location of the clamp on the 39*plus* before installing on the mooring cable. The clamp must line up with one of the 5 possible locations on the net fender, as shown below.



Recommended location - Align clamp mounting holes here



   A. Bringing the 39*plus* and the net fender together, place the mooring cable inside the clamp grooves.
   B. Use a 3/16 inch Allen wrench to tighten the two mounting clamp bolts through the countersunk holes in the back of the net fender.

3. Verify that the hardware and external fittings are secure.

Recovery

WARNING!
If the SBE 39*plus* stops working while underwater, is unresponsive to commands, or shows other signs of flooding or damage, carefully secure it away from people until you have determined that abnormal internal pressure does not exist or has been relieved. Pressure housings may flood under pressure due to dirty or damaged O-rings, or other failed seals. When a sealed pressure housing floods at great depths and is subsequently raised to the surface, water may be trapped at the pressure at which it entered the housing, presenting a danger if the housing is opened before relieving the internal pressure. Instances of such flooding are rare. However, a housing that floods at 5000 meters depth holds an internal pressure of more than 7000 psia, and has the potential to eject the end cap with lethal force. A housing that floods at 50 meters holds an internal pressure of more than 85 psia; this force could still cause injury.
If you suspect the 39*plus* is flooded, point it in a safe direction away from people:

- ***39plus with external connector:*** Loosen the bulkhead connector very slowly, at least 1 turn. This opens an O-ring seal under the connector. Look for signs of internal pressure (hissing or water leak). If internal pressure is detected, let it bleed off slowly past the connector O-ring. Then, you can safely remove the end cap.
- ***39plus with internal connector:*** Slowly turn the end cap ¼ turn at a time (using a wrench on the end cap's wrench flats), letting the internal pressure bleed off slowly past the O-rings as the O-rings are released from the housing. Then, you can completely remove the end cap and electronics from the housing.

Rinse the SBE 39*plus* with fresh water, and dry thoroughly.

Uploading Data

After recovery, data can be uploaded using one of the following methods:

- With the computer connected to the optional external bulkhead connector or the internal RS-232 connector; use Seaterm232 to upload the data. **OR**
- **(much faster, recommended for large data sets)** With a USB cable connected to the internal USB port, use SeatermUSB – SBE39plus to upload the data.

Both methods are detailed below.

Once you have uploaded the data, you can also convert it to a file that is compatible with SBE Data Processing's ASCII Out and Sea Plot modules.

*Note: For best performance and compatibility, Sea-Bird recommends that customers set their computer to English language format and the use of a period (.) for the decimal symbol. Some customers have found corrupted data when using the software's **binary upload** capability while set to other languages. To update your computer's language and decimal symbol (instructions are for a Windows 7 operating system):*

- *In the computer Control Panel window, select Region and Language.*
- *In the Region and Language window, on the Formats tab, select English in the Format pull down box.*
- *In the Region and Language window, click the Additional settings . . . button. In the Customize Format window, select the period (.) in the Decimal symbol pull down box, and click OK.*
- *In the Region and Language window, click OK.*

Uploading Data via RS-232 and Viewing in Plot39

Notes:
- See Seaterm232's Help files.
- If the 39*plus* is connected to the computer by both RS-232 and USB, the USB connection prevents RS-232 communication. Either disconnect the USB cable, or select *SBE 39plus USB* in the Instruments menu (see *Uploading Data via USB and Viewing in Plot39* below).

1. **Connect to bulkhead I/O connector (or skip to Step 2):**
   A. By hand, unscrew the locking sleeve from the 39*plus* bulkhead connector. **If you must use a wrench or pliers, be careful not to loosen the bulkhead connector instead of the locking sleeve**.
   B. Remove the dummy plug from the 39*plus* bulkhead connector by pulling the plug firmly away from the connector.
   C. Install the Sea-Bird I/O cable connector:
   XSG Connector - Align the raised bump on the side of the connector with the large pin (pin 1 - ground) on the 39*plus*. **OR**
   MCBH Connector – Align the pins.
   D. Connect the I/O cable connector to your computer's serial port.
   E. Skip to Step 3.

2. **Connect to (non-bulkhead) internal RS-232 I/O connector:**
   A. Wipe the outside of the titanium end cap and housing dry, being careful to remove any water at the seam between them.
   B. Using a wrench on the end cap's wrench flats, unscrew the end cap.
   C. Pull the end cap and attached electronics out of the housing.
   D. Remove any water from the end cap O-rings and mating surfaces inside the housing with a lint-free cloth or tissue.
   E. Install the data I/O cable's 6-pin Molex connector on the pins on top of the battery pack.
   F. Connect the I/O cable to your computer's serial port.

Note:
While uploading data, `Warning: Low Battery Voltage` may be displayed. Follow **one** of these procedures to continue uploading:
- Connect a 9-volt battery to the I/O connector battery terminal clip, to provide external power. This prevents loss of clock information and data in the 512-byte cache buffer. Once external power is in place, you can replace the internal AA cells without loss of clock information or data.
- Remove the internal AA cells and install new ones. The momentary loss of power resets the clock, preventing analysis of any clock drift, and erases the 512-byte cache buffer data (most recently recorded data, corresponding to no more than 43 data samples of temperature, pressure, and time).

Note that all but the most recent data is stored in non-volatile FLASH memory, which is not affected by loss of power. See *Replacing AA Cells and Desiccant* in *Section 5: Routine Maintenance and Calibration* for replacement of the internal cells. See *Memory* in *Appendix I: Functional Description* for a discussion of the cache buffer.

3. Double click on **SeatermV2.exe**. The main screen appears.

4. In the Instruments menu, select *SBE 39plus RS232*. **Seaterm232** opens.

5. Seaterm232 tries to automatically connect to the 39*plus*. As it connects, it sends **GetHD** and displays the response. Seaterm232 also fills the Send Commands window with the correct list of commands for your 39*plus*. **If there is no communication**:
   A. In the Communications menu, select *Configure*. The Serial Port Configuration dialog box appears. Select the Comm port and baud rate for communication, and click OK. Note that the factory-set baud rate is documented on the Configuration Sheet.
   B. In the Communications menu, select *Connect* (if *Connect* is grayed out, select *Disconnect and reconnect*). Seaterm232 will attempt to connect at the baud specified in Step A, but if unsuccessful will then cycle through all other available baud rates.
   C. If there is still no communication, check cabling between the computer and 39*plus*.
   D. If there is still no communication, repeat Step A with a different comm port, and try to connect again.

Note:
You may need to send **Stop** several times to get the 39*plus* to respond.

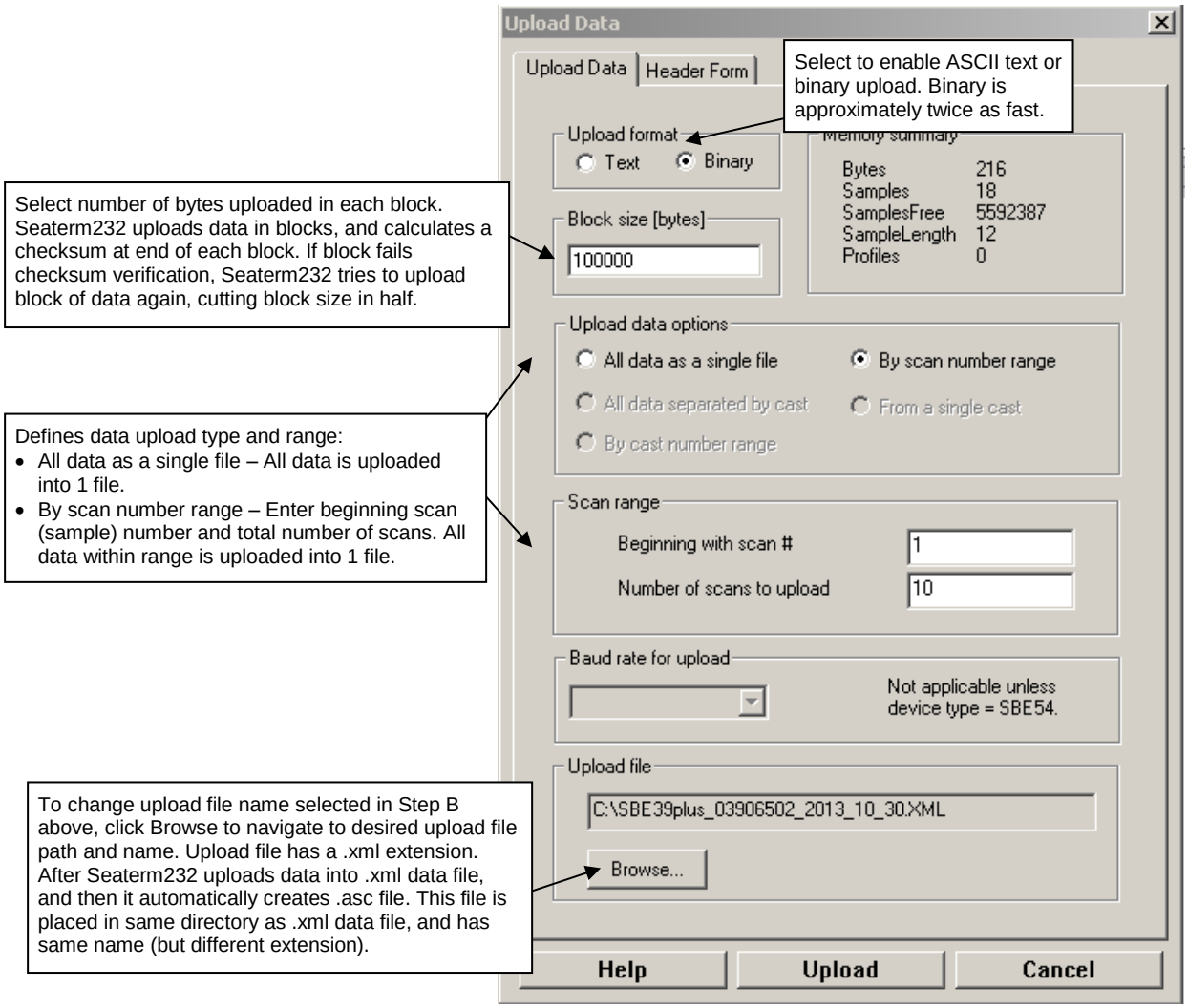
6. If sampling autonomously, command the 39*plus* to stop logging by pressing any key, typing **Stop**, and pressing the Enter key.

