

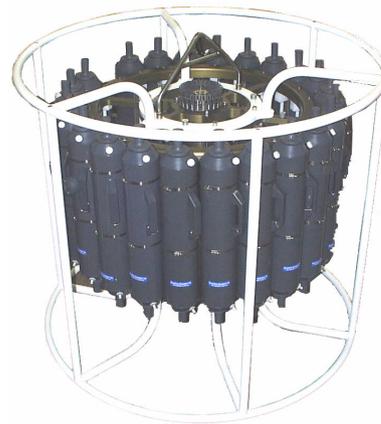


SEA-BIRD
SCIENTIFIC

User manual

SBE 32 Carousel water sampler

32 and 32C



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Section 1 Safety information

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

1.1 Hazard information

⚠ WARNING

Dangerous voltages over 75 volts are present inside the instrument even after external power is removed. Only qualified personnel may do the servicing.

⚠ WARNING

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

NOTICE

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

1.2 Equipment labels

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



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

Safety information



EFUP: 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 Specifications

Power requirement	12–15 VDC
Current draw:	
while capacitor charges	205 mA for approximately 35 seconds when power is supplied. 2 seconds to charge again after each bottle fires.
capacitor not charged	110 mA
Rated depth	6800 m (standard), 7000 or 10500 (optional)
Materials:	
frame	painted aluminum
latch assembly	titanium, acetal plastic, other corrosion-resistant materials
housing	aluminum (standard), titanium (optional)

2.1 Dimensions and weights

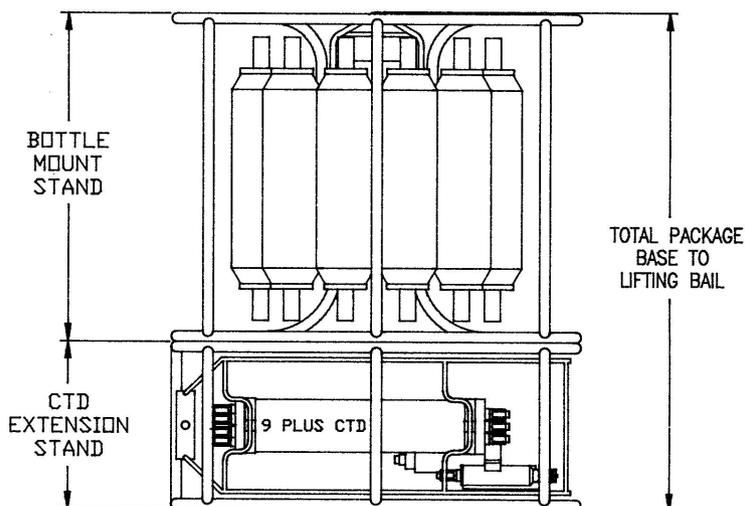
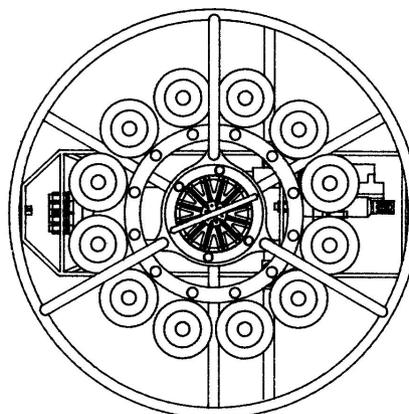
Carousel	Bottle mount stand		CTD extension stand		Total system	
	Height, cm	Diameter, cm	Height, cm	Diameter, cm	Height, cm	Weight, kg
Full size						
12 bottle, 1.7 L	78.8	99.1	40.6	99.1	120.1	68
12 bottle, 2.5 L	102.4				143.8	79
12 bottle, 5 L	82				123.4	78
12 bottle, 8 L	102.4				143.8	79
12 bottle, 10 L	118.9				160.3	82
12 bottle, 12 L	131.6				173	83
24 bottle, 1.7 L	80	114.3		114.3	121.4	85
24 bottle, 2.5 L	100.3				141.7	106
24 bottle, 5 L	86.9	155	42.7	154.9	130	179
24 bottle, 8 L	107.2				150.6	185
24 bottle, 10 L	122.4				165.9	194
24 bottle, 12 L	135.1				178.6	199
36 bottle, 12 L	165.4	213.4	—		166.1	339
Compact (SBE 32C)						
12 bottle, 1.7–8 L	96.5	96.6	—		97.3	68

Specifications

Notes:

Total system height = bottle mount stand + CTD extension stand + height of lifting bail above bottle mount stand (approximately 0.8 cm).

Total weight does not include bottles or CTD.



2.2 Connectors

2.2.1 Standard modem interface

Table 1 9plus, 17plus or AFM connector

Contact	Function	MCBH6MP
1	Return	
2	RS232 RX	
3	RS232 TX	
4	No connect	
5	No connect	
6	Voltage in	

- SBE 9plus: used with SBE 11plus Deck Unit
- SBE 17plus: used with SBE 9plus CTD
- Auto Fire Module (AFM): used with SBE 19, 19plus, SBE 25, SBE 50, or no CTD

2.2.2 Standard modem interface and optional serial interface

Table 2 JB3 to SBE 19, 19plus, or 25, with SBE 33 Deck Unit

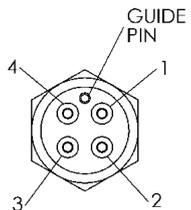
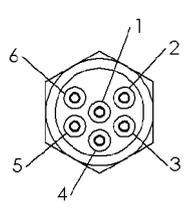
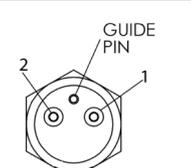
Contact	Function	MCBH4MP
1	Return	 <p>The diagram shows a circular connector with four contacts labeled 1, 2, 3, and 4. A central pin is labeled 'GUIDE PIN'.</p>
2	RS232 TX to CTD	
3	RS232 RX from CTD	
4	Voltage out	

Table 3 JB2 to SBE 9plus, 17plus or AFM

Contact	Function	MCBH6MP
1	Return	 <p>The diagram shows a circular connector with six contacts labeled 1 through 6. A central pin is labeled 'GUIDE PIN'.</p>
2	RS232 RX in	
3	RS232 TX out	
4	No connect	
5	No connect	
6	Voltage in	

- SBE 9plus: when used with SBE 11plus Deck Unit
- SBE 17plus: when used with SBE 9plus
- AFM: when used with SBE 19, 19plus, SBE 25, or SBE 50 pressure sensor

Table 4 Sea cable

Contact	Function	MCBH2MP
1	-	 <p>The diagram shows a circular connector with two contacts labeled 1 and 2. A central pin is labeled 'GUIDE PIN'.</p>
2	+	

Section 3 System configurations

The SBE 32 Carousel Water Sampler is available in two sizes.

- **Full-size carousel (SBE 32):** Use with the SBE 9plus, the 19 or 19plus, 25, or Neil Brown Mk III CTD. The full size carousel holds 12, 24, or 36 bottles, from 1.7 to 12 liters.
- **Compact carousel (SBE 32C):** Use with the SBE 9plus, the 19 or 19plus, or 25 CTDs. The compact carousel holds 12 bottles, from 1.7 to 8 liters.

The SBE 32C is shipped fully assembled. Use this manual to assemble the full-size carousel.

What's in the shipment:

- Guard frame assembly, with upper and lower guard rings, side bars, and CTD extension stand (if a SBE 9plus is part of the system)
- Upper and lower adapter plates
- Hub and pylon, with electronics and latch assembly
- Lifting bail
- Associated hardware and spare parts kit
- Cables
- CD or USB drive with software and documentation.

Each bottle on the carousel has a lanyard release latch that is controlled by a magnetic trigger. The lanyard release latch can be set with the touch of a finger before the lanyards are attached, so that setup is fast and safe. When the microprocessor in the carousel pylon receives a command to fire a bottle, the magnetic trigger for the bottle operates. Bottles can be fired in any order.

The carousel and other SBE products use the Seasoft software, which has the components listed below.

