SEA-BIRD SCIENTIFIC

User manual

SBE 39plus temperature recorder

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Table of Contents

Section 1 Safety information

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

⚠DANGER

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

⚠WARNING

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

⚠CAUTION

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

NOTICE

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

1.1 Hazard information

⚠WARNING

If the user thinks that the lithium batteries have leaks, pressure may have built up inside of the pressure housing. Follow ESD protocols to release internal pressure. Put on safety glasses and protective gloves and make sure that the sensor is pointed away from the body and other people. In a well ventilated area, very SLOWLY loosen the bulkhead connector to release the pressure. Keep away from heat, sparks, flame, and other sources of ignition. Do not smoke.

⚠WARNING

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

⚠CAUTION

The pressure housing contains Electrostatic Discharge (ESD) sensitive parts and assemblies that are susceptible to damage from ESD. Follow ESD protocols:

- Put on protective eye wear before you open the pressure housing.
- Any electrostatic charge on the body of the human operator must be released before the pressure housing is opened: put a hand on a grounded surface, or better, wear a grounded antistatic wrist strap.
- At a minimum, wear short-sleeved antistatic clothing, such as cotton, or better, wear an antistatic smock for this service activity. *Do not wear a sweater, fleece or polyester-based clothing.*
- At a minimum, use a workstation with a wood or metal tabletop, or better, a tabletop that dissipates static. *Do not use a workstation with a synthetic or polymeric-based tabletop.*

NOTICE

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

1.2 Equipment labels

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

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

	EFUP: Hazardous material exists over the threshold of GB/T 26572.2011. The number in the center of the symbol is the Environmentally Friendly Use Period as specified by SJ/T 11364-2014, China's marking for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. This product should be recycled after its environmentally friendly use period.

Section 2 SBE 39plus quick start guide

This quick start guide gives the steps necessary to make sure that the SBE 39plus sensor operates correctly and collects data before it is deployed.

This quick start guide and user manual applies to those SBE 39 models that are equipped with an internal or external RS232 connector.

What's in the box:

- SBE 39plus, with four Saft LS 14500 AA lithium cells installed.
- CD—has software, calibration files, documentation
- Spare parts kit
- I/O cable for internal USB connector to connect the sensor to a PC

1. Install the manufacturer-supplied software on a PC (refer to Install software on page 13 for details.)
2. If necessary, install new batteries and desiccant (refer to Replace batteries and desiccant on page 23 for details.)
   The manufacturer ships new sensors with 4 AA lithium cells installed.
3. Connect the sensor to the PC and start the software.
4. Set up the sensor for deployment (refer to Set up sensor on page 15 for details.)
   a. If necessary, make sure that all data stored in the sensor is transmitted to a PC.
   b. Set the date and time (DateTime)
   c. Configure the data collection settings.
   d. Send the DS and DC commands to verify the setup.
   e. For autonomous data collection, send StartNow to start operation immediately. Send StartDateTime= or StartLater to start at a user-selected time in the future.
5. Immediately after the sensor is recovered from a deployment:
   a. Use the software to turn off the sensor.
   b. Rinse the sensor with fresh water.
   c. Keep the sensor out of direct sunlight between deployments.
6. Transmit data from the sensor to a PC.
7. To store the sensor:
   a. Rinse the sensor thoroughly, then dry.
   b. Leave the batteries in the sensor for storage up to a year.

Section 3 Specifications

3.1 Electrical

	Temperature	Temperature and pressure
Internal batteries	4 Saft LS 14500 AA lithium cells, 7.2 V, 5.2 Ah	
Input	9-30 VDC	
Current draw	(2.5 mA, 280 msec): 0.00070 A-sec	(3 mA, 280 msec): 0.00084 A-sec
Current draw, low power	25 µA	

3.2 Communication

Communication interface	RS232
Data collection interval	1 second to 9 hours, user-programmable

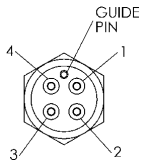
3.3 Analytical

Parameter	Range	Accuracy	Stability	Resolution
Temperature	-5–45 °C	±0.002 °C (-5–35 °C) ±0.01 °C (35–45 °C)	0.0002 °C/mo	0.0001 °C
Pressure	not more than the SBE 39 rated depth	±0.1%	0.05% full scale range/yr	0.002% full scale range

3.4 Mechanical

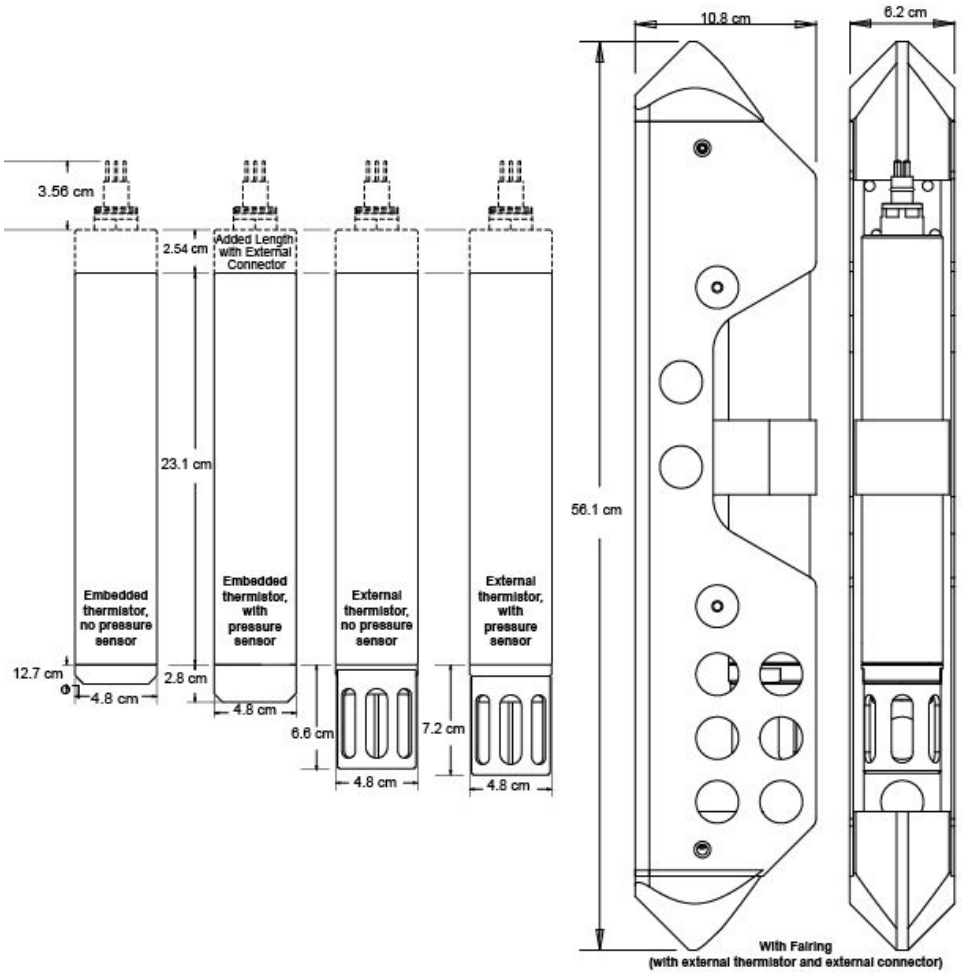
	Plastic	Titanium
Depth rating	600 m	10500 m
Weight in air, water	0.6 kg, 0.25 kg	1.2 kg, 0.7 kg1.2, 0.7 kg

Table 1 4-contact bulkhead connector

Contact	Function	MCBH-4-MP
1	Ground	
2	RS232 RX	
3	RS232 TX	
4	Voltage in	

3.4.2 Dimensions

Figure 1 39plus lengths



Section 4 Overview

The SBE 39plus is a high-accuracy temperature recorder. The sensor is designed for moorings and other long-term, fixed-site deployments.