7. Display 39*plus* status information by typing **DS** and pressing the Enter key. The display looks like this:

```
SBE 39plus V 4.2.0  SERIAL NO. 03909999  26 Jul 2015 08:49:08
battery voltage = 6.40, back-up voltage = 3.20
not logging: received stop command
sample interval = 1 seconds
samplenumber = 18, free = 5592387
serial sync mode disabled
real-time output enabled
configuration = temperature and pressure
data format = converted engineering
output temperature, Celsius
output pressure, Decibar
output sample number
temperature =19.48 deg C
```

Verify that the status is **`not logging.`**

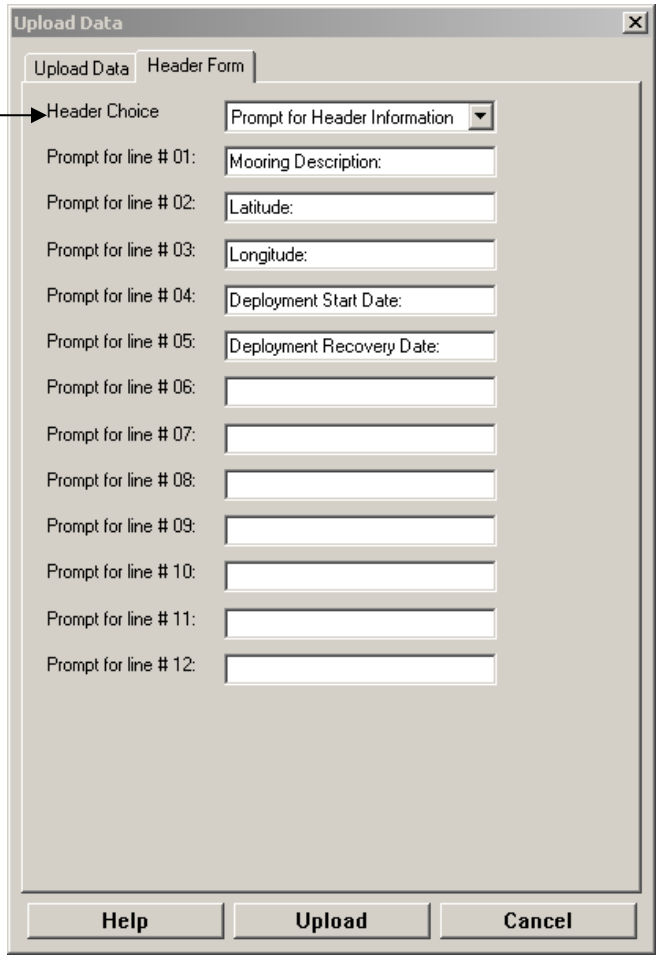
8. Click Upload to upload stored data. Seaterm232 responds as follows:
   A. Seaterm232 sends **GetHD** and **GetSD** and displays the responses to provide information on instrument status, samples in memory, etc.
   B. In the Save As dialog box, enter the desired upload file name and click Save. The upload file has a .XML extension
   C. An Upload Data dialog box appears:



Make the desired selections.

9. Click the Header Form tab to customize the header:

Defines header information included with uploaded data:
- Prompt for header information – As data is uploaded, user is prompted to fill out user-defined header form.
- Include default header form in upload file – User-defined default header form included in upload file. User is not prompted to add any information when data is uploaded.
- Don't include default header form in upload file – Header information not included in upload file.



The entries are free form, 0 to 12 lines long. This dialog box establishes:
- the header prompts that appear for the user to fill in when uploading data, if *Prompt for header information* was selected
- the header included with the uploaded data, if *Include default header form in upload file* was selected

Enter the desired header/header prompts.

10. Click Upload; the Status bar at the bottom of Seaterm232 displays the upload progress: .
    A. Seaterm232 sends several status commands providing information regarding the number of samples in memory, calibration coefficients, etc., and writes the responses to the upload .xml file.
    B. **If you selected *Prompt for header information* in the Upload Data dialog box** – a dialog box with the header form appears. Enter the desired header information, and click OK. Seaterm232 writes the header information to the upload .xml file.
    C. Seaterm232 sends the data upload command, based on your selection of upload range in the Upload Data dialog box, and writes the data to the upload .xml file.
    D. From the information in the .xml file, Seaterm232 creates a .asc data file that is compatible with Plot39 for plotting the data. The .asc file is placed in the same directory as the .xml data file and has the same name (but different extension).

Note:
See Plot39 Help for details.

11. Ensure all data has been uploaded by reviewing the data using Plot39 (with the .asc file).

12. **(if you connected to internal RS-232 I/O connector)** Remove the RS-232 cable from the internal connector.

13. **(if you connected to internal RS-232 I/O connector)** Install new desiccant (see *Replacing AA Cells and Desiccant* in *Section 5: Maintenance and Calibration*).

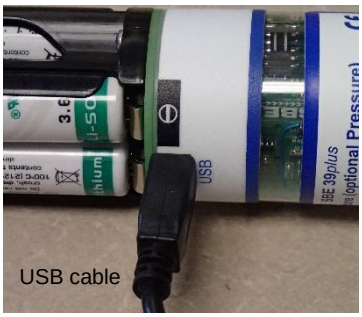
14. **(if you connected to internal RS-232 I/O connector)** Reinstall the end cap and electronics in the housing:
    A. Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to O-ring and mating surfaces.
    B. Carefully fit the end cap into the housing, pushing in until the first O-ring is seated.
    C. Using a wrench, screw the end cap into the housing.

CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

Notes:
To prepare for re-deployment after all data has been uploaded:
1. Send **InitLogging**. If this is not sent, new data will be stored after the last recorded sample, preventing use of the entire memory capacity.
2. Make any desired setup changes.
3. Do *one* of the following:
   - Send **QS** to put the 39*plus* in quiescent (sleep) state until ready to redeploy. Quiescent current is only 25 microamps, so the AA cells can be left in place without significant loss of capacity.
   - Use **StartNow** to begin logging immediately.
   - Set a date and time for logging to start using **StartDateTime=** and **StartLater**.
   - Send **SyncMode=y** to put the 39*plus* in serial line sync mode.

Uploading Data via USB and Viewing in Plot39

Note:
If the 39*plus* internal battery pack voltage is low, the computer supplies sufficient power through the USB cable for the data upload.



USB cable

1. **Connect to internal USB connector:**
   A. Wipe the outside of the titanium end cap and housing dry, being careful to remove any water at the seam between them.
   B. Using a wrench on the end cap's wrench flats, unscrew the end cap.
   C. Pull the end cap and attached electronics out of the housing.
   D. Remove any water from the end cap O-rings and mating surfaces inside the housing with a lint-free cloth or tissue.
   E. Connect the USB cable to the USB connector below the battery pack.
   F. Connect the USB cable to your computer's USB port.