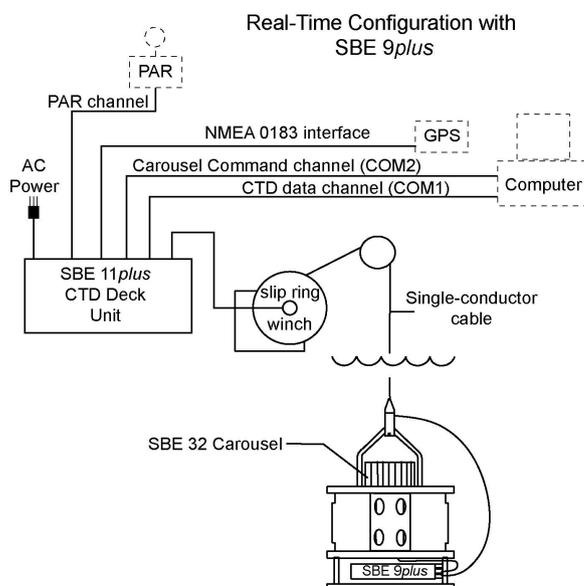
- Seaterm—terminal program to communicate with system and transmit data.
- SeatermAF—terminal program to communicate with system that includes an AFM or 17plus Searam.
- Seasave—software used to collect, convert, and show data, either in real-time or stored.
- SBE Data Processing—software used to calculate and make plots of conductivity, temperature, pressure, and auxiliary sensor data, and derived variables such as salinity and sound velocity.

3.1 Real-time data collection and control

Two COM ports are required on the connected PC. COM1 is the CTD data channel and COM2 is the carousel command channel. Any two ports can be used to set up the COM port with the Seasave software.

The carousel is connected to an SBE 9plus CTD and controlled with the SBE 911plus modem channel. Bottles can be closed with the push-buttons on the 11plus, or with the RS232C modem connector on the back of the 11plus during data collection.

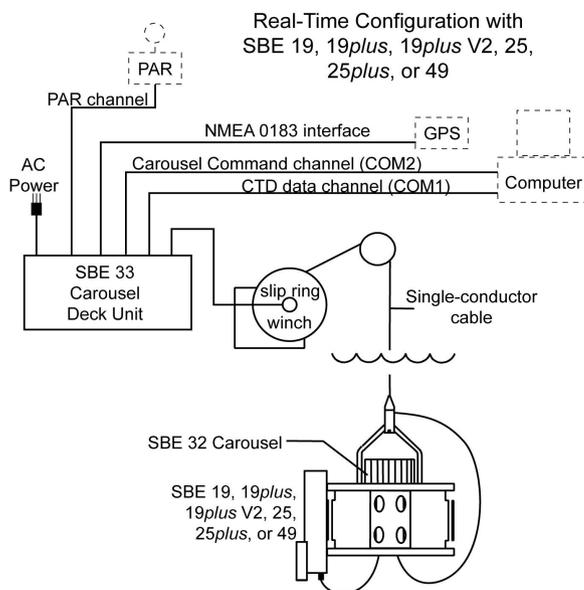
The 11plus has a standard NMEA interface and an interface for a Surface PAR sensor.



An SBE 33 Deck Unit can also be used to supply power to and control the carousel, with or without a CTD. Data can be transmitted in real-time. When used without a CTD, bottles are closed with the SBE 33 front panel controls. The depth of the carousel must be calculated by the length of cable used.

The SBE 32 and 33 have optional NMEA and Surface PAR interfaces.

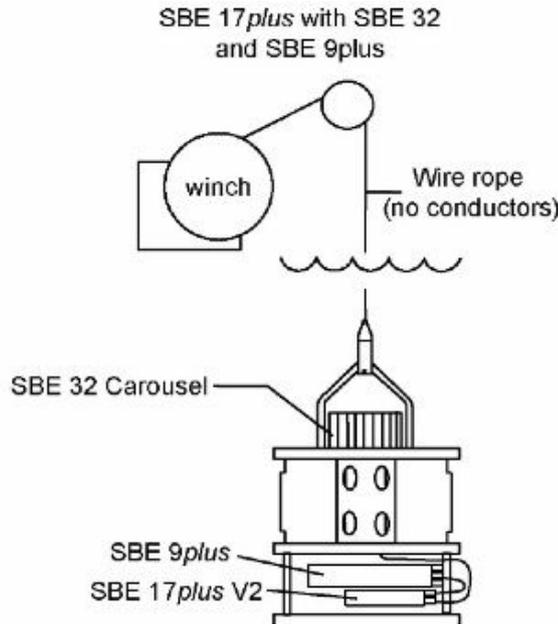
An optional interface is available for a standard Neil Brown Mk III CTD. The carousel supplies the necessary voltage to the Mk III and extra power for fluorometers and other sensors that are not easily supported by the Mk III. NMEA and Surface PAR are not available for this setup.



3.2 Autonomous data collection and control

The carousel operates autonomously on non-conducting cables when connected to a SBE 17plus V2 Searam and a 9plus CTD. The Searam uses pressure data from the SBE 9plus and a programmable table of bottle closure pressures to command the bottles on the carousel to close on upcast. Built-in logic and user-entered parameters control when the upcast starts. This prevents accidental bottle closure caused by temporary upward movements during the downcast.

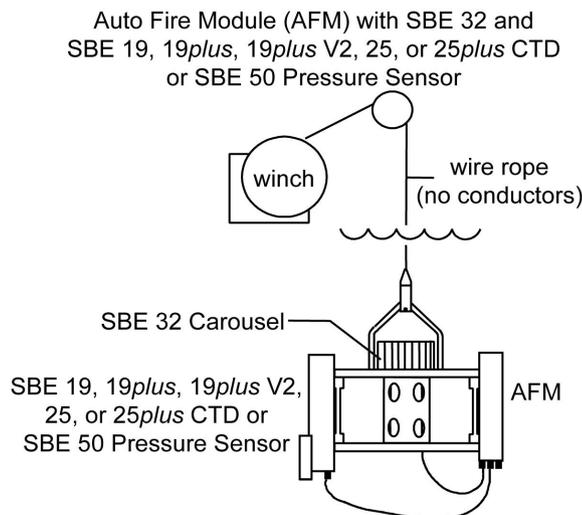
Power is supplied to the SBE 9plus and the carousel by the Searam batteries. Data from the SBE 9plus is stored in the Searam memory.



The carousel can use the Auto Fire Module (AFM) to operate autonomously on a non-conducting cable with or without a CTD.

- If used without a CTD, the AFM fires bottles at pre-set intervals. The depth at which samples are taken is calculated by elapsed time and the approximate length of cable used.
- If used with an SBE 19, 19plus, 25, or SBE 50 pressure sensor, the AFM monitors the pressure data recorded by the CTD in real-time, and fires bottles at pre-set pressures on upcast or downcast, or when the system is stationary for a specified time.

Power is supplied to the carousel by the AFM batteries. The bottle number the fire confirmation, and five samples of CTD data are stored in the AFM memory for each bottle fired.



Section 4 Assemble carousel

The steps in this section are to assemble the 12- and 24-bottle full-size carousels. There are also steps to attach CTDs.

4.1 Assemble 12-bottle carousel frame

The manufacturer supplies Never-Seez[®] Blue Moly and recommends that the user put a small quantity on all screws so they do not seize.

1. Put the lower guard ring on a flat surface on two boards.
The boards lift the assembly to make it easier to install the guard side bars.

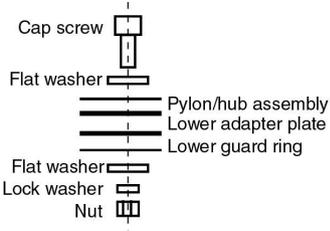


2. Align the holes and set the lower adapter plate on the flange of the lower guard ring. The lower adapter plate has bottle locator pins on its top surface.
3. Remove (temporarily) the lifting bail from the pylon-hub assembly and note the configuration of the hardware. The pylon-hub assembly has six socket head cap screws, lock washers, and flat washers that keep the pylon in the hub.