Optional equipment:

- Pressure sensor, strain gauge
- Fairing ("net fender") to protect from fishing lines and nets.
- External RS232 bulkhead connector

Two thermistor options are available:

- Embedded thermistor, with a time constant of approximately 25 seconds.
- External thermistor, with a time constant of approximately 0.5 seconds.

Communication is through a full-duplex RS232, with commands and data transmitted half-duplex between a PC and the SBE 39plus.

The user can operate the sensor in one of several modes:

Autonomous operation—interval

- Operates at user-selected intervals (0.5 seconds to 6 hours).
- Operation sequence:

  1. The sensor makes one measurement
  2. The data is stored internally
  3. The sensor goes into a low power mode until the next sample is collected.

Controlled (polled) operation

- Controlled data collection is useful when the sensor is integrated with satellite, radio, or wire telemetry equipment.
- Operation sequence:

  1. The sensor makes one measurement
  2. The sensor sends the data to the controller
  3. The sensor goes into a low power mode until the next command to operate.

Serial Line Synchronization

The sensor responds to a pulse on the serial line. This mode makes it easy to synchronize the sensor with other devices such as Acoustic Doppler Current Profilers (ADCP) or current meters, and does not use their internal power.

- Operation sequence:

  1. The sensor makes one measurement
  2. The data is stored internally
  3. The sensor goes into a low power mode until the next sample is collected.

4.1 Sample time

Sample time is affected by the sample mode, if real-time data is transmitted, and if the 39plus has a pressure sensor.

Power-on time for each sample:

- Data collection power-on time = 0.28 seconds
- Data collection power-on time to transmit at 9600 baud, temperature and time = 0.04 seconds for converted decimal, 0.062 seconds for raw, or 0.25 seconds for xml.
- Data collection power-on time to transmit at 9600 baud, temperature, time, and pressure = 0.05 seconds for converted decimal, 0.096 seconds for raw, or 0.28 seconds for xml.

If real-time temperature, time, and pressure data is transmitted at other baud rates, multiply the time to transmit by 9600/baud. For example, if data is transmitted at 2400 baud in converted decimal, the time to transmit is 9600 ÷ 2400 × 0.05 = 0.2 seconds.

Total time for each sample = data collection power-on time + real-time power-on time to transmit data.

Make sure to set the sample interval (**SampleInterval=**) to **more** than the total time for each sample, or data collection may not be accurate.

Example: What is the minimum sample interval necessary to transmit real-time temperature, pressure, and date and time in xml at 2400 baud?
Data collection time = 0.28 seconds

Time to transmit data in real-time = 0.28 seconds × (9600 ÷ 2400) = 1.12 seconds

Total time for each sample = 0.28 + 1.12 = 1.14 seconds. Set the sample interval to **SampleInterval=2**. The sample interval can be decreased if the output format is changed to converted decimal or raw data, or if the baud rate is increased.

4.2 Battery life

The battery pack is 4 size AA cells in series of 3 parallel strings. The battery holder has a yellow cover plate. It is NOT compatible with the older battery holder that has a red cover plate. The manufacturer recommends the user uses a conservative capacity value of 4.0 amp-hours, even though the nominal capacity is calculated at 5.2 amp-hours.

If the SBE 39plus is set to transmit data in real-time, the current draw is 6 mA.

The time required for each sample depends on the user-set data collection mode, and whether the 39plus has a pressure sensor. The 39plus is shipped with Deployment Endurance Calculator software to calculate the maximum deployment time. An example of a manual calculation is shown below.

Example: A 39plus with pressure sensor is set up to take a sample every 5 seconds, or 720 samples/hour. Data is transmitted in real-time in converted decimal at 9600 baud. How long can it be deployed?
Sample time = 0.00084 A-s/sample

720 × 0.00084 = 0.605 A-s/sample

Communications current draw = 0.006 A × 0.05 seconds = 0.0003 A-s/sample

720 × 0.0003 = 0.216 A-s/hour

Low power current draw = 0.000025 mA × [3600 seconds/hour - 720 × (0.28 seconds + 0.05 seconds)] = 0.084 A-s/hour

Power consumed/hour = 0.605 + 0.216 = 0.084 = 0.905 A-s/hour

Battery capacity = (4.0 aH × 3600 seconds/hour) ÷ 0.905 A-s/hour = 15,911 hours = 663 days = 1.8 years

Number of samples = 15,911 hours × 720 samples/hour = 11,455, 920 samples

The memory capacity is approximately 5,500,00 samples. The 39plus will continue to collect and transmit data after the memory is full, but will not overwrite the data stored in memory.

Battery life is also affected by deployment orientation. The manufacturer recommends that the 39plus is deployed vertically, with the thermistor pointed down, or horizontally. If the 39plus is deployed with the thermistor pointed up, the battery life may be reduced by up to 40%. This will not affect most deployments because even with a 40% reduction, the SBE 39plus could still collect approximately 7.4 million samples, more than the memory can store.

4.3 Cable length and external power

Calculate IR loss for real-time data collection if the 39plus is used with external power. The SBE 39plus will draw power from the power source with the highest voltage, either the internal battery pack or an external source. If power is supplied from an external source—

1. The communications IR loss should be 1 V or less when real-time data is transmitted. The 39plus will not transmit data if the IR loss is greater than 1V because of the difference in ground potential.
2. Supply enough power so that sufficient power is available to the sensor after IR loss is calculated.

Limit IR loss to 1 V to transmit real-time data

Maximum communications current draw × common wire resistance on the power wire = limit to the length of the cable.

$V_{limit} = 1\ V = IR_{limit}$

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

I = required communications current of 6 mA.

Example 1:
What is the maximum cable length that can supply power to the SBE 39plus with 24 gauge wire?
= $1\ V = IR_{limit} = V_{limit} \div I = 1\ V \div 0.006\ A = 166$ ohms
Maximum cable length = 166 ohms ÷ 0.0257 ohms/ft = 6485 ft (1977 m)

Example 2: Same as above, but an external power supply supplies four SBE 39plus sensors.
$R_{limit} = V_{limit} \div I = 1\ V \div (0.006\ A \times 4 = 41$ ohms
Maximum cable length = 41 ohms ÷ 0.0257 ohms/ft = 1621 ft (494 m) (furthest 39plus from power supply)

Table 2 Common wire resistances

Gauge	Ohms/ft.
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

Table 3 Maximum cable length and baud rate

Length, m	Baud rate
1600	600
800	1200
400	2400
200	4800
100	9600
50	19200
25	38400
16	57600
8	115200

Use the software to see data in real-time.