2. Double click on **SeatermV2.exe**. The main screen appears.

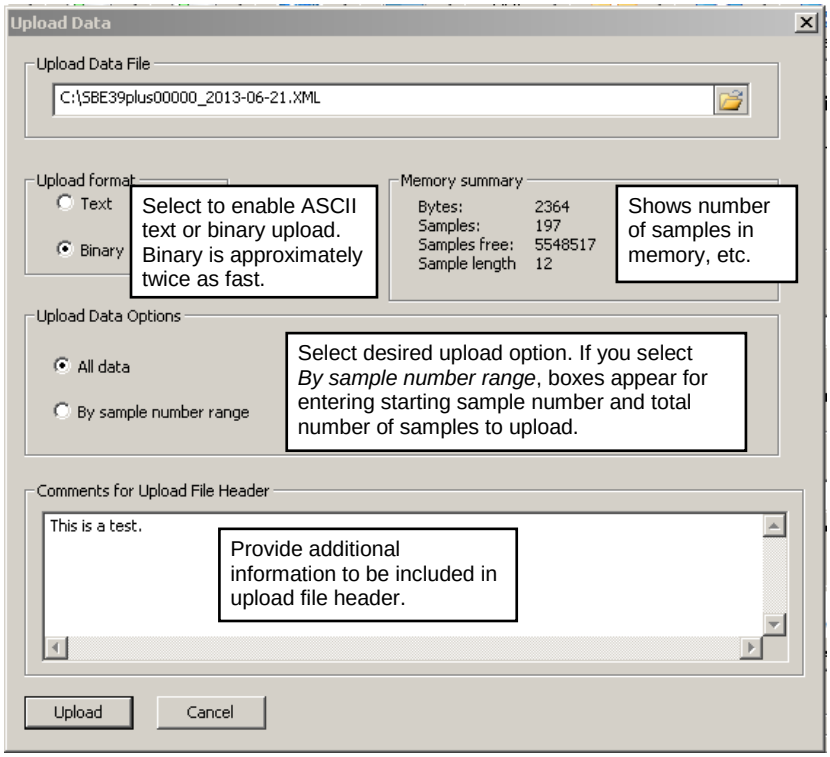
3. In the Instruments menu, select *SBE 39plus USB*.
   SeatermUSB – SBE39plus opens.

4. If there is only one USB device connected, SeatermUSB – SBE39plus should automatically connect to the device (you may need to click Refresh). If there are multiple USB devices, click on the desired device and click Refresh. When SeatermUSB – SBE39plus connects to the device, it automatically sends the **Stop** command to stop autonomous sampling.

Note:
If there are multiple 39*plus* cabled to USB ports, you can upload from all of them by clicking the **Upload All** button. Note the following limitations of **Upload All** compared to **Upload**:
- Does not allow you to select file names (uploads data from each instrument to a separate file which includes the serial number; you can rename the files later).
- Does not allow you to select the sample range (uploads **all** samples in each 39*plus*).
- Does not allow you to add header information (you can add it later manually by opening the files in a text editor).

5. Click the **Upload** button.
   A. The Save As dialog box appears; navigate to the desired folder. SeatermUSB – SBE39plus suggests a file name with a format SBE39plus*Serialnumber_Date*.xml (*Serialnumber* is the 39*plus* serial number, and *Date* is the upload date). You can enter a different file name if desired; the file name has an .xml extension. Click Save.

6. The Upload Data dialog box appears, showing the selected file name and location.



Make the desired selections/entries.

7. Click Upload; the Status bar at the bottom of SeatermUSB – SBE39plus displays the upload progress.
   A. SeatermUSB – SBE39plus sends the data upload command, based on your selection of upload range in the Upload Data dialog box, and writes the data to the upload .xml file.
   B. From the information in the .xml file, SeatermUSB – SBE39plus creates a .asc data file that is compatible with Plot39 for plotting the data. The .asc file is placed in the same directory as the .xml data file and has the same name (but different extension).

Note:
See Plot39 Help for details.

8. Ensure all data has been uploaded by reviewing the data using Plot39 (with the .asc file).

9. Remove the USB cable from the internal connector.

10. Install new desiccant (see *Replacing AA Cells and Desiccant* in *Section 5: Maintenance and Calibration*).

11. Reinstall the end cap and electronics in the housing:
    A. Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to O-ring and mating surfaces.
    B. Carefully fit the end cap into the housing, pushing in until the first O-ring is seated.
    C. Using a wrench, screw the end cap into the housing.

CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

Notes:
To prepare for re-deployment after all data has been uploaded:
1. Click *Clear memory*. If memory is not cleared, new data will be stored after the last recorded sample, preventing use of the entire memory capacity.
2. Select *one* of the following to define the 39*plus* response when the USB cable is removed:
   - *Do not start sampling* - put the 39*plus* in quiescent (sleep) state. Quiescent current is only 25 microamps, so the AA cells can be left in place without significant loss of capacity.
   - *Start sampling on USB cable disconnect* - begin autonomous sampling.
   - *Start sampling at* - set a date and time for autonomous sampling to start.
   - *Enable serial line sync mode* - put the 39*plus* in sync mode.
3. Make any desired setup changes.
4. Click the **Update Configuration** button.

Converting Uploaded .xml File to .cnv File for use in SBE Data Processing

Notes:
- See SBE Data Processing Help for details on ASCII Out and Sea Plot.
- You can also re-create the .asc file using the Convert process, if you misplaced the .asc file that was created during the upload.

The upload process created a .xml data file and a .asc data file; the .asc file is compatible with Plot39 plotting software. If desired, you can also convert the uploaded .xml file to a .cnv file, which is compatible with SBE Data Processing's ASCII Out and Sea Plot modules. This conversion can be done in SeatermUSB – SBE39plus or Seaterm232.

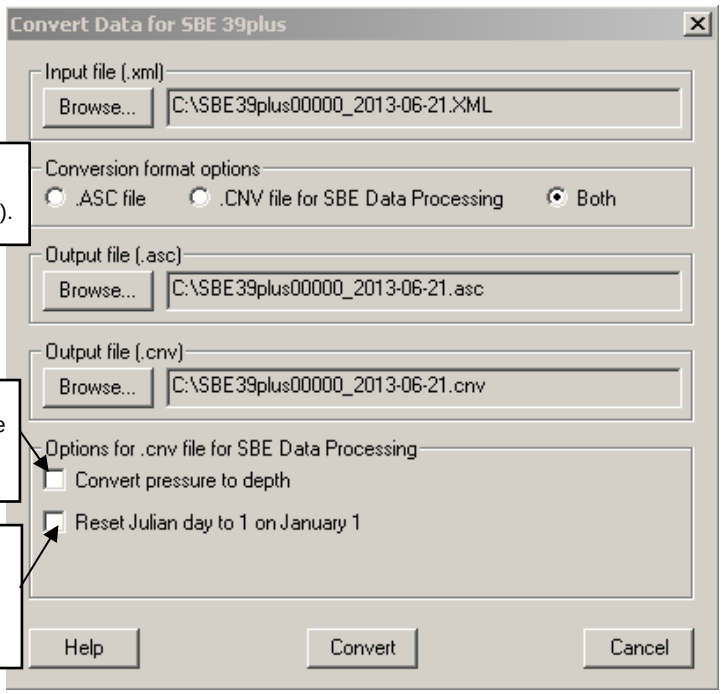
1. In SeatermUSB – SBE39plus click the **Convert XML Data** button, or in Seaterm232 click **Convert .XML data file** in the Tools menu. The Open dialog box appears; navigate to the appropriate folder, click on the uploaded .xml file, and click Open.

2. The Convert Data for SBE 39plus dialog box appears, showing the selected .xml file and location.

.asc file can be used to quickly plot data in Plot39.
.cnv file can be used in SBE Data Processing (only modules applicable to 39*plus* are ASCII Out and Sea Plot).

If you select *Convert pressure to depth*, a field appears for Latitude to be used in depth calculation; enter latitude (degrees) at which 39*plus* was deployed. Software replaces pressure with depth in output .cnv file.

Software converts date and time to Julian day with 5 significant digits in .cnv file. As default, software does not reset Julian day when rolling over from December 31 to January 1; if desired, click *Reset Julian day to 1 on January 1* to reset Julian day on January 1.



Click Convert.

Section 5: Routine Maintenance and Calibration

This section reviews corrosion precautions, connector mating and maintenance, AA cell and desiccant replacement, O-ring maintenance, pressure sensor maintenance, and sensor calibration. The SBE 39*plus*' accuracy is sustained by the care and calibration of the sensors and by establishing proper handling practices.