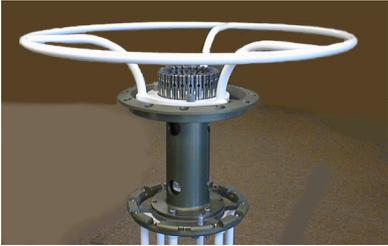
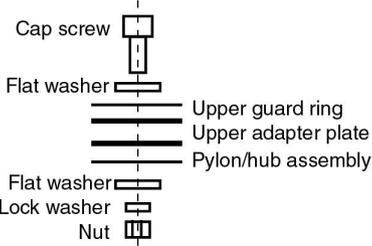


4. Align the screw holes and set the pylon-hub assembly on the lower adapter plate.
5. Attach the pylon-hub assembly and lower adapter plate to the lower guard ring through the four 1/2 inch holes.

Assemble carousel

		
Hub on adapter plate	Hardware configuration	Hub assembly on frame

6. Align the screw holes of the upper adapter plate with the pylon-hub assembly.
7. Align the screw holes on the upper guard ring with the upper adapter plate and attach to the pylon-hub assembly.

	
<p>upper guard ring (white) upper adapter plate pylon-hub assembly</p>	<p>4 1/2-13 x 3 1/2-inch socket head cap screws 4 1/2-inch flat washers upper guard ring upper adapter plate pylon-hub assembly 4 1/2-inch flat washers 4 1/2-inch split lock washers 4 1/2-13 hex nuts.</p>

8. Put the six guard side bars between the upper and lower guard rings. There are two types of side bars. The bar on the left is used for positions with no riser bar. The bar on the right is used for positions with riser bars.



9. Connect the side bars to the upper guard ring with 1/4-20 x 1 1/2-inch flat head socket cap screws. Do not tighten completely.
10. Connect the side bars to the lower guard ring with 1/4-20 x 1 1/2-inch flat head socket cap screws. Tighten completely.
11. Fully tighten the screws that connect the side bars and the upper guard ring.



- 12.** Install the lifting bail again.
- a. Install two longer plastic insulators in the upper guard ring-upper adapter plate-pylon assembly.
 - b. Install two shorter insulators in the pylon-lower adapter plate-lower guard ring.
 - c. Insert the legs of the lifting bail through the upper insulators.
 - d. Put a 1/2-inch nut on each leg of the lifting bail and turn to within 1 inch of the end of the threads.
 - e. Put a 1/2-inch flat washer on each leg and the insert the bail legs into the lower insulators.
 - f. Insert the bail so that the stops on the bail legs are against the upper insulators.
 - g. Install two more short insulators over the ends of the bail legs and into the bottom of the lower guard ring.
 - h. Attach the bail legs to the lower guard ring with the 1/2-inch nuts, split lock washers, and flat washers.
 - i. Tighten the nuts above the lower guard ring connection until they are against the insulators.

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- 13.** Make sure to tighten all hardware and make sure that all threads are protected with Never-Seez Blue Moly.

4.2 Assemble 24-bottle carousel frame

The manufacturer supplies Never-Seez[®] Blue Moly and recommends that the user put a small quantity on all screws so they do not seize.

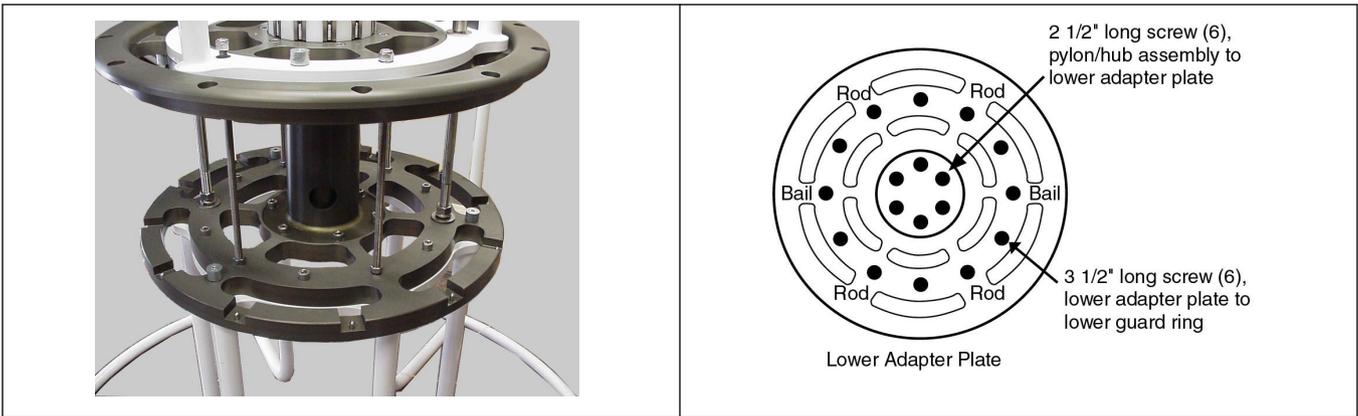
1. Put the lower guard ring on a flat surface on two boards.

Assemble carousel

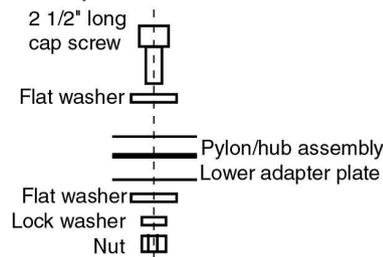
The boards lift the assembly to make it easier to install the guard side bars.



- Align the holes and set the lower adapter plate on the flange of the lower guard ring. The lower adapter plate has bottle locator pins on its top surface.

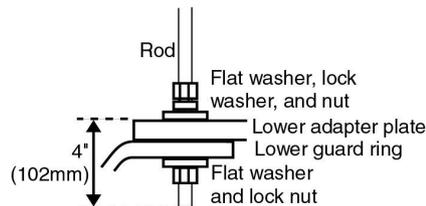


- Attach the adapter plate to the guard ring through six $\frac{1}{2}$ -inch holes with $\frac{1}{2}$ -13 \times $3\frac{1}{2}$ -inch socket head cap screws, $\frac{1}{2}$ -inch flat washers (on lower adapter plate on the lower ring guard), then $\frac{1}{2}$ -inch flat washers, $\frac{1}{2}$ -inch split lock washers, and $\frac{1}{2}$ -13 hex nuts. Do not tighten completely.
- Align the screw holes and set the pylon-hub assembly on the lower adapter plate.
- Attach the pylon-hub assembly and lower adapter plate to the lower guard ring through the six $\frac{1}{2}$ -inch holes with $\frac{1}{2}$ -13 \times $2\frac{1}{2}$ -inch socket head cap screws, $\frac{1}{2}$ -inch flat washers (on pylon assembly on the lower adapter plate), then $\frac{1}{2}$ -inch flat washers, $\frac{1}{2}$ -inch split lock washers, and $\frac{1}{2}$ -13 hex nuts. Do not tighten completely.

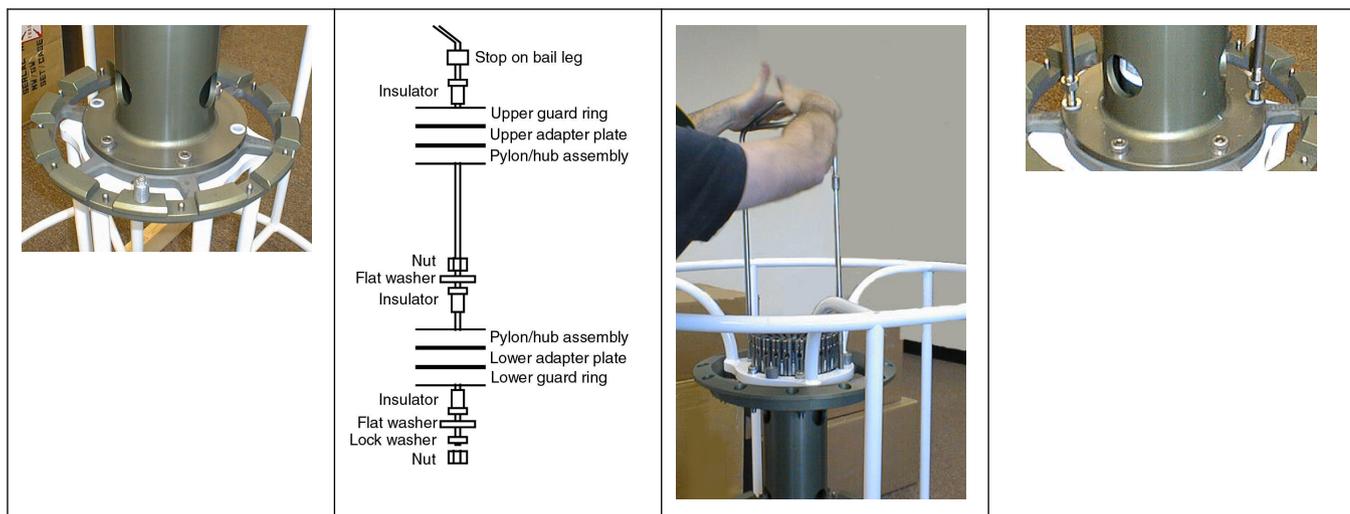


- Install the four rods. The hardware is attached to each rod so that the user can see the configuration.