Supply sufficient power to 39plus

The power requirement depends on sufficient voltage at the power source after IR loss:

- Supply a minimum of 8 V, after IR loss, so the MicroCAT uses the internal batteries, or if no batteries are installed. V - IR >/= 8 V.
- Supply a minimum of 5 V, after IR loss, if power is supplied from a battery pack, or if no size AA cells are installed. V - IR >/= 5 V.

Example1:
What is the maximum distance to supply power to the 39plus with 24 gauge wire and a 9 V power supply, and not use any power from the internal battery pack?

9 V - 0.006 A × (0.0257 ohms/ft × 2 × cable length) >/= 8 V. Cable length = 3242 ft (988 m).

Note that 988 m < 1977 m, so the IR loss controls the distance. Baud rate also has an effect on cable length. Maximum cable length is 1600 m at 600 baud and less for higher baud rates.

Example 2: Same as above, but an external power supply supplies four SBE 39plus sensors.
9 V - (0.006 A × 4) × 0.0257 ohms/ft × 2 × cable length) >/= 8 V. Cable length = 810 ft (247 m).

Section 5 Set up sensor and verify operation

Set up the hardware and install the software for the sensor to make sure that it functions correctly before deployment.

- Install the manufacturer-supplied software.
- Verify operation.

IMPORTANT:all commands are pre-pended with #ii. Do not use #ii for RS232 and SDI-12 protocols. For example, the "Stop" command is **ii#Stop** for IMM and SIM and **Stop** for RS-232.

5.1 Install software

Make sure that the sensor is connected to the PC through the serial connector on the supplied cable. Most PCs no longer have serial ports, and a serial-to-USB adapter is necessary. Make sure that the USB driver software is installed on the PC so that there is communication between the sensor and the PC.

1. Install the software from the manufacturer-supplied CD.
2. Start the software. It automatically connects at the default baud rate of 19200 but will try others if necessary. The software automatically looks for the serial port number of the connected sensor.
3. Select the connected sensor.

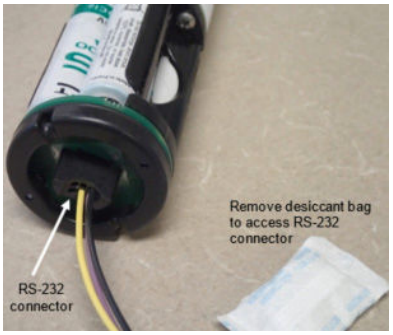
5.2 Set up and test RS232 communication

If the sensor is equipped with an external bulkhead connector, use the manufacturer-supplied cable to connect the sensor to the PC and do step 2 next.

If the sensor is equipped with an internal RS232 connector, remove the end flange to connect to the internal RS232 connector.

1. Set up the internal RS232 connection:
   a. Make sure the outside of the sensor is dry.
   b. Use a wrench on the wrench flats of the end flange to unscrew the end flange.

   c. Pull the end flange and the attached electronics out of the pressure housing.
   d. Use a lint-free cloth or tissue to remove any water from the O-rings and surfaces inside the housing.
   e. Remove the desiccant bag and connect the RS232 connector to the sensor.



   f. Connect the RS232 cable to the PC.

2. Start the software.
3. Make sure all of the data from the sensor is uploaded to the PC.
4. Change any settings in the **SBE 39plus Configurations** area.
5. Disconnect the RS232 cable from the 39plus.
6. Install new desiccant.
   Refer to Replace batteries and desiccant on page 23 for details.
7. Attach the end flange:
   a. Make sure that there is no water on surfaces or O-rings.
   b. Inspect the O-rings.
      The O-rings should be pristine.
   c. Replace the O-rings if necessary: apply a light coat of Parker Super O Lube to each replaced O-ring and then install.
   d. Carefully push the end flange into the housing until the first O-ring is seated.
   e. Use a wrench to tighten the end flange into the pressure housing.

5.3 Set up and test USB communication

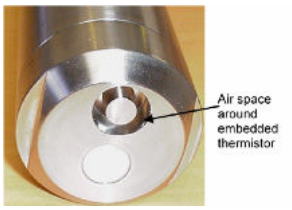
You must remove the end flange to connect to the internal USB connector.

1. Set up the USB connection:
   a. Make sure the outside of the sensor is dry.
   b. Use a wrench on the wrench flats of the end flange to unscrew the end flange.
   c. Pull the end flange and the attached electronics out of the pressure housing.
   d. Use a lint-free cloth or tissue to remove any water from the O-rings and surfaces inside the housing.
   e. Connect the USB cable to the USB connector near the battery pack.
   f. Connect the USB cable to the USB port on the PC.
2. Start the software.
3. Select *SBE 39plus USB*.
   The software opens. If there is only one USB device connected the software should automatically connect to it (it may be necessary to select **Refresh**). If there is more than one device connected, select the one you want, then **Refresh**.
4. Make sure all of the data from the sensor is uploaded to the PC.
5. Change any settings in the **SBE 39plus Configurations** area.
6. Unplug the USB cable from the 39plus-IM.
7. Install new desiccant.
   Refer to Replace batteries and desiccant on page 23 for details.
8. Attach the end flange:
   a. Make sure that there is no water on surfaces or O-rings.
   b. Inspect the O-rings.
      The O-rings should be pristine.
   c. Replace the O-rings if necessary: apply a light coat of Parker Super O Lube to each replaced O-ring and then install.
   d. Carefully push the end flange into the housing until the first O-ring is seated.
   e. Use a wrench to tighten the end flange into the pressure housing.

Section 6 Deployment and recovery

6.1 Set up sensor

Set up the sensor hardware for deployment. The manufacturer recommends that the sensor is deployed with the thermistor end down, or horizontal. This gives maximum battery pack endurance, and keeps sediment out of the thermistor.



Hardware setup includes:

- Install batteries and replace desiccant in the sensor
- Attach the optional mounting clamp(s)
- Attach the sensor to the mooring cable
- Attach the optional fairing.

The wire guide and mounting clamps are designed to hold one of these sizes of mooring wire: ¼, 5/16, 3/8, ½, 5/8 in, and 6, 8, 10, 12, and 16 mm.

1. Install batteries if necessary. If the pressure housing is opened to replace batteries, replace the desiccant as well.
   Refer to Replace batteries and desiccant on page 23 for details.
2. Attach the mounting clamp(s):
   a. Remove the two large titanium hex bolts.
   b. Put the mooring cable inside the clamps' grooves.
   c. Attach the two halves of the clamp with the titanium hex bolts.

   Make sure that the clamps are secure.