Corrosion Precautions

All exposed materials are titanium or plastic. No corrosion precautions are required, but direct electrical connection of the SBE 39*plus* (titanium) housing to mooring or other dissimilar metal hardware should be avoided. Rinse the 39*plus* with fresh water after use and prior to storage.

External Connector Mating and Maintenance

Note:
See *Application Note 57: Connector Care and Cable Installation*.

CAUTIONS:
- **Do not use WD-40** or other petroleum-based lubricants, as they will damage the connectors.
- For wet-pluggable MCBH connectors: **Silicone lubricants in a spray can** may contain ketones, esters, ethers, alcohols, or glycols in their propellant. **Do not use these sprays, as they will damage the connector.**

For SBE 39*plus* with external connector -
Clean and inspect the connectors, cable, and dummy plug before every deployment and as part of your yearly equipment maintenance. Inspect connectors that are unmated for signs of corrosion product around the pins, and for cuts, nicks or other flaws that may compromise the seal.

When remating:

1. Lightly lubricate the inside of the dummy plug/cable connector with silicone grease (DC-4 or equivalent).
2. **XSG Connector** - Install the plug/cable connector, aligning the raised bump on the side of the plug/cable connector with the large pin (pin 1 - ground) on the 39*plus*. Remove any trapped air by *burping* or gently squeezing the plug/connector near the top and moving your fingers toward the end cap. **OR**
   MCBH Connector - Install the plug/cable connector, aligning the pins.
3. Place the locking sleeve over the plug/cable connector. Tighten the locking sleeve finger tight only. **Do not overtighten the locking sleeve and do not use a wrench or pliers.**

Verify that a cable or dummy plug is installed on the SBE 39*plus* before deployment.

Replacing AA Cells and Desiccant

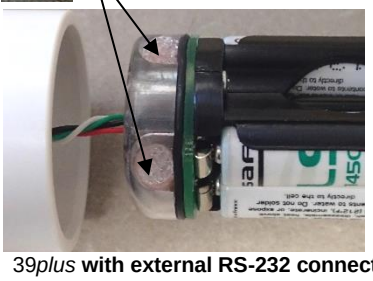
Note:
Before delivery, desiccant is placed in the housing, on top of the battery pack, and the electronics chamber is filled with dry Argon gas. These measures help prevent condensation.
To ensure proper functioning:

1. **Install new desiccant each time you open the housing. Desiccant capsule used in 39*plus* with external RS-232 connector cannot be regenerated by heating.**
2. If possible, dry gas backfill each time you open the housing. If you cannot, wait at least 24 hours before redeploying, to allow the desiccant to remove any moisture.

With external thermistor; detail similar for 39*plus* with embedded thermistor

Wrench flat (both sides)

Desiccant capsule



39*plus* **with external RS-232 connector**

39*plus* with **no external connector**

Desiccant bag

CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

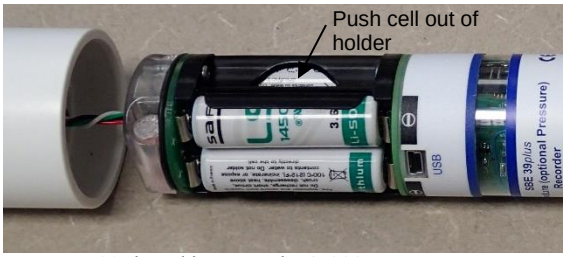
Sea-Bird ships the SBE 39*plus* with four Saft LS 14500 AA lithium cells installed. Leave the cells in place when storing the 39*plus* (quiescent current is only 25 microamps). If the 39*plus* is to be stored for long periods, **replace the cells yearly to prevent cell leakage** (which could damage the 39*plus*).

Replace the desiccant **on top of the battery pack** each time you open the housing. *There is also a desiccant bag inside the plastic cylinder that protects the electronics; the plastic cylinder should not be removed by the customer.*

Follow instructions below to replace the AA cells and desiccant. See *Shipping Precautions* in *Section 1: Introduction* for details on shipping lithium cells.

1. Remove the titanium end cap and electronics from the housing as follows:
   A. Wipe the outside of the end cap and housing dry, being careful to remove any water at the seam between them.
   B. Using a wrench on the end cap's wrench flats, unscrew the end cap.
   C. Pull the end cap and attached electronics out of the housing.
   D. Remove any water from the end cap O-rings and mating surfaces inside the housing with a lint-free cloth or tissue.

2. Replace the AA cells: Push each cell out of the battery holder, and install the new cells.



39*plus* with external RS-232 connector;
battery detail similar for other configurations

3. (39*plus* with **external** connector) Install two new desiccant capsules in the slots on top of the battery pack.

4. (39*plus* with **no external connector**) Install a new desiccant bag on the top of the battery pack. If a new bag is not available, see *Application Note 71: Desiccant Use and Regeneration (drying)*.

5. Reinstall the end cap:
   A. Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to O-ring and mating surfaces.
   B. Carefully fit the end cap into the housing, pushing in until the first O-ring is seated.
   C. Using a wrench, screw the end cap into the housing.

O-Ring Maintenance

Note:
For details on recommended practices for cleaning, handling, lubricating, and installing O-rings, see the *Basic Maintenance of Sea-Bird Equipment* module in the Sea-Bird training materials on our website.

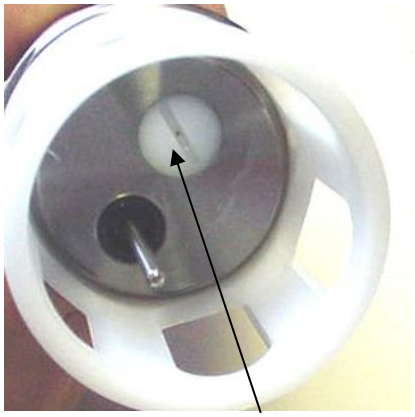
CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

Inspect the O-rings each time you open the housing to replace the AA cells or connect to the internal USB connector; replace approximately once a year.

Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect O-rings and mating surfaces for dirt, nicks, and cuts. Clean or replace as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to O-rings and mating surfaces.

Pressure Sensor Maintenance

Shown with external thermistor; pressure port detail similar for configuration with embedded thermistor



Pressure sensor port plug

CAUTION:
Do not put a brush or any object in the pressure port. Doing so may damage or break the pressure sensor.

The pressure port plug has a small vent hole to allow hydrostatic pressure to be transmitted to the pressure sensor inside the instrument, while providing protection for the pressure sensor, keeping most particles and debris out of the pressure port.

Periodically (approximately once a year) inspect the pressure port to remove any particles, debris, etc.:

1. Unscrew the pressure port plug from the pressure port.
2. Rinse the pressure port with warm, de-ionized water to remove any particles, debris, etc.
3. Replace the pressure port plug.

Sensor Calibration

Sea-Bird sensors are calibrated by subjecting them to known physical conditions and measuring the sensor responses. Coefficients are then computed, which may be used with appropriate algorithms to obtain engineering units. The sensors on the SBE 39*plus* are supplied fully calibrated, with coefficients printed on the Calibration Certificate (in the manual). These coefficients have been stored in the 39*plus*' EEPROM.

We recommend that the SBE 39*plus* be returned to Sea-Bird for calibration.

Temperature Sensor Calibration

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.

Pressure Sensor Calibration

The optional strain-gauge pressure sensor is a mechanical diaphragm type, with an initial static error band of 0.05%. Consequently, the sensor is capable of meeting the SBE 39*plus*' 0.10% error specification with some allowance for aging and ambient-temperature induced drift.

Pressure sensors show most of their error as a linear offset from zero. A technique is provided below for making small corrections to the pressure sensor calibration using the *offset* (**POffset=**) calibration coefficient term by comparing SBE 39*plus* pressure output to readings from a barometer.

Allow the SBE 39*plus* to equilibrate in a reasonably constant temperature environment for at least 5 hours before starting. Pressure sensors exhibit a transient change in their output in response to changes in their environmental temperature. Sea-Bird instruments are constructed to minimize this by thermally decoupling the sensor from the body of the instrument. However, there is still some residual effect; allowing the 39*plus* to equilibrate before starting will provide the most accurate calibration correction.