- Remove the lock nut and the flat washer from the bottom of the rod.



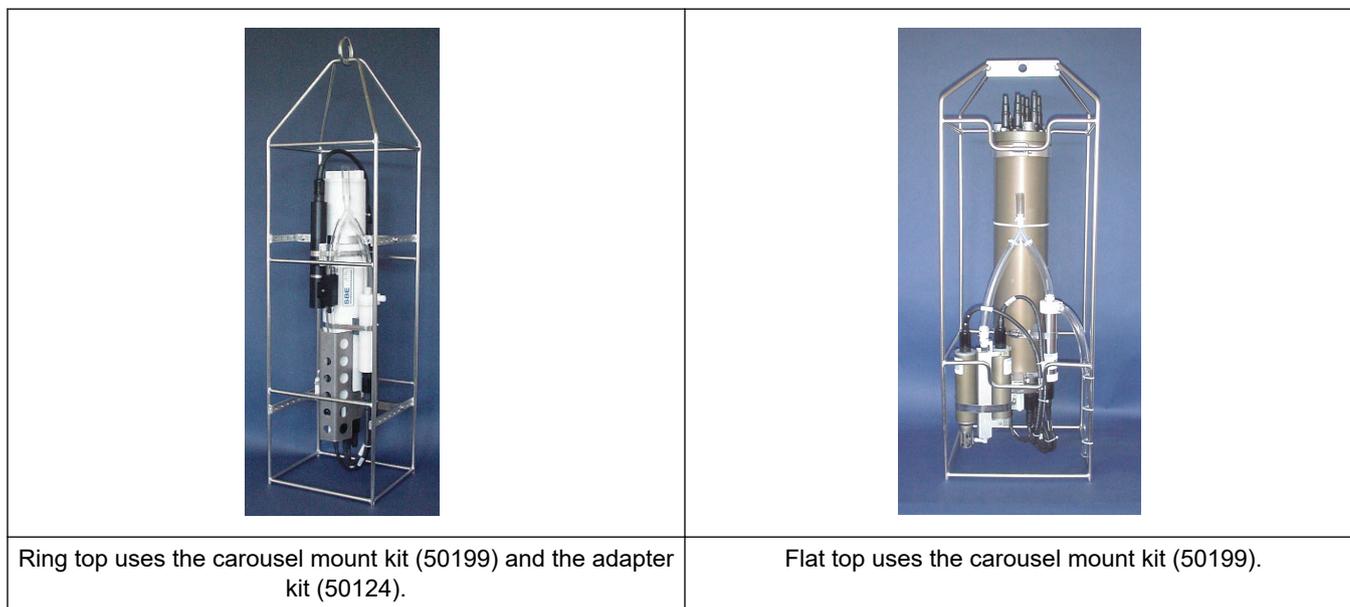
Assemble carousel



14. Make sure to tighten all hardware and that all threads are protected with Never-Seez Blue Moly.

4.3 Attach CTD Extension and CTD

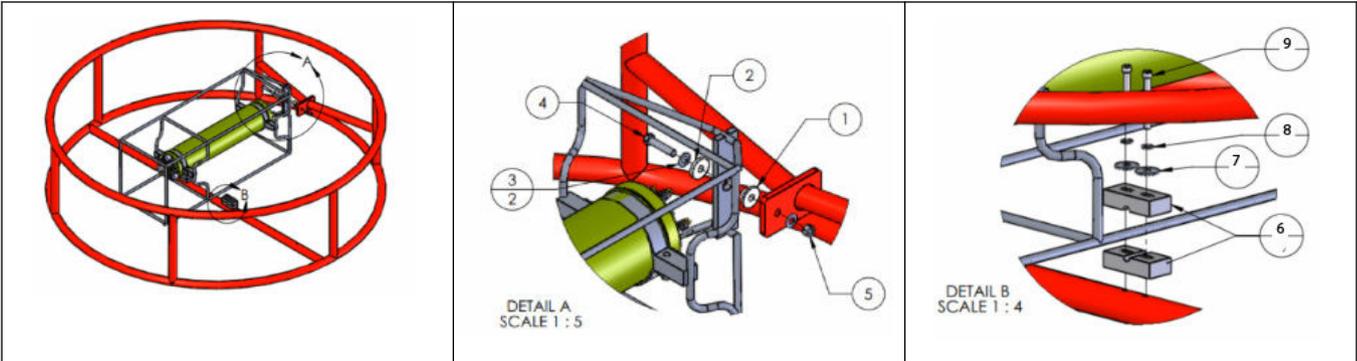
The full-size SBE 32 is sold with an extension frame to attach the CTD horizontally. There are two types of cages: ring top and flat top.



1. Put the carousel on top of the CTD extension frame.
2. Wrap the manufacturer-supplied Teflon™ tape around the carousel and extension at the four locations the U-bolts will be used. This will protect the painted surfaces of the carousel and extension.
3. Apply Never-Seez Blue Moly to all threaded surfaces.
4. Use four U-bolts, each with a flat washer and two lock nuts to attach the carousel to the extension.



5. Use the hardware from the carousel mount kit to attach the CTD to the extension.



Item	Description	Quantity
1	Insulator bushing	1
2	Insulator washer	1
3	Washer, 3/8" flat stainless steel, 7/8" max OD	2
4	Bolt, 3/8-16 × 1 3/4" hex, stainless steel	1
5	Nut, 3/8-16 nylon stop	1
6	CTD mount clamp	4
7	Washer, 1/4 fender, stainless steel, 1" OD	4
8	Washer, 1/4 split ring lock, stainless steel	4
9	Cap screw, 1/4-20 × 2 1/4", socket head, stainless steel	4
10	CTD extension frame	1

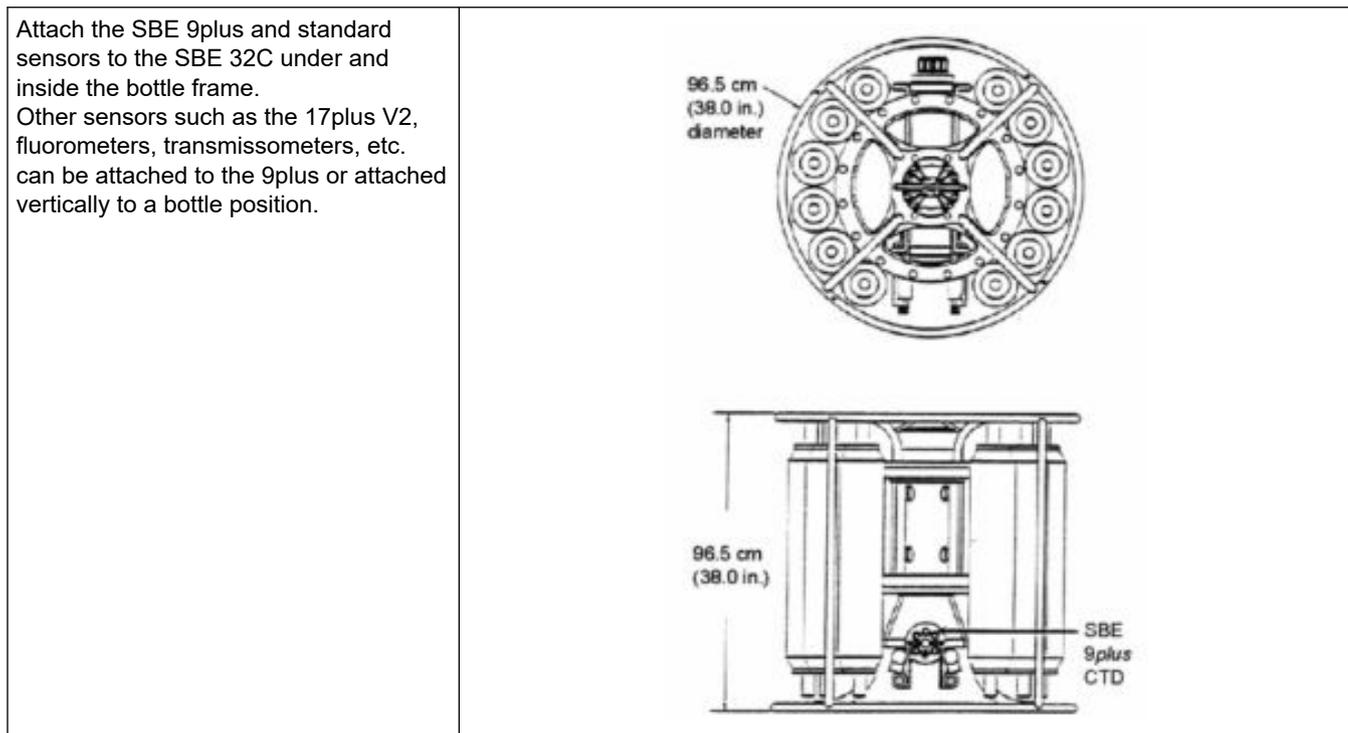
6. For ring-top cages:

- a. Use the carousel mount kit without parts 1 and 2, the insulator bushing and washer.
- b. Assemble the CTD adapter kit (part number 50124) to attach to the ring top (shown assembled).



4.4 Attach CTD to SBE 32C

Table 5 Horizontal CTD



System configuration:

- Put the dissolved oxygen (DO) sensor intake above the conductivity sensor exhaust.
- Put the pump intake above the DO sensor exhaust.
- If the system does not have a DO sensor, connect the tubing from the conductivity cell directly to the pump intake.
- Make sure that the pump exhaust outlet corner is pointed up.
- Put a 12 mm (0.5 inch) lone piece of 9.5 mm ID Tygon tubing at the DO sensor intake and exhaust, and put a 13 mm ID length of tubing over it to make a tight seal.

If the system is not set up correctly, air can be trapped and the pump will not work correctly.

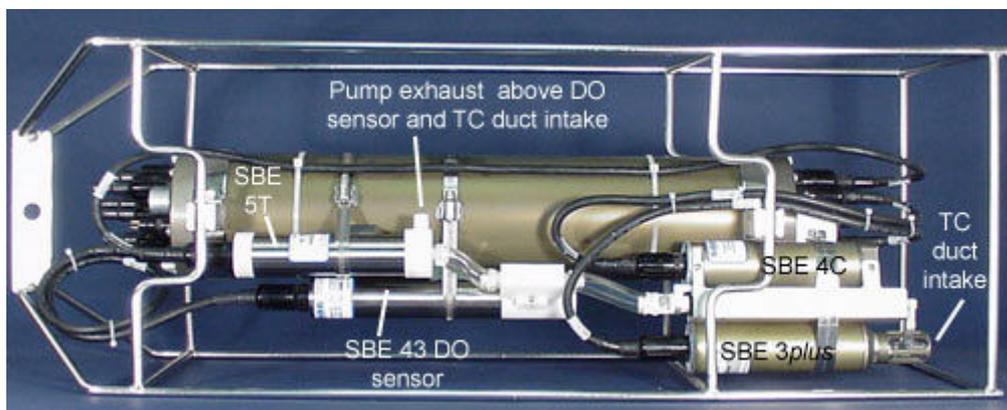
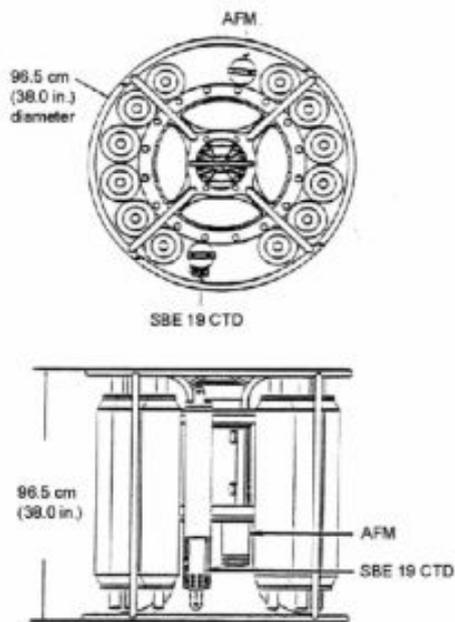


Table 6 Vertical CTD

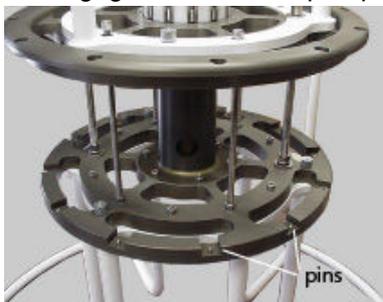
Attach the SBE 19 or 19plus vertically to a bottle position on the 32C.
 An SBE 25 can be attached to another bottle position, and the standard sensors for the 25 attach together on another bottle position. The Auto Fire Module, fluorometers, transmissometers, etc. can be attached to additional bottle positions.



4.5 Install bottles onto carousel

This section applies only to the full 32 carousel. The SBE 32C comes from the manufacturer with the bottles installed.

1. Tilt the bottle to engage the lower adapter plate pin in the bottom of the bottle mount.



2. Push the bottle plunger and rotate the bottle until the bottle plunger engages in the upper adapter.



Section 5 Deployment and recovery

5.1 Set up system

Install the Seasoft V2 software and set up the system with one of the four controllers for the carousel:

- SBE 11plus Deck Unit, for real-time operation with a SBE 9plus CTD.
- SBE 33 Deck Unit, for real-time operation with a SBE 19, 19plus or SBE 25plus CTD.
- SBE 17plus V2 SEARAM, for autonomous operation with a SBE 9plus CTD.
- Auto Fire Module, for autonomous operation with a SBE 19, 19plus or 25plus CTD.

Refer to the specific manual for details on setup and operation.

During normal operation, commands are sent automatically to from the controller to the carousel.

The .con file has information about the CTD, auxiliary sensors that are used with the system, channels, serial numbers, and calibration dates and coefficients. The .con file also specifies if an NMEA or Surface PAR data will be appended to the CTD data. The Seasave and Data Processing software use this information to process the raw data.

If the .con file does not agree with the actual configuration of a sensor, the software will not process data correctly.

5.1.1 SBE 11plus Deck Unit

Set up and operate the 11plus Deck Unit.

1. Connect the six pin connector on the carousel to JT7 on the SBE 9plus.
Refer to the SBE 9plus user manual for details about auxiliary sensor connectors.
2. Connect JT1 on the 9plus to "Sea Cable" on the 11plus Deck Unit.
Refer to the SBE 11plus user manual for details about auxiliary sensor connectors and to connect the 11plus to a PC.
3. Set up the SBE 11plus in the Seaterm software.
4. In the **Configure** menu of the Seasave software, select *Water Sampler Configuration*. Set the total number of bottles to be closed, the water sampler type (SBE carousel), fire sequence, and bottle positions (for table-driven bottle-fire sequence).
5. For and NMEA device: Select the **Configure** menu, then *NMEA [Lat/Lon] Interface*. Select how to save the NMEA data.
6. Do any other setup selections in the **Configure** and **ScreenDisplay** menus of the Seasave software.
7. In the Seasave software, select the **RealTime Data** menu, then *Start Acquisition*.
 - a. Select the CTD configuration (.con) file.
 - b. Enter the name and location in which to save collected data.
 - c. Configure the PC Comm ports:
 - The *CTD Data Comm Port* connects to the SBE 11plus *Interface* (RS232 or IEEE488).
 - The *Deck Unit Modem Comm Port* connects to the SBE 11plus *Modem Channel*.
 - The *CTD Data Baud Rate* is the baud rate used by the SBE 11plus to transmit CTD data to the PC. For 11 and 11plus, the baud is set by a dip switch in the deck unit to 19200 (default) or 9600. For the 11plus V2, the baud is always 19200.
 - d. Select *Start Acquire*.