3. Attach the optional fairing:
   a. Use a 3/16-in. hex wrench to loosen the 4 countersunk bolts (2 at each end) at the back of the fairing. Do not remove the other bolts. They attach the clamps to the sensor.
   b. Remove the fairing.
   c. Place the mooring wire inside the clamp grooves.
   d. Put the fairing back on the sensor. Secure the fairing in one of five possible locations along the back.

6.2 Set up software

Use the software to send commands to the sensor.

Command overview

- A serial number command prefix of #Sx: or !Sx: sends commands to a 39plus with the same integrated IMM serial number. The manufacturer sets the serial number to 700xxxxx or 701xxxxx. 700 or 701 is the IMM and the xxxxx is the unique five-digit serial number of the IMM. A serial number address can help if you accidentally set the same ID for more than one sensor and do not know that until the sensor is deployed.
- A Group command prefix of #Gn or !Gn sends commands to all sensors in a user-set Group. For example, all 39plus-IM sensors can be in Group 1, and all 37-IMP-ODO sensors can be in Group 2.
- A GData command does not require a prefix and is recognized be all IM sensors attached to the same inductive cable.

6.3 Configure software

Make sure that the sensor is connected to a PC with the software installed to configure the sensor for a specific deployment.

1. If necessary, make sure that all of the data stored in the sensor is transmitted to the PC.
2. Send **InitLogging** to make sure that the memory in the sensor is erased.
   If this command is not sent, data will be stored after the last recorded sample.

3. Use **DateTime=** to set the date and time.
4. Select the setup and data collection configuration.
5. Do one of the options listed below to start data collection:
   - **StartNow** to collect a sample every **SampleInterval=** seconds.
   - **StartDateTime=** and **StartLater** to start data collection at the specified date and time, to collect a sample every **SampleInterval=** seconds.
   - **SyncMode=Y to** to put the sensor in serial line synch mode, so a pulse on the line will start one sample.

6.3.1 Timeout description

The IMM, SIM, and the 39plus-IM have timeout algorithms.

Refer to the IMM manual for the IMM timeout description.

The SIM timeout puts the PC in control if no reply is received from the sensor in a specified length of time. New commands can be sent at that time. There are two user-specified SIM timeouts:

- **DataNNMax=** timeout for **!iiData** and **Dataii** only. Default is 1000 milliseconds.
- **RelayMax=** timeout for all other commands. Default is 20 seconds.

Use the "Esc" key and then "Enter" to take control of the SIM sooner than the timeout.

The 39plus-IM timeout puts the sensor into a low-power mode if no command is received for 2 minutes. To start communication again, there are three options:

- Select *Connect*
- For SIM, send **PwrOn**
- For IMM, wait at least 1 second, send **ForceCaptureLine**, then send **SendWakeupTone**.

6.4 Data collection modes

The sensor can collect data in one of three basic modes:

- Polled
- Autonomous
- Serial Line Synchronization

Commands can be used in various combinations and in one or more modes. The sensor can collect data in real-time with the software.

6.4.1 Autonomous mode

At user-selected intervals, the pump operates, the sensor collects one sample, stores that data in the flash memory, and goes into a low power state. Use **SampleInterval=** to set the sample interval. Use **StartNow** or **StartLater** to start data collection. Use **Stop** to stop data collection. use **#iiSL** to get the last sample while the sensor continues to collect data. The pump operation time depends on the setting for **#iiAdaptivePumpControl=**, and on the temperature and pressure values from the previous sample.

Note that the MicroCAT has a lockout feature to prevent interference with data collection. if the sensor is in operation or ready to start, only these commands can be sent:

- **GData, PwerOff, Dataii, ID?,#iiGetCD, #iiGetSD, #iiGetCC, #iiGet EC, #iiGetHD, #iiDS, #iiDC, #iiTS, #iiTSR, #iiTPS, #iiTPSH, #iiTPSS, #iiSL, #iiSLTP, #iiStop.**

In autonomous mode, the power-on time for each sample:

- With optional pressure sensor: 2.4 seconds to sample.
- Without optional pressure sensor: 1.8 seconds to sample.

The sensor will not accept commands while it collects a sample. If the sensor does not respond, send the command again to continue to try and start communication.

6.4.2 Controlled (polled) mode

On command, the pump operates, the sensor collects one sample. Data is stored in the flash memory of the sensor. Other options are available with different commands. Data collection from each sensor cannot be synchronized.

The sensor does a check of the previous sample to verify that the minimum conductivity is greater than the value of **#iiMinCondFreq=** before it operates the pump. The pump operation time depends on the setting for **#iiAdaptivePumpControl=**, and on the temperature and pressure values from the previous sample.

In polled mode, the power-on time for each sample is approximately 4 seconds.

6.4.3 Serial line synchronization mode

Not compatible with SDI-12.

In this mode a pulse (a single character) on the RS232 line will start a sample. This lets acoustic Doppler current profilers or current meters integrate the MicroCAT data collection. The MicroCAT does not use the battery or memory resources of the other sensor.

To enable this mode, send SyncMode=Y and then wait two minutes or send QS to put the MicroCAT in a low power mode. When a pulse is sent, the sensor takes a sample and stores the data in the flash memory. The sensor will send real-time data if TxRealTime=Y.

To disable this mode after when a sample is finished, send three Esc characters. The sync mode changes to no. It may take a minute to come out of this mode. Then push any key to put the sensor in standby mode to accept the full range of commands.

Keep the line "open circuit" or within ±0.3V relative to ground to minimize power consumption between pulses.

In serial line synchronization mode, the power-on time for each sample:

- With optional pressure sensor: 2.6 seconds to sample.
- Without optional pressure sensor: 2.0 seconds to sample.

6.5 Default output format

OutputFormat=1 is data in decimal format, converted to engineering units.

tttt.tttt	temperature, °C or °F. Sent if **OutputTemp=Y**, with units in **SetTempUnits=**.
pppp.ppp	pressure, dbar or psi. Sent if installed on sensor and **OutputPress=Y** with units in **SetPressUnits**=.
dd mmm yyyy	day, month, year
mm-dd-yyyy	month, day, year
hh:mm:ss	hour, minute, second
n	sample number in flash memory. Sent if **#iiTxSampleNum=y**when the sensor transmits data while in autonomous mode and in response to a command that transmits a sample from the flash memory.

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

Example: Sensor transmits data in real-time in autonomous mode. Pressure sensor installed. **OutputFormat=1**, **OutputTemp=Y**, **SetTempUnits=0**, **OutputPress=Y**, **SetPressUnits=0**, and **#iiTxSampleNum=y**
temperature, date, time, sample number
Example output:
`23.1258, -0.051, 14 Jul 2016, 09:01:34, 1126`

6.6 Recover sensor from deployment

⚠ DANGER

If the system stops while under water or shows other signs of damage, it may be flooded. The end flange may be ejected from the pressure housing with lethal force. Upon recovery, carefully secure it away from people, and slowly loosen the end flange (½ turn of each screw) until the pressure is released.