Note:
The SBE 39*plus*' pressure sensor is an absolute sensor, so its **raw** output (**OutputFormat=0**) includes the effect of atmospheric pressure (14.7 psi). As shown on the Calibration Sheet, Sea-Bird's calibration (and resulting calibration coefficients) is in terms of psia. However, when outputting pressure in **engineering units**, the 39*plus* outputs pressure relative to the ocean surface (i.e., at the surface the output pressure is 0 decibars). The 39*plus* uses the following equation to convert psia to decibars:
Pressure (dbar) =
[pressure (psia) - 14.7] * 0.689476

1. Place the 39*plus* in the orientation it will have when deployed.

2. In Seaterm232:
   A. Set the pressure offset to 0.0 (**POffset=0**).
   B. Set the output format to converted decimal (**OutputFormat=1**) with pressure in decibars (**SetPressUnits=y**), so the pressure output will be in decibars.
   C. Send **TP** to take 100 samples and transmit data.

3. Compare the 39*plus* output to the reading from a good barometer at the same elevation as the 39*plus* pressure sensor port.
   Calculate *offset* = barometer reading – 39*plus* reading

4. Enter the calculated offset (positive or negative) in the 39*plus'* EEPROM, using **POffset=** in Seaterm232.

Offset Correction Example
Absolute pressure measured by a barometer is 1010.50 mbar. Pressure displayed from 39*plus* is -2.5 dbar.
Convert barometer reading to dbar using the relationship: mbar * 0.01 = dbar
Barometer reading = 1010.50 mbar * 0.01 = 10.1050 dbar
The 39*plus'* internal calculations output gage pressure, using an assumed value of 14.7 psi for atmospheric pressure.
Convert 39*plus* reading from gage to absolute by adding 14.7 psia to the 39*plus'* output:
-2.5 dbar + (14.7 psi * 0.689476 dbar/psia) = -2.5 + 10.13 = 7.635 dbar
Offset = 10.1050 – 7.635 = + 2.47 dbar
Enter offset in 39*plus.*

For demanding applications, or where the sensor's air ambient pressure response has changed significantly, we recommend calibration using a dead-weight generator. The pressure sensor port uses a $^{7}/_{16}$-20 straight thread for mechanical connection to the pressure source. Use a fitting that has an O-ring tapered seal, such as Swagelok-200-1-4ST, which conforms to MS16142 boss.

Section 6: Troubleshooting

This section reviews common problems in operating the SBE 39*plus*, and provides the most common causes and solutions.

Problem 1: Unable to Communicate with 39*plus* via RS-232

If **OutputExecutedTag=N**, the `S>` prompt indicates that communications between the SBE 39*plus* and computer have been established. Before proceeding with troubleshooting, attempt to establish communications again by selecting *Connect* in the Communications menu in Seaterm232.

Cause/Solution 1: The I/O cable connection may be loose. Check the cabling between the SBE 39*plus* and computer for a loose connection.

Cause/Solution 2: The instrument type and/or its communication settings may not have been entered correctly in Seaterm232. Verify the settings in the Configure Communications dialog box (Communications menu -> *Configure*). The settings should match those on the instrument Configuration Sheet.

Cause/Solution 3: The I/O cable between the SBE 39*plus* and computer may not be the correct one. The I/O cable supplied with the 39*plus* permits connection to standard 9-pin RS-232 interfaces.

Problem 2: No Data Recorded

Cause/Solution 1: The memory may be full; once the memory is full, no further data will be recorded. Verify that the memory is not full using **DS** (*free = 0* or *1* if memory is full). Sea-Bird recommends that you upload all previous data before beginning another deployment. Once the data is uploaded, send **InitLogging** to reset the memory. After the memory is reset, **GetSD** or **DS** will show *samplenumber = 0*.

Problem 3: Unreasonable T or P Data

The symptom of this problem is a data file that contains unreasonable values (for example, values that are outside the expected range of the data).

Cause/Solution 1: A data file with unreasonable (i.e., out of the expected range) values for temperature or pressure may be caused by incorrect calibration coefficients in the SBE 39*plus*. Send **DC** to verify the calibration coefficients in the 39*plus* match the instrument Calibration Certificates. Note that calibration coefficients do not affect the raw data stored in 39*plus* memory.

- If you have not yet overwritten the memory with new data, you can correct the coefficients and then upload the data again.
- If you have overwritten the memory with new data, you can correct the coefficients in the .xmlcon configuration file, and then reprocess the data in SBE Data Processing's Data Conversion module.

Glossary

Battery Pack – 7.2 V, 5.2 Amp-hour pack consisting of 4 AA Saft LS 14500 AA lithium cells (3.6 V and 2.6 Amp-hours each).

Note:
All Sea-Bird software listed was designed to work with a computer running Windows 2000/XP. Extensive testing has not shown any compatibility problems when using the software with a computer running Windows Vista or Windows 7 (32-bit or 64-bit).

Deployment Endurance Calculator – Sea-Bird's Windows software used to calculate deployment length for moored instruments, based on user-input deployment scheme, instrument power requirements, and battery capacity.

PCB – Printed Circuit Board.

Plot39 – Sea-Bird's Windows software for plotting SBE 39 and 39*plus* data.

SBE 39*plus* – High-accuracy temperature and optional pressure recorder with ***RS-232 serial interface and internal USB interface***.

SBE 39*plus*-IM – High-accuracy temperature and optional pressure recorder with ***inductive modem interface and internal USB interface (available soon)***.

SBE Data Processing – Sea-Bird's Win 2000/XP data processing software, which calculates and plots temperature, pressure, and derived variables.

Scan – One data sample containing temperature, optional pressure, and date and time.

Seasoft V2 – Sea-Bird's complete Win 2000/XP software package, which includes software for communication, real-time data acquisition, and data analysis and display. Seasoft V2 includes ***Deployment Endurance Calculator, SeatermV2***, ***Plot39***, and ***SBE Data Processing***.

SeatermV2 – Win 2000/XP terminal program *launcher*, which launches the appropriate terminal program for the selected instrument (Seaterm232 for this SBE 39).

Seaterm232 – Win 2000/XP terminal program used with Sea-Bird instruments that communicate via an **RS-232** interface, and that were developed or redesigned in 2006 and later. The common feature of these instruments is the ability to output data in XML.

SeatermUSB – SBE 39plus – Win 2000/XP program used when communicating via the SBE 39*plus* internal **USB** connector. This program can send commands to provide status display, **basic** data acquisition setup, and data upload. For access to the full set of setup and testing commands, use SeatermUSB Terminal (accessed by clicking the Terminal button in this program).

SeatermUSB Terminal – Win 2000/XP program used when communicating via SBE 39*plus* internal USB connector. This program provides access to the full set of setup and testing commands when communicating via USB.

CAUTION:
Do not use Parker O-Lube, which is petroleum based; use only *Super* O-Lube.

Super O-Lube – Silicone lubricant used to lubricate O-rings and O-ring mating surfaces. Super O-Lube can be ordered from Sea-Bird, but should also be available locally from distributors. Super O-Lube is manufactured by Parker Hannifin (www.parker.com/ead/cm2.asp?cmid=3956).

Appendix I: Functional Description

Sensors

The SBE 39*plus* includes the same temperature sensor element (pressure-protected thermistor) previously employed in Sea-Bird's modular SBE 3 sensor and in Sea-Bird's SeaCAT family.

Note:
Pressure ranges are expressed in meters of deployment depth capability.

The optional strain-gauge pressure sensor is available in the following ranges: 20, 100, 350, 600, 1000, 2000, 3500, and 7000 meters. Compensation of the temperature influence on pressure offset and scale is performed by the 39*plus*' CPU.

Sensor Interface

Temperature is acquired by applying an AC excitation to a hermetically sealed VISHAY reference resistor and an ultra-stable aged thermistor with a drift rate of less than 0.002°C per year. A 24-bit A/D converter digitizes the outputs of the reference resistor and thermistor (and optional pressure sensor).
AC excitation and ratiometric comparison using a common processing channel avoids errors caused by parasitic thermocouples, offset voltages, leakage currents, and reference errors.

Real-Time Clock

To minimize power and improve clock accuracy, a temperature-compensated crystal oscillator (TCXO) is used as the real-time-clock frequency source. The TCXO is accurate to ±1 minute per year (0 °C to 40 °C).

Memory

Data

The SBE 39*plus* has a 64 MB FLASH memory for data storage. FLASH memory is non-volatile, and data in the memory is not lost as a result of depletion or removal of the AA cells. Because FLASH is written to a *page* (512 bytes) at a time, data is first accumulated in a 512-byte cache buffer. When the cache is full, its contents are transferred to FLASH memory. The cache is volatile, and thus depends on battery pack power. That is why a 39*plus* with a depleted battery pack will lose its most recently stored data unless external power is used (see *Uploading Data* in *Section 4: Deploying and Operating SBE 39plus*).

The data upload process integrates the data from the FLASH memory and the cache. **SampleNumber=** controls the memory pointers that manage this process. Setting **SampleNumber=0** (or sending **InitLogging**) resets the pointer in the FLASH memory and in the cache memory, causing the SBE 39*plus* to overwrite existing data. It is important not to change **SampleNumber=** until all data has been uploaded.