8. To fire a bottle from Seasave, Push **Ctrl F3**, OR, in the **View** menu, select *Fire Bottle Control*. The *Bottle Firebox* shows. This can be open during the cast. Select *Fire Bottle*.
9. To fire a bottle from the SBE 11plus front panel:
 - a. Push *Home/Arm*.
 - b. Push *Fire*.
The carousel fires bottle 1, and then fires in sequence each time *Fire* is pushed.

5.1.2 SBE 33 Deck Unit

Set up and operate the 33 Deck Unit. Refer to the CTD manual for connections to auxiliary sensors and the SBE 33 manual for connections to the PC and auxiliary equipment.

1. Connect the 2-pin connector on the carousel to *Sea Cable* on the SBE 33 Deck Unit.
2. Connect the 4-pin connector on the carousel to the CTD data I/O connector.
3. Set up the SBE 33 in the Seaterm software.
4. In the **Configure** menu of the Seasave software, select *Water Sampler Configuration*. Set the total number of bottles to be closed, the water sampler type (SBE carousel), fire sequence, and bottle positions (for table-driven bottle-fire sequence).
5. For an NMEA device: Select the **Configure** menu, then *NMEA [Lat/Lon] Interface*. Select how to save the NMEA data.
6. Do any other setup selections in the **Configure** and **ScreenDisplay** menus of the Seasave software.
7. In the Seasave software, select the **RealTime Data** menu, then *Start Acquisition*.
 - a. Select the CTD configuration (.con) file.
 - b. Enter the name and location in which to save collected data.
 - c. Configure the PC Comm ports:
 - The *CTD Data Comm Port* connects to the SBE 33 *Serial Data*.
 - The *Deck Unit Modem Comm Port* connects to the SBE 33 *Carousel Data*.
 - The *Baud Rate between SBE 33 and Computer* and *Baud Rate between SBE 32 and CTD* must agree with the CTD setup and the SBE 33 dip switch setting.
 - d. Select *Start Acquire*.
8. If the CTD is not already on, the software tells you to turn on the magnetic switch on the CTD.
9. To fire a bottle from Seasave, Push **Ctrl F3**, OR, in the **View** menu, select *Fire Bottle Control*. The *Bottle Firebox* shows. This can be open during the cast. Select *Fire Bottle*.
10. To fire a bottle from the SBE 33 front panel:
 - a. Set the *Bottle to Fire* switch to 00 and push *Reset*.
 - b. To fire in random order, set the *Bottle to Fire* switch to the bottle to fire, and push *Fire*.
 - c. To fire in sequence, set the *Bottle to Fire* switch to 99 before you fire the first bottle, then push *Fire*.

The carousel fires bottle 1, and then fires bottles in sequence each time you push *Fire*.

5.1.3 17plus V2 Searam

The Searam fires bottles on the upcast only, at pre-selected pressures. The Searam uses the pressure sensor coefficients to calculate pressure from the CTD pressure frequency

data. This tells the Searam when to close bottles based on user-input bottle position and close parameters.

1. Connect the 6-pin carousel connector to the 6-pin connector that is directly across from the switch plunger on the 17plus V2.
2. Connect the 6-pin connector on the 17plus V2 to the JT7 connector on the SBE 9plus that is clockwise from the switch plunger.
Refer to the SBE 9plus manual for connections to auxiliary sensors.
3. Connect the Searam to the PC with the data I/O cable.
4. In the SeatermAF software, select the **Configure** menu, then *SBE 17plus*.
 - a. Set the communication parameters.
 - b. Set the auto-fire parameters and select the CTD configuration (.con) file.
 - c. Push **Connect**.
 - d. Set the time and date.
 - e. Set the memory parameters. The definition of the auxiliary sensor channels must agree with the .con file.
 - f. Push **Program** to send the auto-fire parameters to the Searam.
 - g. Push **Arm** to enable the Searam to fire bottles.
5. Replace the I/O cable with the dummy plug and lock collar.
6. Push in the Searam switch plunger to start data collection.

5.1.4 Auto Fire Module (AFM)

The AFM closes bottles on the upcast, the downcast, when the system is stopped, or on time intervals. The SBE 19 and 25 use the pressure sensor coefficients to calculate pressure from the CTD pressure frequency data. This tells the sensors when to close bottles based on user-input bottle position and close parameters. Refer to the CTD manual for connectors on auxiliary sensors.

1. Connect the 6-pin connector on the carousel to the 6-pin connector on JB2 of the AFM.
2. Connect the 3-pin connector on JB1 of the AFM to the CTD or SBE 50 data I/O connector.
3. In the SeatermAF software, select the **Configure** menu, then select the AFM with the applicable sensor.
 - a. Set the communication parameters.
 - b. Set the auto-fire parameters and select the CTD configuration (.con) file
 - c. Push **Connect AFM** to send auto-fire parameters to the AFM.
 - d. Set the time and date.
 - e. Push **Program** to send the auto-fire parameters to the AFM.
 - f. Push **Arm** to enable the AFM to fire bottles.
4. Replace the I/O cable with the dummy plug and lock collar.
5. Turn on the magnetic switch of the CTD to start data collection.

5.2 Recover carousel

⚠ WARNING	
	<p>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.</p>

Flush the carousel, the CTD, and auxiliary equipment with fresh water. Do not let the carousel sit in direct sunlight.

5.3 Process data

The Data Processing module of the manufacturer's software converts all of the raw data and makes a water bottle file (.ros) as well. The .ros file has data for each bottle fire and a user-selected range of collected data from before and after each bottle fire. The data to make the water bottle file typically comes from one of these sources:

- Bottle log (.bl) file. If the Seasave software was used to collect real-time data, it makes a .bl file. Each time a bottle fire confirmation is received, the bottle sequence number, position, date, time, and the start and end number of the scan is written to the .bl file.
- If Seasave is used to collect data from an SBE 9plus used with an 11plus Deck Unit, or the 17plus V2, both a .bl file and data marked with a bottle confirm bit can be used as the source file to make the water bottle file. The confirm bit is set for all data within a 1.5-second duration after the carousel receives confirmation that a bottle was fired.
- Auto Fire Module (.afm) file. This file has five scans of CTD or SBE 5- data recorded by the AFM each time a bottle is fired.

Refer to the SBE Data Processing manual for details on how data is processed.

Section 6 Maintenance

⚠ WARNING



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

Make sure to flush the carousel with fresh water after each cast and keep it away from direct sunlight.

The titanium trigger mechanisms are coated with Tiodize[®], which is similar to anodized aluminum. **Do not apply petroleum- or silicon-based products.** Flush the trigger mechanisms with fresh water after each cast and clean them with warm, soapy water at regular intervals. Refer to [Remove and replace latch assembly](#) on page 27 for details.

Make sure that the zinc anodes are attached correctly and replace as necessary.

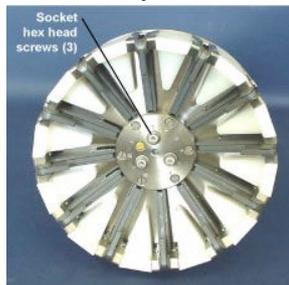
- On the SBE 23C: two each on the lower adapter plate, the lower guard ring, and one on the pylon-hub assembly.
- On the 12-bottle SBE 32: three each on the upper and lower guard rings, two on the lower adapter plate, one on the pylon-hub assembly.
- On the 24-bottle SBE 32: three each on the upper and lower guard rings, three on the upper and lower adapter plates, one on the pylon-hub assembly.
- On the CTD extension stand: two.

All screws that come into contact with seawater have been lubricated with a thick coat of Never-Seez Blue Moly[®], and anti-seize compound. Make sure to lubricate all screws if the carousel is disassembled then assembled again.

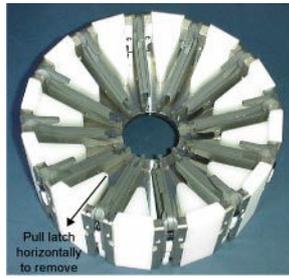
6.1 Remove and replace latch assembly

Flush the latch assembly with clean fresh water at regular intervals. If the latches do not operate smoothly, remove the assembly and use warm, soapy water to clean the latches.