1. Flush the sensor with fresh water.
2. If necessary, connect the sensor to the PC and send the command to stop data collection (**Stop** or **#iiStop**).
3. Select **Upload...** to transmit the data stored in the sensor to the PC.
   Look at the data to make sure it was transmitted and not corrupted. If there is any problem with the data, transmit the data again; the next deployment will overwrite this data.
4. Put the sensor in a low power state (**PwrOff**) and keep the battery pack in the sensor even if it will not be deployed soon.
   The current draw in this state is 60 µA, which reduces battery capacity by approximately 13% per year.
5. If the sensor is equipped with a pressure sensor, record the atmospheric pressure with a barometer.
   This information can be used to compare with the sensor output in air to verify and correct for pressure sensor drift.

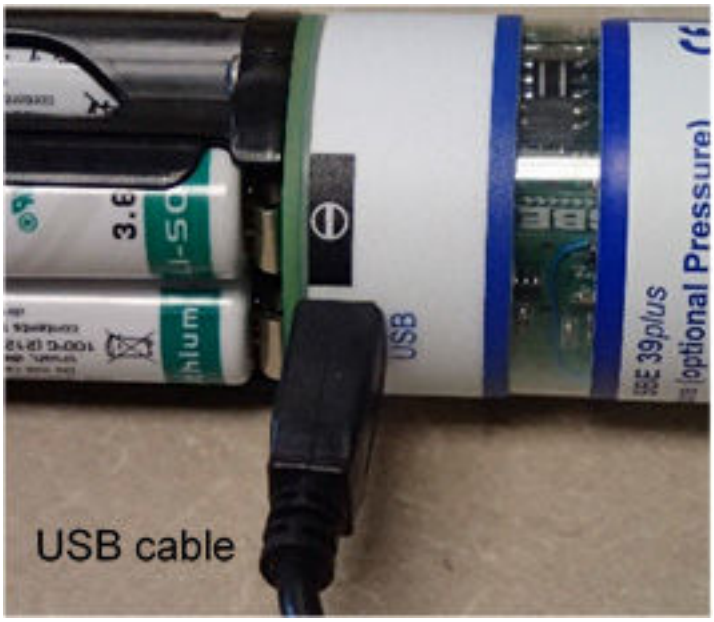
Section 7 Transmit and convert data

Data that is collected and stored by sensors must be transmitted to a PC to process the data into a human-readable format.

7.1 Transmit data to a PC

Use either the external RS232 or the internal USB to transmit data stored in the 39plus to a PC. The manufacturer recommends the USB to transmit large amounts of data because it is faster than the RS232 connection. Make sure that there is sufficient battery power available to transmit data.

1. Connect the PC to the internal USB connector:
   a. Make sure the pressure housing is clean and dry.
   b. Use a wrench on the wrench flats of the pressure housing to unscrew the end flange of the sensor from the body.
   c. Carefully pull the end flange and attached electronics off of the body.
   d. Use a lint-free cloth or tissue to dry any water from the O-rings and mating surfaces of the end flange.
   e. Connect the USB connector to the sensor and a PC.



2. Option: connect the external RS232 connector to a PC.
3. Start the software.
4. Select *SBE 39plus USB* (or *RS232* as applicable).
   The software should automatically connect to the device. If there is more than one sensor, select the correct device, then select **Refresh**.
5. If the sensor is in operation in autonomous mode, stop data collection: push any key or enter **Stop**, then the **Enter** key. It may be necessary to do this several times.
6. Verify that the sensor is not in operation (no data collection).
7. Select **Upload**.
   The *Save As* box opens. Go to the folder that was set up to save the data. The software pre-fills a file name with the format "SBE39plusSerialNumber_Date.xml," where the serial number is the last five digits of the sensor serial number and date is the upload date. You can change this.
8. Select **Save**.
   The **Upload Data** window opens.

9. Select the options to upload data:
   a. In the "Upload format" area, select "Text" (ASCII) or "Binary." Binary uploads approximately twice as fast, but ASCII is more stable.
   b. Select "All data" or "By sample number range."
   c. Enter any additional information you want to include in the file header. This might include the name of the PI, latitude-longitude, start and end dates of the deployment.
10. Prepare the sensor to be deployed again:
    a. Select **Clear memory**.
    b. Select only one of the options below to configure the sensor response when the USB is removed:
       - *Do not start*—the sensor will go to a low power mode (60 µA).
       - *Start*—the sensor will start data collection in autonomous mode when the USB is disconnected.
       - *Start at...*—the sensor will start data collection at a date and time specified by the user.
    c. Make any other changes to the configuration.
    d. Select **Update Configuration**.
11. Disconnect the internal USB or RS232 connector from the sensor and PC.
12. Install new desiccant in the sensor. Refer to Replace batteries and desiccant on page 23 for details.
13. Make sure that the O-rings are pristine and replace them if there is any question. Apply a light coat of silicone-based Parker Super O-Lube to the O-rings, then install.
14. Carefully push the end flange and attached electronics into the pressure housing body until the first O-ring is seated.
15. Use a wrench to screw the end flange into the housing.

⚠WARNING

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

8.1 Replace batteries and desiccant

⚠WARNING

Explosion hazard. If the batteries are not installed correctly, explosive gases can be released. Make sure that the batteries are of the same approved chemical type and are inserted in the correct orientation.

⚠WARNING

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

⚠WARNING

If the user thinks that the lithium batteries have leaks, pressure may have built up inside of the pressure housing. Follow ESD protocols to release internal pressure. Put on safety glasses and protective gloves and make sure that the sensor is pointed away from the body and other people. In a well ventilated area, very SLOWLY loosen the bulkhead connector to release the pressure. Keep away from heat, sparks, flame, and other sources of ignition. Do not smoke.

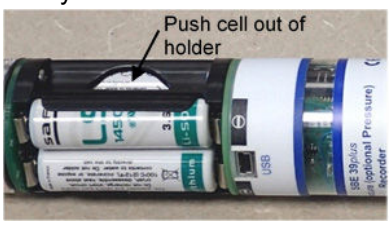
⚠CAUTION

The pressure housing contains Electrostatic Discharge (ESD) sensitive parts and assemblies that are susceptible to damage from ESD. Follow ESD protocols:

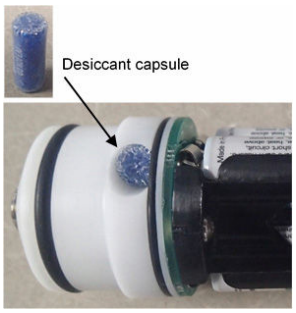
- Put on protective eye wear before you open the pressure housing.
- Any electrostatic charge on the body of the human operator must be released before the pressure housing is opened: put a hand on a grounded surface, or better, wear a grounded antistatic wrist strap.
- At a minimum, wear short-sleeved antistatic clothing, such as cotton, or better, wear an antistatic smock for this service activity. *Do not wear a sweater, fleece or polyester-based clothing.*
- At a minimum, use a workstation with a wood or metal tabletop, or better, a tabletop that dissipates static. *Do not use a workstation with a synthetic or polymeric-based tabletop.*

The manufacturer ships the 39plus and 39plus-IM with four Saft LS 14500 lithium batteries installed. Even if it is stored for long periods of time, keep the batteries installed (the current draw is 60 µA) to keep the internal clock accurate. Replace the desiccant capsule each time the batteries are replaced.
If possible, fill the pressure housing that contains the electronics with dry Argon gas after the batteries and desiccant are replaced to prevent condensation. If that is not possible, wait for 24 hours after the desiccant is replaced before the sensor is deployed, so the desiccant can remove any internal moisture.