If **SampleNumber=** is inadvertently set to 0 (or **InitLogging** is sent) before data is uploaded, and you wish to upload data, the following conditions apply:

Was additional data logged after SampleNumber= was changed or InitLogging was sent?	**User then returns SampleNumber= to:**	**Description of Uploaded Data**
No	Original value	All data (data in FLASH as well as data in cache) uploads correctly.
No	Estimated value larger than original value	All data in FLASH uploads correctly. Data in cache is corrupted (minimum of 0 and maximum of 36 scans).
Yes < 512 bytes of new data (approximately 73 scans of T; approximately 43 scans of T and P)	Original value	Old data in FLASH uploads correctly. Old data in cache is corrupted. First scan of new data in cache is corrupted; remaining scans of new data in cache upload correctly.
Yes >512 bytes of new data (approximately 73 scans of T; approximately 43 scans of T and P)	Original value	Old data in FLASH is overwritten with new data. Old data in cache is corrupted. If new data set is smaller than old set, a portion of old set can be recovered; scan bridging old and new data is corrupted. First scan of new data in cache is corrupted; remaining scans of new data in cache upload correctly.

T= temperature, P= pressure

Note:
After you have recovered the data, send **Initlogging** or **Samplenumber=0** to reset the memory before beginning logging again. Failure to do so will result in corrupted data.

Settings

Calibration coefficients and setup and operating parameters (**BaudRate=**, **SampleNumber=**, **SampleInterval=**, etc.) are written to EEPROM and are non-volatile. These settings do not change if power is removed.

Appendix II: Command Summary

Note:
See *Command Descriptions* in *Section 4: Deploying and Operating SBE 39plus* for detailed information and examples.

CATEGORY	COMMAND	DESCRIPTION
Status	**GetCD**	Get and display configuration data.
	GetSD	Get and display status data.
	GetCC	Get and display calibration coefficients
	GetEC	Get and display event counter data.
	ResetEC	Reset event counter.
	GetHD	Get and display hardware data.
	Help	Display list of currently available commands.
	DS	Get and display status and configuration data.
	DC	Get and display calibration coefficients.
General Setup	**DateTime= mmddyyyyhhmmss**	Set real-time clock month, day, year, hour, minute, second.
	BaudRate=x	**x=** RS-232 baud rate (600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200). ***Default 9600.*** (600 baud not compatible with SeatermUSB – SBE 39plus)
	OutputExecutedTag =x	**x=Y:** Display XML Executing and Executed tags. ***Default***. **x=N:** Do not.
	TxRealTime=x	**x=Y:** Output real-time data for autonomous and serial line sync sampling. Does not affect storing data to memory, but increases power consumption. ***Default***. **x=N:** Do not.
	QS	Enter quiescent (sleep) state. Logging and memory retention unaffected.
Memory Setup	**InitLogging**	Initialize logging to make entire memory available for recording.
	SampleNumber=x	**x=** sample number for last sample in memory. **SampleNumber=0** equivalent to **InitLogging**.
Output Format Setup	**OutputFormat=x**	**x=0**: output raw decimal data. **x=1**: output converted decimal data. ***Default***. **x=2**: output converted XML decimal data.
	OutputTemp=x	**x=Y:** Output temperature. ***Default***. **x=N**: Do not.
	SetTempUnits=x	**x=0**: Temperature °C, ITS-90. ***Default***. **x=1** Temperature °F, ITS-90.
	OutputPress=x	**x=Y:** Output pressure. ***Default***. **x=N**: Do not.
	SetPressUnits=x	**x=0**: Pressure decibars. ***Default***. **x=1**: Pressure psi.
	TxSampleNum=x	**x=Y:** Output sample number with each *real-time* sample. ***Default***. **x=N**: Do not.
	SetCoastal=x	**x=0**: Reset units to °C and dbar, enable temperature and pressure output, disable sample number output. **x=1**: Reset units to °C and psi, enable temperature and pressure output, disable sample number output.
	Legacy=x	**x=0**: Allow all commands. ***Default***. **x=1**: Reset units to °C and dbar, enable temperature and pressure output, disable sample number. Do not allow user to change those settings. Modify **DS** response to match firmware < 4.0, for consistency with older instruments.

Autonomous Sampling (Logging)	**SampleInterval=x**	**x=** interval (sec) between samples (0.5, and 1-21600). When commanded to start sampling with **StartNow** or **StartLater**, 39*plus* takes sample, stores data in FLASH memory, transmits real-time data (if **TxRealTime=Y**), and powers down at **x** sec intervals. ***Default 10***.
	StartNow	Start logging now.
	StartDateTime=mmddyyyyhhmmss	Delayed logging start: day, month, year, hour, minute, second.
	StartLater	Start logging at delayed logging start time.
	DNx	Upload last **x** scans (1-250) from memory while sampling autonomously, in format defined by **OutputFormat=**.
	Stop	Stop logging or stop waiting to start logging. Press Enter key before entering **Stop**. Send **Stop** before uploading data. Alternate method: send 3 Esc characters.
Polled Sampling	**TS**	Take sample, store in buffer, output data.
	TSR	Take sample, store in buffer, output raw data.
	TSS	Take sample, store in FLASH memory, output data, and turn power off.
	TSSOn	Take sample, store in FLASH memory, output data.
	TSN:x	Take **x** (1-1000) samples and output data.
	SL	Output last sample in buffer.
	SLT	Output data from last sample in buffer, then take new sample and store in buffer (do not output data from new sample).
Serial Line Sync	**SyncMode=x**	**x=Y:** Enable Serial Line Sync mode. **x=N:** Disable Serial Line Sync mode. ***Default***.
Data Upload	**GetSamples:b,e**	Upload scan b to e, in format defined by **OutputFormat=**. Send **Stop** before sending **GetSamples:b,e**.
Testing	**TT**	Measure temperature for 100 samples or until Esc key is pressed, output converted data.
	TP	Measure pressure for 100 samples or until Esc key is pressed, output converted data.
	TTR	Measure temperature for 100 samples or until Esc key is pressed, output raw data.
	TPR	Measure pressure for 100 samples or until Esc key is pressed, output raw data.
Coefficients (F=floating point number; S=string with no spaces) Calibration coefficients are initially factory-set and should agree with Calibration Certificates shipped with 39*plus*. View all coefficients with **GetCC** or **DC**.	**TCalDate=S**	**S=**Temperature calibration date.
	TA0=F	**F=**Temperature A0.
	TA1=F	**F=**Temperature A1.
	TA2=F	**F=**Temperature A2.
	TA3=F	**F=**Temperature A3.
	PCalDate=S	**S=**Pressure calibration date.
	PA0=F	**F=**Pressure A0.
	PA1=F	**F=**Pressure A1.
	PA2=F	**F=**Pressure A2.
	PTHA0=F	**F=**Thermistor coefficient A0.
	PTHA1=F	**F=**Thermistor coefficient A1.
	PTHA2=F	**F=**Thermistor coefficient A2.
	PTCA0=F	**F=**Pressure ptca0.
	PTCA1=F	**F=**Pressure ptca1.
	PTCA2=F	**F=**Pressure ptca2.
	PTCB0=F	**F=**Span TC b0.
	PTCB1=F	**F=**Span TC b1.
	PTCB2=F	**F=**Span TC b2.
	POffset=F	**F=**Pressure offset (decibars).

Note:
Use Seaterm232's Upload menu to upload data that will be processed by Plot39 or SBE Data Processing. Manually entering a data upload command does not produce data with the required header information for processing by those programs.

Appendix III: *Old-Style* Compatible Commands and Data Format

To assist customers who have SBE 39s with firmware less than 4.0 as well as the newer 39*plus* documented in this manual, Sea-Bird retained the old commands and old data format in the new firmware.

Old-Style Compatible Commands

Notes:
- See *Data Formats* in *Section 4: Deploying and Operating SBE 39plus* for data output format compatible with firmware < 4.0.
- **DDMMYY=** and **MMDDYY=** are equivalent. Either can be used to set the date.
- **Always set date and then time.** If a new date is entered but not a new time, the new date will not be saved. If a new time is entered without first entering a new date, the date will reset to the last date it was set for with **MMDDYY=** or **DDMMYY=**.
- If the 39*plus* is logging or waiting to start logging (**StartLater** has been sent), it will not allow the user to reset date or time.

You can use these commands as an alternative to the equivalent commands documented in *Section 4: Deploying and Operating SBE 39plus*.