1. Remove the three socket hex head screws, the lock washers, and flat washers from the top of the latch assembly.



2. Lift the assembly off of the pylon.
3. Optional: remove each trigger.
 - a. Put a mark at the location of trigger 1 on the trigger mount disk to help assemble it again.
 - b. Remove the Phillips-head screws. There are eight for the 32C, and six for the 32.
 - c. Lift the retainer disk off of the latch assembly.
 - d. Pull triggers horizontally from the trigger mount disk and put marks on the triggers to help install them again.



Replace triggers on the trigger mount disk

4. Put the retainer disk on the triggers: align the mark for trigger 1 on the trigger mount disk with trigger 1 on the retainer disk.
5. Make sure that the triggers are installed correctly in the grooves and that the disk is flat.
6. Install the Phillips-head screws: tighten the screws diagonally so that the disk stays flat.
7. Align the latch assembly alignment hole with the pylon alignment pin.



8. Set the latch assembly on the pylon. Install the three socket hex head screws, lock washers, and flat washers.

6.2 Remove center pylon

1. Make sure to disconnect all cables from the connectors.
2. Remove the lifting bail hardware from under the lower guard ring.
3. Pull the lifting bail up until it is above the lower guard ring- adapter plate-hub assembly connection.
4. Remove the hardware from the legs of the lifting bail.
5. Pull the lifting bail out of the upper guard ring.
6. Remove the six socket ¼-inch head cap screws, lock washers, and flat washers from the underside of the top flange of the pylon-hub assembly.



7. Pull the latch assembly with the pylon up and out of the carousel frame. There are plastic insulators on the underside of the lower guard ring-adapter plate-hub assembly for the lifting bail and on the top flange of the hub assembly for the pylon. Make sure these have not fallen out when the pylon and lifting bail are installed again.

6.3 Clean bulkhead connectors

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

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:

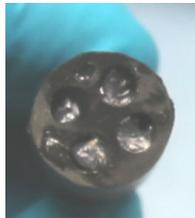
Any corrosion.		
Cracks, scratches, or other damage on the rubber pins or in the sockets.		

Maintenance

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.

Section 7 Reference

7.1 Commands

Use the commands below with the SBE 17plus to test the system. All commands must be in upper case.

Command	Decimal code	Description
#SR	163 211 210	Go to home position (position 1)
#SF	163 211 198	Fire next position (sequential fire)
#SNx	163 211 206 x	Fire position x (first position is 1), where x is in ASCII. For example: <ul style="list-style-type: none">• #SN1, decimal 163 211 206 177—fire position 1• #SN2, decimal 163 211 206 178—fire position 2• #SN<, decimal 163 211 188• #SNH, decimal 163 211 206 200—fire position 24
#SBx	163 211 194 x	For carousel with interface for operation with SBE 33 Deck Unit, set carousel to CTD communications baud rate: #SB0, decimal 163 211 194 176—600 baud #SB1, decimal 163 211 194 177—1200 baud #SB2, decimal 163 211 194 178—2400 baud #SB3, decimal 163 211 194 179—4800 baud

The carousel sends one of these messages when it receives a reset command (go to home position) or bottle fire command:

Sent from carousel	Description
6 33 6	Home position. Next bottle to fire is #1.
6 35 6	Received invalid bottle number
6 45 6	Did not confirm bottle number
6 x 6	Fired bottle # (x - 48). For example: 6 49 6—fired bottle #1 6 50 6—fired bottle #2 6 72 6—fired bottle #24

7.2 Make lanyards

All carousels have lanyards installed by the manufacturer if water bottles are ordered at the same time. Refer to the next section for steps to make lanyards for a specific carousel.

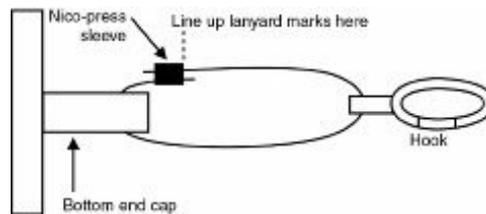
Use heavy-weight nylon monofilament to make lanyards. The 0.80 inch monofilament used for line trimmers is available at most home and garden stores. Make the lanyard loops with Nicopress crimped copper sleeves, available from the manufacturer or industrial suppliers. Install the sleeves with pliers made to crimp soldered electrical connections. If copper sleeves are not available, make a knot in the monofilament.

7.2.1 Make lower lanyard

1. Cut an 8 inch length of monofilament and make two marks 1 inch from each end.
2. Put the monofilament through the hole in the bottom end cap.
3. Put the monofilament through the hole in a brass snap hook.



- Put one end of the monofilament through the Nicopress sleeve. Put the other end through the sleeve from the opposite direction. Align the marks of one side of the sleeve

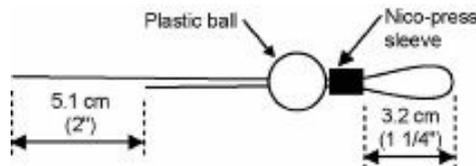


- Crimp the sleeve in two places.
- Cut any extra length of monofilament at a 45 degree angle for a smooth end.
- Move the loop around on the lower end cap until the sleeve is next to the end cap. Pull straight out on the brass hook to move the lanyard to the correct place.

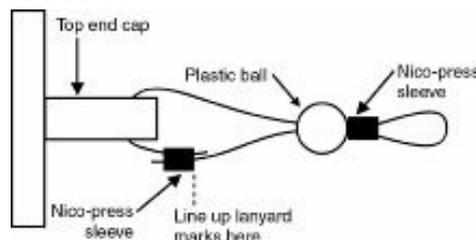
7.2.2 Make upper lanyard

The length of the upper lanyard depends on the size and type of bottle used on the carousel. It may take several tries to make the correct length.

- Cut a length of monofilament and make two marks 1 inch from each end.
- Put both ends of the monofilament through one end of a Nicopress sleeve and keep a loop of 1¼ inches to hook onto the pylon for the rigging. Adjust the ends so that one end is 2 inches longer than the other. **Do not crimp the sleeve.**



- The plastic lanyard ball has a hole drilled through it. One side is slightly larger. Put both ends of the monofilament through the larger hole and move the ball up on the monofilament until it touches the Nicopress sleeve.
- Put the longer end of the monofilament through the hole on the top end cap.
- Put the ends of the monofilament through the Nicopress sleeve in opposite directions.
- Crimp this sleeve.



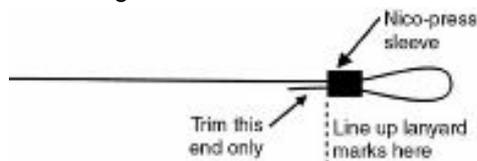
- Cut any extra length of monofilament at a 45 degree angle for smooth ends.

8. Adjust the ball and other sleeve so that the tension equal on both lengths of the monofilament.
9. Crimp the sleeve.
10. To test the lanyard assembly, put the loop over the appropriate trigger hook. The end cap should be in the correct set position. If it is not, make another lanyard and adjust the lengths as required.

7.2.3 Make middle lanyard

The middle lanyard connects the upper and lower lanyards. It may take several tries to make the correct length.

1. Cut a length of monofilament to the approximate length and make two marks 1 inch from each end:
 - For a 12-bottle carousel, 12 inches (31 cm) longer than the bottle.
 - For a 24-bottle carousel, 24 inches (61 cm) longer than the bottle.
2. Put both ends of the monofilament through one end of a Nicopress sleeve and keep a loop to connect to the bottom end cap hook.
3. Align the marks on the side of the sleeve opposite the loop.
4. Crimp the sleeve.
5. Cut any extra length of monofilament next to the sleeve at a 45 degree angle.



6. Open both bottle end caps:
 - a. Put the loop of the upper lanyard on the trigger hook so that it is in the "set" position. Put a 2-inch wide wood spacer in the top bottle mouth for safety.
 - b. Put another wood spacer in the bottom bottle mouth. Make sure the handle on the end cap is pointed away from the center of the carousel.
 - c. Verify that the bottle end caps are set at the correct positions.
7. Connect the middle lanyard loop into the lower lanyard snap hook.