1. Make sure the outside of the sensor is dry.
2. Use a wrench on the wrench flats of the end flange to unscrew the end flange.
3. Carefully pull the end flange and the attached electronics out of the pressure housing.
4. Use a lint-free cloth or tissue to remove any water from the O-rings and surfaces inside the housing.
5. Push each battery cell out of the holder.



6. Insert new AA size lithium batteries. The manufacturer recommends Saft LS 14500 batteries.
7. Remove and replace the desiccant.



8. Attach the end flange again:
   a. Make sure that there is no water on surfaces or O-rings.
   b. Inspect the O-rings.
      The O-rings must be pristine. If there is any question about whether an O-ring is clean and undamaged, replace it with a new one.
   c. To replace the O-rings if necessary: apply a light coat of silicone-based Parker Super O Lube to each replaced O-ring and then install.
   d. Carefully push the end flange into the housing until the first O-ring is seated.
   e. Use a wrench to tighten the end flange into the pressure housing.

8.2 Clean pressure sensor

NOTICE

Do not put a brush or any object in the pressure port. It may damage or break the pressure sensor.

If the SBE 39plus is equipped with the optional pressure sensor, make sure to examine and clean it at regular intervals (approximately annually).
The pressure port plug has a small vent hole that transmits hydrostatic pressure to the pressure sensor inside the SBE 39plus. The plug keeps most particles and debris out of the pressure port.

1. Unscrew the pressure port plug from the pressure port (shown below with an external thermistor).

2. Flush the pressure port with warm de-ionized water to remove any debris.
3. Replace the pressure port plug.
4. Let the 39plus equilibrate at a stable temperature for at least 5 hours before operation.
   This will let you get the most accurate calibration correction.

8.2.1 Calculate pressure correction

Calculate the pressure sensor offset to store in the 39plus. Note that the raw output of the pressure sensor is shown on the Calibration Sheet in psia. The 39plus uses the equation Pressure, dbar = (psia - 14.7) × 0.689476.

to convert psia to dbar.

1. Put the 39plus in the orientation in which it will be deployed.
2. Use the software to enter **POffset=0** to set the pressure offset to 0.0.
3. Enter **OutputFormat=1** to set the output to converted decimal., and
4. Enter **SetPressUnits=0** to set the pressure output to decibars.
5. Enter **TP** to take 100 samples and transmit the data.
6. Compare the output of the 39plus to the value indicated by a quality barometer at the same elevation. Calculation:
   Barometer indication - 39plus output = offset
7. Store the calculated offset value in the sensor: enter **POffset=** .

8.3 Examine O-rings

NOTICE

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

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

1. Dry the O-rings and O-ring grooves with a lint-free cloth or tissue.
2. Examine each O-ring to make sure there is no damage, dirt, lint or hair on it.

3. Replace an O-ring if necessary.
4. Apply a small quantity of silicone-based Parker Super O Lube® or Dow Corning® high vacuum grease to each O-ring.
   - The lubricant helps the O-ring move into its groove with no twist, which can compromise the seal.
   - Do NOT use petroleum-based lubricants on any O-ring.

8.4 Clean bulkhead connectors

NOTICE

Do not use WD-40® or petroleum-based lubricant on bulkhead connectors. It will cause damage to the rubber.
Damaged connectors can cause a loss of data and additional costs for service.
Damaged connectors can cause damage to the sensor and make it unserviceable.
Use silicone-based lubricants only.

Examine, clean, and lubricate bulkhead connectors at regular intervals. Connectors that are not lubricated increase the damage to the rubber that seals the connector contacts. The incorrect lubricant will cause the failure of the bulkhead connector.

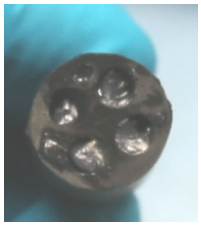
1. Apply isopropyl alcohol (IPA) as a spray or with a nylon brush or lint-free swab or wipes to clean the contacts.
2. Flush with additional IPA.
3. Shake the socket ends and wipe the pins of the connectors to remove the IPA.
4. Blow air into the sockets and on the pins to make sure they are dry.
5. Use a flashlight and a magnifying glass to look for:

Any corrosion.		
Cracks, scratches, or other damage on the rubber pins or in the sockets.		
Separation of the rubber from the pins.		
Swelled or bulging rubber pins.		

6. Use a silicone-based lubricant on each of the contacts of the bulkhead connector. The manufacturer recommends any of the products listed below.
   - 3M™ Spray Silicone Lubricant (3M ID# 62-4678-4930-3). Make sure to let it dry.
   - Dow Corning Molykote® III Compound (DC III)
   - Dow Corning High Vacuum Grease® (DC 976 V)

- Dow Corning 4 Electrical Insulating Compound® (DC 4)
- Dow Corning Molykote 44 High Temperature Grease® (DC 44)

Use a finger to put a small quantity (approximately 1 cm in diameter) of silicone grease on the socket end of the connector and push as much of the lubricant as possible into each socket. Do not use too much lubricant, as that will prevent a good seal.



7. Connect the connectors.
8. Use a lint-free wipe to clean any unwanted lubricant from the sides of the connectors.

8.5 Spare parts and accessories

Part number	Description	Quantity
50504	Saft 3.6 V size AA Lithium batteries	4
172557	USB type A to Mini-B cable, 1.8 m	1
801836	39plus internal data I/O cable, 0.3 m	1
801263	Data/power interface cable, MCIL4FS to DB9S and battery snap , 2.4 m	1
801206	Data/power interface cable, MCIL4FS to DB9S with red-black twisted wire leads	1
20200.0	USB to serial port adapter, FTDE UC232R-10	1
60058	Desiccant capsules (39plus with external connector)	5
60039	Desiccant pack, 1 gram (39plus with no external connector)	25
60069	Spares kit, 39plus with external connector	1
60070	Spares kit, 39plus with no external connector	1
171398.1	Dummy plug and lock sleeve, MCIL4FS	1
231847	Pressure port plug	1
50377	6 mm (¼ in) cable clamp kit	1
50378	8 mm (5/16 in) cable clamp kit	1
50379	10 mm (3/8 in) cable clamp kit	1
50380	12 mm (½ in) cable clamp kit	1
50381.1	16 mm (5/8 in) cable clamp kit	1

8.6 Calibration

The manufacturer calibrates every sensor to known conditions and measures the response of the sensor. Calibration coefficients are calculated and are used to get engineering units.

8.6.1 Temperature

As the thermistor element ages during the first year, the calibration of temperature sensor changes by a few thousandths of a degree. Change is less in subsequent years. Environmental conditions do not have much effect on the calibration.