MMDDYY=mmddyy — Set real-time clock month, day, year. Must be followed by **HHMMSS=** to set time.

DDMMYY=ddmmyy — Set real-time clock day, month, year. Must be followed by **HHMMSS=** to set time.

HHMMSS=hhmmss — Set real-time clock hour, minute, second.

Example: Set current date and time to 10 July 2014 12:00:00 (user input in bold).

```
MMDDYY=071014
HHMMSS=120000
  or
DDMMYY=100714
HHMMSS=120000
```

Notes:
- The 39*plus* baud rate (set with **Baud=**) must be the same as Seaterm232's baud rate (set in the Communications menu).
- **Baud=** must be sent twice. After the first entry, the 39*plus* waits for the command to be sent again **at the same baud** (if it does not receive the command again, it reverts to the previous baud).
  - **If communicating via RS-232:** After you receive confirmation that it changed the baud, in the Communications menu select *Configure*. In the dialog box, select the new baud and click OK. Click the Enter key to reconnect at the new baud.

Baud=x — **x=** baud rate (600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200). ***Default 9600.*** Check capability of your computer and terminal program before increasing baud; high baud requires a short cable and good PC serial port with accurate clock. **Command must be sent twice to change rate.**
Length of cable that 39*plus* can drive is dependent on baud. See *Baud Rate, Cable Length, Power, and Data Transmission Rate*.

Example: Change baud to 19200 (user input in bold).

```
Baud=19200
<!--Repeat command to confirm 19200 baud-->
<Executed/>
Baud=19200
<!--Baud rate changed to 19200-->
```

(In Communications menu, select *Configure*. In dialog box, select 19200; click OK.)
(Click Enter to reconnect at new baud.)

SampleNum=x

x= sample number for first sample when sampling begins. **SampleNum=0** is equivalent to **InitLogging**. After all data has been uploaded from 39*plus*, set sample number to 0 before starting to sample to make entire memory available for recording. If not set to 0, data will be stored after last recorded sample. **Do not send SampleNum= until all data has been uploaded.** This command requires confirmation, to prevent accidental reset.

Example: Make entire memory available for recording (user input in bold).

```
SAMPLENUM=0
<WARNING> Memory pointers will be modified </WARNING>
<!--Repeat command to confirm-->
<Executed/>
SAMPLENUM=0      (enter command again to confirm)
<Executed/>
```

Note:
If you set **Interval=0** (*continuous* sampling in the old SBE 39), the 39*plus* will set it to the fastest sampling speed, 0.5 seconds.

Interval=x

x= interval (sec) between samples (0.5, and 1 to 21600). When commanded to start sampling with **StartNow** or **StartLater**, 39*plus* takes a sample, stores data in FLASH memory, transmits real-time data (if **TxRealTime=Y**), and powers down at **x** sec intervals.

StartMMDDYY=mmddyy

Set delayed logging start month, day, year. Must be followed by **StartHHMMSS=** to set delayed start time.

Notes:
- **StartDDMMYY=** and **StartMMDDYY=** are equivalent. Either can be used to set the delayed start date.
- After setting the delay start date and time, send **StartLater** (documented in *Command Descriptions* in *Section 4: Deploying and Operating SBE 39plus*).

StartDDMMYY=ddmmyy

Set delayed logging start day, month, year. Must be followed by **StartHHMMSS=** to set delayed start time.

StartHHMMSS=hhmmss

Set delayed logging start hour, minute, second.

DDb,e

Upload data from scan **b** to scan **e**, in converted decimal format (**OutputFormat=1**) (regardless of **OutputFormat=**). First scan is number 1. If **DDb** is sent, only scan **b** is uploaded. If **DD** is sent, all scans in memory are uploaded.
As data uploads, screen first displays
`start time =`
`start sample number = .`
These are start time and starting sample number for requested data.

Examples: Upload data from memory (user input in bold).
(Click Capture menu and enter desired filename in dialog box.)

```
DD1,200     (Upload scans 1 through 200)
DD1         (Upload scan 1)
DD          (Upload all scans in memory)
```

SLTR

Transmit **raw** data from last sample stored in buffer, and then take new sample.

Old-Style Data Format

Notes:
- Time is the time at the **start** of the sample.
- When **TxRealTime=Y**, real-time autonomous data and real-time serial line sync data transmitted to the computer is preceded by a **#** sign.
- If **TxRealTime=Y**: Output format affects the time required to transmit real-time data. **Verify that the total acquisition plus transmission time for each sample is less than the sample interval (SampleInterval=).** Failure to set **SampleInterval=** appropriately can lead to inconsistent sampling. See *Sample Timing* in *Section 2: Description of SBE 39plus*.
- The 39*plus*' pressure sensor is an absolute sensor, so its **raw** output includes the effect of atmospheric pressure (14.7 psi). As shown on the Calibration Sheet, Sea-Bird's calibration (and resulting calibration coefficients) is in terms of psia. However, when outputting pressure in **decibars**, the 39*plus* outputs pressure relative to the ocean surface (i.e., at the surface the output pressure is 0 decibars). The 39*plus* uses the following equation to convert psia to decibars:
  pressure (db) =
  [pressure (psia) - 14.7] * 0.689476

Set **Legacy=Y** to output data in the data format consistent with the old SBE 39 (firmware < 4.0). This is identical to the format when **Legacy=N**, **OutputFormat=1**, **OutputTemp=Y, SetTempUnits=0**, **TxSampleNum=N**, and (if 39*plus* includes pressure sensor) **OutputPress=Y** and **SetPressUnits=0**.

Each scan ends with a carriage return <CR> and line feed <LF>. All data is separated with a comma and at least one space.

tttt.tttt, pppp.ppp, dd mmm yyyy, hh:mm:ss

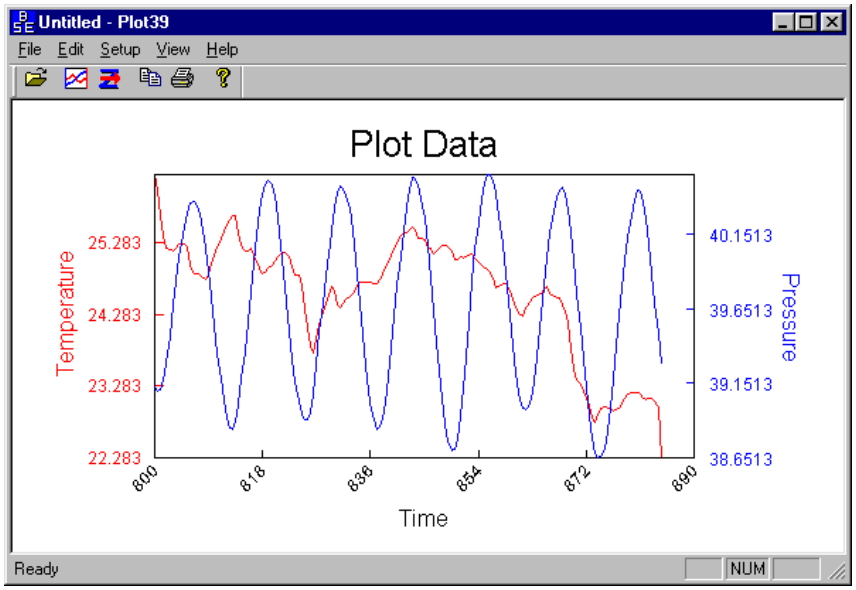
where
- tttt.tttt = temperature (°C, ITS-90).
- pppp.ppp = pressure (dbar).
- dd mmm yyyy = day, month, year.
- hh:mm:ss = hour, minute, second.

Example: Sample data output when transmitting real-time data while autonomous sample. Pressure sensor is installed and **Legacy=Y**:

```
#  23.1258,   -0.076, 27 Jun 2014, 09:43:01
```

(temperature, pressure, date, time)

Appendix IV: Plot39 Data Plotting Program



Note:
Help files provide detailed information on the use of Plot39.

Plot39 is used to plot ASCII data (.asc file) that has been uploaded from the SBE 39*plus*. Plot39:

- Plots the data in color. The plot can be saved as a graphic file for presentation.
- Improves display speed with data culling. Plot39 plots every Nth data value, where N is dependent on the number of data values to be displayed and the width of the display rectangle in pixels.
- Allows axis and font sizes to be easily changed.
- Allows a section of a plot to be magnified to reveal more detail.

If not already installed, install Plot39 and other Sea-Bird software programs on your computer using the supplied software CD (see *Software Installation* in *Section 3: Preparing SBE 39plus for Deployment*).