8.6.2 Pressure

The strain-gauge pressure sensor has an initial static error band of 0.05%. Pressure sensors show most of their error as a linear offset from zero. Note that the pressure sensor is an "absolute" sensor, so the raw data includes the effect of atmospheric pressure of 14.7 psi. Engineering units, however, are relative to the ocean surface. The sensor uses the equations below to convert psia:

P (db) = P (psi) = P (psia) - 14.7

P (dbar) = [P (psia) - 14.7] × 0.689476

The manufacturer recommends that the user use the offset calibration coefficient to make small corrections to the pressure sensor calibration. Compare the pressure values to a barometer.

1. Let the sensor equilibrate in a constant temperature bath for at least 5 hours in the orientation in which it will be deployed.
2. Start the software.
3. Set the pressure offset to 0.0 (POffset=0).
4. Set the output format to converted decimal (OutputFormat=1).
5. Set the pressure output to yes (OutputPress=y), and pressure units to decibars (SetPressUnits=0).
6. Take 100 samples and transmit data (TSN:100).
7. Compare the sensor output to what a barometer at the same elevation as the pressure sensor port shows.
   - Calculate the offset: the barometer value - pressure sensor value.
8. Set the calculated offset (POffset=).

Section 9 Reference: command descriptions

This is a reference for advanced users. The values of these commands are stored in the sensor until the user changes them. Notes about terminal commands are listed below.

- Commands are not case-sensitive. Use "Enter" to store a command.
- The sensor sends `<ERROR type='INVALID COMMAND' msg='Cmd not recognized'/>`if a command is sent while the sensor is in operation.
- The argument Y and 1 are both "Yes" and N and 0 are both "No." For example, TxSampleNum=y and TxSampleNum=1 are equivalent.
- The sensor will go into a low power mode if there is no command sent for 2 minutes. Select *Connect* to start communication again.
- During autonomous operation, the sensor will only respond to commands that do not change the setup or interrupt data collection.
- If the user sent StartNow (autonomous mode) and the sensor is in operation or in standby, the user can use the Status commands GetCD, GetSD, GetCC, GetEC, GetHD, DS, DC, DNx, TS, TSR, SL, QS, Stop, and Help. For any other command, the sensor sends `<Error type-'NOT ALLOWED' msg='Inactive command'/>`. If, for example, DS is sent, the 39plus will stop data collection temporarily. Data collection starts again at the next scheduled time.
  Example: the 39plus collects data at 30 second intervals--

  sample 1 at 30 sec.

  sample 2 at 60 sec.

  sample 3 at 90 sec.

  DS command sent at 119 sec.

  sample 4 at 150 sec.
- If the user sent StartLater (autonomous mode) and the sensor is in standby, the user can use the Status commands GetCD, GetSD, GetCC, GetEC, GetHD, DS, DC, DNx, TS, TSR, SL, QS, Stop, and Help. For any other command, the sensor sends `<Error type-'NOT ALLOWED' msg='Inactive command'/>`.To send other commands, enter the Stop command, then enter any other commands, and send StartLater again.

9.1 Status

GetCD	Show configuration data

Example, user entries in **boldface:**

GETCD

`<ConfigurationData DeviceType='SBE39plus' SerialNumber='03909999'>`

`<PressureInstalled>yes</PressureInstalled>` (installed by manufacturer)

OutputFormat=	`<SampleDataFormat>converted engineering</SampleDataFormat>`
OutputTemp=	`<OutputTemperature>yes</OutputTemperature>`
SetTempUnits=	`<TemperatureUnits>Celsius</TemperatureUnits>`
OutputPress=	`<OutputPressure>yes</OutputPressure>`
SetPressUnits=	`<PressureUnits>Decibar</PressureUnits>`

TxSampleNum=	<TxSampleNumber>yes</TxSampleNumber>
TxRealTime=	<TxRealTime>yes</TxRealTime>
SampleInterval=	<SampleInterval>0.5</SampleInterval>
SyncMode=	<SyncMode>no</SyncMode>
	</ConfigurationData>

GetSD	Show status data
	Sensor model, S/N
	DateTime= format of date and time yyyy-mm-ddThh:mm:ss
	Event counter, reset with ResetEC
	Voltages, main and back-up lithium
	Memory: number of bytes in memory, number of samples in memory, number of additional samples that can be saved in memory. Reset with InitLogging
	Data collection status, Y or N (if applicable, the reason data collection stopped)

GetCC	Show calibration coefficients. Same as the Calibration Certificates from the manufacturer.

GetEC	Show event counter. Some events include:
	PowerOnReset: power turned on each time the batteries are removed and replaced.
	OutOfMemory: memory is full. Transmit all data to a PC.
	LowBatteryVoltage: low battery voltage detected during data collection.
	WatchdogReset occurs if microcontroller does not respond. Resets the 39plus and operation continues.
	LoggingRestartPON: power turns off, then on during data collection. Data collection starts again.
	LoggingRestartNoAlarm: no sample taken for 8 hours. Data collection started again.
	SyncModeRestartPON: power turns off, then on again when in serial line sync mode.
	HardReset: processor is reset and instrument reboots.
	BufWrOflow: write buffer overflow. Contact manufacturer.
	BufRdOflow:read buffer overflow. May cause errors in transmitted data.
	ThermistorError: thermistor wiring may be damaged. Contact manufacturer.

ResetEC	Erase all events in the event counter.

GetHD	Show hardware data
	Sensor model, S/N
	Manufacturer
	Firmware version
	Firmware data
	Command set version
	PCB S/N and assembly numbers

	Manufacture date
	Sensor types and S/Ns

DS	Show operation status and setup parameters
	Firmware version, S/N, date and time. DateTime=
	Voltages, main and back-up cell voltage
	SampleNum= number of samples saved and available space in memory
	SampleInterval= time between samples for autonomous operation
	OutputFormat= format of data
	OutputSal= salinity output; shows if set to yes
	OutputSV= sound velocity
	SyncMode= serial line sync mode status
	TxRealTime= real-time output status
	OutputFormat= format of data
	OutputTemperature= shows if set to yes
	OutputPress= shows if the sensor has a pressure sensor
	SetPressUnits= shows if the sensor has a pressure sensor
	TxSampleNum= transmits the sample number with real-time or serial line sync data
	BaudRate= shows if the sensor uses USB to communicate
	SetTempUnits= current temperature, always in deg C

Note:

- The DS command is equivalent to the responses from GetSD and GetCD, with a different format.

DC	Calibration coefficients in a different format from GetCC

9.2 General setup

DateTime=x	Set real-time clock. Format is mmddyyyyhhmmss.
BaudRate=x	For RS232 communication. Available baud rates are 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. Default is 9600. A high baud rate requires a short cable and good PC serial port and accurate clock. **Send the command two times to change the rate.**
OutputExecutedTag=x	x=Y: show XML tags during and after execution. x=N: do not show XML tags. Tags show one or more times during execution if the response to the command requires additional time.
TxRealTime=x	x=Y: show real-time data for autonomous or serial line sync data collection (default) x=N: do not
QS	Quit session and put the sensor into a low-power state. The main power is turned off. Autonomous data collection and memory are not affected. Cannot be sent with USB.

9.3 Memory setup

Initlogging	Resets the memory pointer to sample number 0. Makes all memory available for storage. **Do not send this command until all data has been transmitted**. Send command two times to confirm.
SampleNumber=x	Sample number for last sample in memory. SampleNumber=0 is the same as InitLogging. Send command two times. **Do not send SampleNumber=0 or InitLogging until all stored data is transmitted.**

9.4 Output format setup

OutputFormat=x	x=0: raw decimal data x=1: converted decimal data (default) x=2: converted decimal data in .xml format
OutputTemp=x	x=Y: show temperature. x=N: do not
SetTempUnits=x	x=0: °C. x=1: °F.
OutputPress=x	x=Y: show pressure. x=N: do not
SetPressUnits=x	x=0: decibars. x=1: psi (gauge)
TxSampleNum=x	x=Y: if OutputFormat=1. Show the number of samples stored in memory at the time the sample was taken. x=N: do not
SetCoastal	x=0: set units to °C and dbar, enable temperature and pressure output, disable sample number output. x=1: set 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, pressure. Disable sample number.

9.4.1 Diagnostic data format

OutputFormat=0 is data in decimal format used by the manufacturer for diagnostics.

ii,ttttt, ppppppp, vvvvv, dd mmm yyyy, hh:mm:ss
39 Plus-IM ID (0–99), temperature (A/D counts), pressure (A/D counts), pressure sensor pressure temperature compensation A/D counts, date, time
Example output in response to !iiData with #iiOutputFormat=0, #iiFormat=0, ID=03, with pressure sensor
`03,1722523, 93818, 23833, 20 Jun 2018, 10:16:44`
ID,temperature counts, pressure sensor counts, pressure sensor temperature compensation counts, date, time

Notes:

Time = time at the start of the sample.

The Sample Number is never transmitted if #iiOutputFormat=0. It over-rides the setting for #iiTxSampleNum=.

The pressure sensor is an absolute sensor. The raw output, #iiOutputFormat=0, includes the effect of atmospheric pressure (14.7 psi). When the output is in engineering units, pressure data is relative to the ocean surface, at 0 decibars. The sensor uses the equation:

pressure, dbar = (pressure, psia - 14.7) × 0.689476

9.4.2 XML data format

Data in XML format where OutputFormat=2. There are no <CR> or <LF> between tags.

OutputFormat=2, OutputTemp=Y, SetTempUnits=0, TxSampleNum=Y
ssssss, tttt.tttt, ppppp.ppp, n, yyyy-mm-ddThh:mm:ss
temperature, pressure, sample number, date, time
Example output:
<?xml version="1.0"?>,datapacket><hdr><mfg>Sea-Bird</mfg><model>SBE 39plus</model><sn>03720132</sn></hdr><data><t1>23.1258</t1><p1>0.0516</p1><smpl>78</smpl><dt>2018-06-13T15:00:36</dt></data></datapacket> CRLF

9.5 Autonomous operation with data storage

SampleInterval=x	x=interval between samples, 0.5, and 1–21600 secs. when used with StartNow or StartLater, the sensor takes a sample, stores data, transmits the data in real-time (if TxRealTime=Y) and turns off every x seconds.
StartNow	Start data collection at a rate defined by SampleInterval=. The sensor takes a sample, stores data, transmits the data in real-time (if TxRealTime=Y). If the command is sent while the USB is connected, the sensor will start data collection after the USB is disconnected.
StartDateTime=	Start data collection at mmddyyyyhhmmss
StartLater	Start data collection at a set time in the future, at a rate of SampleInterval=. Data is transmitted in real-time if TxRealTime=Y. To change the setup after StartLater has been sent, but before data collection starts, send Stop. Change the setup, then send StartLater again. If the command is sent while the USB is connected, the sensor will start data collection after the USB is disconnected and the StartDateTime= setting is reached.
DNx	Upload the last x samples, 1–250, from memory to get data from the sensor while it is deployed. This can occur while the sensor is in autonomous operation.
Stop	Stop data collection that was started with StartNow or StartLater or stop countdown for StartLater if data collection has not started. Push the Enter key, then Stop. Send Stop before data is transmitted.

9.6 Controlled ("polled") data collection

TS	Collect a sample and transmit data.
TSR	Collect a sample and transmit raw data.
TSS	Collect a sample, store data in flash memory, transmit data and turn power off. If the USB is connected, the power will not turn off.
TSSOn	Collect a sample, store data in flash memory, transmit data.
TSN:x	Collect *x* samples, 1–1000, and transmit data. To stop, press the Esc key.
SL	Transmit data from the last sample stored in the buffer. SL can be sent while data collection occurs.
SLT	Transmit data from the last sample stored in the buffer, and then take a new sample.

- Unless stated otherwise, the sensor does not store data in the flash memory.
- If the sensor operates autonomously (#iiStartNow or #iiStartLater has been sent), the only command it accepts is #iiSL.
- Unless noted otherwise, data shows in the format set my #iiOutputFormat.

9.7 Serial line sync data collection

SyncMode=x	x=Y: Enable serial line sync mode. When a single pulse, or character, is transmitted, the 39plus collects a sample, stores it in flash memory and goes into a low power mode. Data is transmitted in real-time if TxRealTime=Y. For RS232, the 39plus goes into sync mode after two minutes or a QS command puts it into low power mode. For USB, the 39plus goes into sync mode after the cable is removed. The 39plus leaves sync mode when the USB is connected. x=N: Disable serial line sync (default).

9.8 Test commands

Data is not stored in the flash memory with these commands.

TT	Measure temperature for 100 samples or until the **Esc** key is pushed. The output is converted data.
TP	Measure pressure for 100 samples or until the **Esc** key is pushed. The output is converted data.
TTR	Measure temperature for 100 samples or until the **Esc** key is pushed. The output is raw data.
TPR	Measure pressure for 100 samples or until the **Esc** key is pushed. The output is raw data.

9.9 Coefficients

F = floating point number. S = String with no spaces. Show 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

9.10 Transmit data

Send **Stop** or push **Esc** 3 times before the upload command. Use either USB or RS232. The USB lets you upload data in ASCII or binary. Binary is approximately twice as fast as ASCII, though ASCII is more stable.

GetSamples:b,e	Transmit ("upload") sample b to sample e, in format specified by OutputFormat= . First sample number is 1. Maximum is 250. The screen will show—
	`start time =`
	`start sample number =`

Section 10 General information

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

10.1 Warranty

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

10.2 Service and support

The manufacturer recommends that sensors be sent back to the manufacturer annually to be cleaned, calibrated, and for standard maintenance.
Refer to the website for FAQs and technical notes, or contact the manufacturer for support at support@seabird.com. Do the steps below to send a sensor back to the manufacturer.

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

10.3 China RoHS disclosure table

Name of Part	Hazardous substance or element in product					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
PCBs	X	O	O	O	O	O
This table is compiled to the SJ/T 11364 standard.						
O: This hazardous substance is below the specified limits as described in GB/T 26572. X: This hazardous substance is above the specified limits as described in GB/T 26572.						

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