Appendix V: USB Driver Installation

To communicate with the SBE 39plus **via its internal USB connector**, open SeatermV2 (**version 2.4.1 or later, dated 2015 or later**) and select *SBE 39plus USB* in the Instruments menu. This launches SeatermUSB – SBE39plus. SeatermUSB – SBE39plus should be able to automatically detect and communicate with your SBE 39*plus*; if it does not:

1. Click the Refresh button. If it still does not connect, go to Step 2.
2. Disconnect and reconnect the SBE 39*plus* to the computer via its USB cable. Repeat 2 or 3 times to see if it will connect.

If the 39*plus* does not connect, it is likely that your computer did not automatically install the driver.
New drivers that fixed this problem were incorporated in the Seasoft V2 and Seaterm V2 software release in July 2015; see Field Service Bulletin 28 for details (www.seabird.com/document/fsb28). Install the latest software package from our website (www.seabird.com/software/software and click on the Download tab), and try connecting again.
If you do not want to reinstall the latest Sea-Bird software package, see *Installing Driver via Windows Update* and *Uninstalling and Reinstalling Driver* below.

The procedures below require a working internet connection.

CAUTION:
Windows 7 or 8, 32-bit computers **may** require an internet connection to install the USB driver. **Always plug the 39*plus* into the computer you will be using and verify that the driver has installed properly before going to sea;** this is good practice, regardless of the type of computer.

Note:
If the software freezes with the status bar showing *Obtaining instrument state: 00%*, it is likely that the Microsoft Windows registry is confused about the driver's installation state. Uninstall and reinstall the driver (see *Uninstalling and Reinstalling Driver* in this Appendix).

Installing Driver via Windows Update

If you are unable to connect to the SBE 39*plus*, try the following method to install the drivers.

A. Connect the SBE 39*plus* to the computer via its USB cable.
B. Left-click on the Windows Start Menu and select *Control Panel*.
C. In the Control Panel window, click *Windows Update*.
D. In the left-side panel of Windows Update, click *Check for updates*; wait for the search for updates to finish.
   A. Click *<number> important updates are available*. In the Select updates to install window, uncheck *Name* at the top of the screen. Check the update that includes *Sea-Bird...SBE39plus...*; go to Step 5. If there is no such update, go to Step B.
   B. In the left-side column, click *Optional <number>*. Uncheck *Name* at the top of the screen. Check the update that includes *Sea-Bird...SBE39plus...*; go to Step 5. If there is no such update, contact Sea-Bird.
E. In the bottom right corner of the Select updates to install window, click the *OK* button. You will be returned to the main Windows Update window, where it should say that you have one update selected. Click the *Install updates* button and wait for it to finish.
1. If successful, go to Step 6.
2. If unsuccessful, contact Sea-Bird.
F. To confirm a successful installation: run SeatermV2, select *SBE 39plus USB* in the Instruments menu, and monitor the status bar at the bottom left of the SeatermUSB – SBE39plus window. It should display *Obtaining instrument state XX% complete*, where XX scrolls from 00 to 99. When done connecting, the status bar should be empty, the Connected Devices panel should display *SBE39plus - <serial number>* and the *Current Configuration* panel should display information about your instrument.

Note:
You *may* be asked to supply administrator credentials. Consult your IT department as necessary.

Uninstalling and Reinstalling Driver

Note:
You must have administrator privileges to complete this procedure. Re-login to your computer using an administrator-privileged account, or consult your IT department.

If SeatermUSB – SBE39plus freezes with the status bar showing *Obtaining instrument state: 00%*, it is likely that the Microsoft Windows registry is confused about the driver's installation state. Uninstall the driver and then reinstall it, following the procedure below.

- uter via its USB cable.
- Left-click on the Windows Start Menu and select *Devices and Printers*.
- Right-click on the SBE39plus icon and select *Properties*.
- In the SBE39plus Properties window, click the Hardware tab.
  Verify that the SBE39plus USB is selected in the *Device Functions* table, and then click the *Properties* button.
- In the SBE 39plus Temperature Recorder Properties window, click the *Change settings* button.
- *tall* button.
  - In the Confirm Device Uninstall dialog, check the box next to *Delete the driver software for this device*, and click OK.
  - In the SBE 39plus Temperature Recorder Properties window, click OK.

Note:
If you do not see the *Change settings* button, you do not have (or have not logged in with) administrator privileges. Re-login to your computer using an administrator-privileged account, or consult your IT department.

- seconds, then plug it back in.
- re should bring up a system-tray dialog stating something similar to *Installing device driver software, click here for details*. The plug and play feature automatically goes online to Windows Update, finds the appropriate driver package, downloads and installs it, and correctly registers it in the Windows registry.
- Open SeatermV2, and try connecting to the SBE 39*plus* again.

Appendix VI: Replacement Parts

Part Number	Part	Application Description	Quantity in SBE 39*plus*
50504	Cells, 3.6-volt, 2.6 A-hr AA lithium, Saft LS14500 (quantity 4)	Power 39*plus*	1
233062	Plastic temperature sensor guard	Screws to end cap to protect temperature sensor for **39*plus* with external thermistor**	1
50377	SBE 39*plus* clamp kit; complete kit includes 1 mooring clamp (tightens around housing) with matching cable clamp (attaches to mooring clamp), bolts, washers, O-rings	1/4 inch or 6 mm cable	-
50378		5/16 inch or 8 mm cable	
50379		3/8 inch or 10 mm cable	
50380		1/2 inch or 12 mm cable	
50381		5/8 inch or 16 mm cable	
801836	6-pin DF11 to 9-pin DB-9S I/O cable, 0.3 m (1 ft) long	Cable from 39*plus* **internal RS-232 I/O connector** to computer	-
172557	Cable, USB Type A to Mini-B, M5USB2-USB-1, 1.8 m (6 ft)	USB cable from 39*plus* to computer	1
801376	RMG-4FS to DB-9S with battery snap, 2.4 m (8 ft) long	Cable from 39*plus* **with external I/O connector (XSG)** to computer and external power	-
17046.1	4-pin RMG-4SD-LP dummy plug with locking sleeve	For 39*plus* **with external I/O connector (XSG)**	-
801263	MCIL-4FS to DB-9S with battery snap, 2.4 m (8 ft) long	Cable from 39*plus* **with external I/O connector (wet-pluggable)** to computer and external power	-
171398.1	4-pin MCIL-4FS dummy plug with locking sleeve	For 39*plus* **with external I/O connector (wet-pluggable)**	-
171192	Locking sleeve for MCIL cable	Locks (wet-pluggable) I/O cable or dummy plug in place	-
171888	25-pin DB-25S to 9-pin DB-9P cable adapter	For use with computer with DB-25 connector	-
60058	Desiccant for 39*plus* with external connector	Desiccant capsules in glass bottle (5 PN 31044 capsules, for replacing 2 desiccant capsules each time you open housing)	-
60039	Desiccant for 39*plus* with no external connector	Desiccant bags in metal can (25 1-gram PN 30558 bags and 1 humidity indicator card, for replacing desiccant bag each time you open housing)	-
60069	Spares kit for 39*plus* with external connector	Kit includes: 31018 O-ring, Parker 2-029 N674-70 60058 Desiccant capsules in glass bottle	-
60070	Spares kit for 39*plus* with no external connector	Kit includes: 31018 O-ring, Parker 2-029 N674-70 60039 Desiccant bags in metal can	-

Appendix VII: Manual Revision History

Manual Version	Date	Description
001	08/14	Firmware 4.1.0 and electronic redesign changes: changes in memory and power consumption, command set, software (SeatermV2 instead of Seaterm).
002	08/15	Add caution to use 'Super' o-lube, silicone- based (*Parker O-lube* is petroleum-based; do not use). Add notes about setting PC to English language and decimal period (.) for binary upload (problems have been reported for other configurations). Switch to Sea-Bird Scientific cover. Update language on where to find updated software on website (as a result of the website rebuild in late 2014). Add sampling rate to specifications Remove internal RS-232 cable from typical shipment page; add note that cable for external RS-232 connector is included only with 39plus with external connector. Add 60069 and 60070 spares kits to replacement parts appendix. Add notes about USB driver installation problem being fixed by July 2015 software release; left appendix on USB driver installation in manual for reference.
003	10/15	Remove external RS-232 cable from typical shipment page (must be ordered separately, not automatically included with shipment). Clarify that internal RS-232 cable is included only if ordered (not automatically included with shipment).
004	06/16	Update SeatermV2 main screen. Add information that SeatermUSB does not support baud rate of 600. Add note that capsule type of desiccant (for 39*plus* with external connector) cannot be regenerated by re-heating. Update pressure sensor calibration section to provide information on setup of output units for test. Fix typos. Update Declaration of Conformity.

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