8. If the bottle has a handle, put the end of the middle lanyard through the handle to prevent the loss of either end cap if the rubber tubing between the end caps breaks.
9. Put the end of the middle lanyard through a Nicopress sleeve.
10. Put the end of the middle lanyard through the loop on the upper lanyard.
11. Bring the end of the middle lanyard back through the Nicopress sleeve so that it makes a loop through the upper lanyard.



12. Adjust the middle lanyard length so that it takes up the tension on the bottom end cap.
13. Adjust the position of the Nicopress sleeve so that the upper loop is approximately 1 inch long.
14. Crimp the sleeve.
15. Cut any extra length of monofilament at a 45 degree angle.
16. Remove the wood spacers.
Both end caps should be in the correct "set" position. If they are not, make another lanyard and adjust the measurements as necessary.

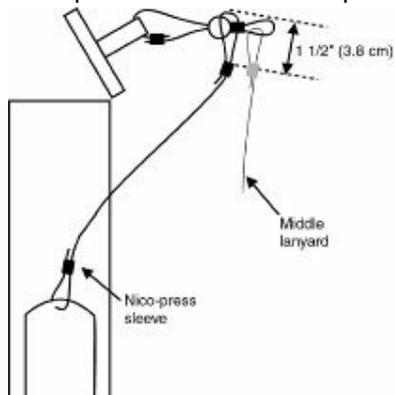


7.2.4 Make reversing thermometer lanyard

The reversing thermometer lanyard attaches to the upper lanyard. The length depends on the size of the bottle and the type of thermometer. It may take several tries to make the correct length.

1. Put the loop of the upper lanyard on the trigger hook so that it is in the "set" position. Put a 2 inch wood spacer in the mouth of the bottle for safety.
2. Measure the distance from the hold in the thermometer to the ball on the upper lanyard. Add approximately 6 inches to this length and cut a length of monofilament.
3. Hold the thermometer in the "set" position and pull one end of the monofilament through a Nicopress sleeve, through the top hole in the thermometer, and back through the sleeve.
4. Adjust the sleeve until the loop fits snugly around the thermometer hole.
5. Crimp the sleeve.
6. Cut any extra length of monofilament at a 45 degree angle.

7. Pull the other end of the monofilament through a Nicopress sleeve, **around** the upper lanyard loop. **Do not go through the loop**. Pull the end back through the sleeve.
8. Adjust the lanyard length until the loop takes up the tension on the upper lanyard ball.
9. Adjust the sleeve position so that the loop is approximate 1½ inches long.



10. Crimp the sleeve.
11. Cut any extra length of monofilament next to the sleeve at a 45 degree angle.
12. Make sure that the wood spacer is still in place and release the trigger hook: push on the bottom of the white plastic release.



The thermometer lanyard fall away from the upper lanyard and the thermometer should rotate so it can be read. Note that when the bottle associated with the thermometer has fired, the thermometer lanyard can potentially cause interference with the correct deployment of another bottle position. Use a rubber band or a length of monofilament to prevent this.

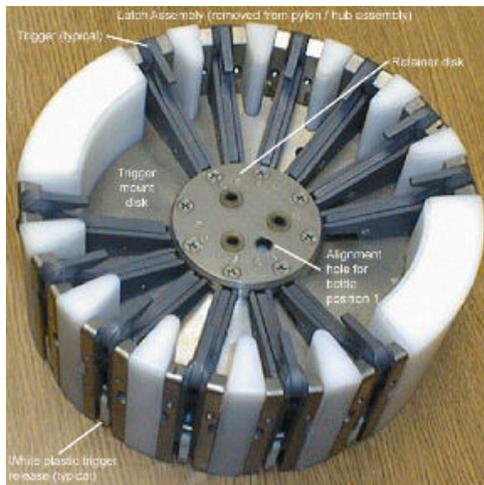
7.2.5 Lanyard tension less than 25 kg

1. Detach the lower lanyard from the middle lanyard.

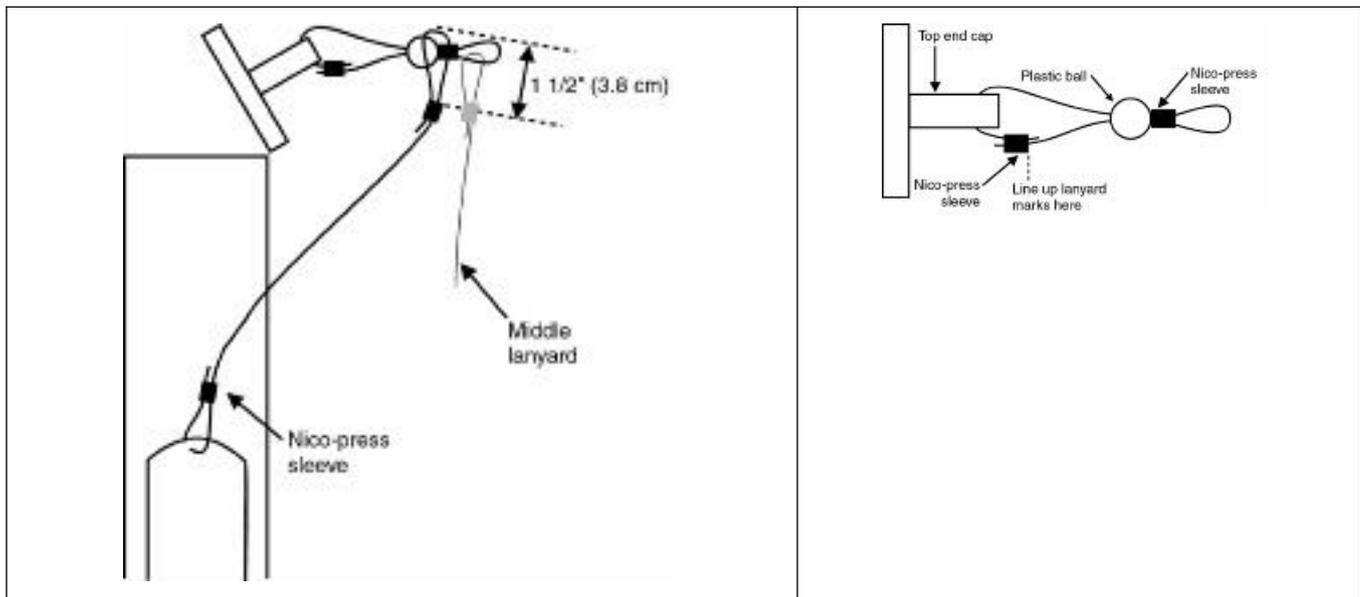


2. To set the release mechanism, push against each trigger until it clicks and locks into place.
If the trigger does not click into place, push on the top part of the white plastic trigger release, the push against the trigger until it clicks into place.

Reference



3. If the carousel will be deployed with reversing thermometers, turn the thermometer rack and position the thermometer lanyard loop over the upper lanyard so that it is against the upper lanyard ball.



4. Attach the upper lanyard to the trigger hook.



5. Attach the lower lanyard to the middle lanyard. The end cap handle should angle out, away from the carousel.
6. Center the connection on the bottom end cap.

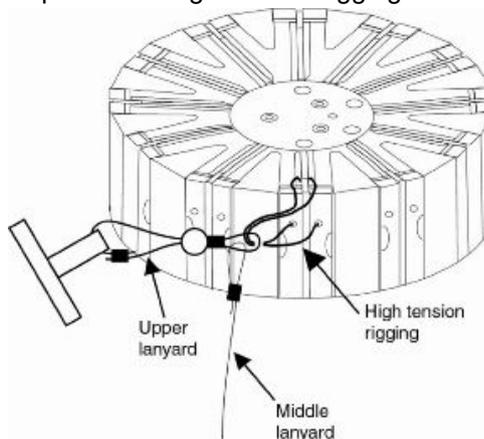
- If the bottle has a handle, put the middle lanyard through the handle to prevent the loss of either end cap if the rubber tubing between the two end caps breaks.
- Some larger bottles have a small loop of monofilament on the handle. If so, the lanyard can go through the monofilament. This makes a straighter path for the lanyard and puts the bottom end cap in a better position when it is set.

		
Lanyard through handle	Correct lanyard connection (centered)	Incorrect lanyard connection (to the side)

7.2.6 Lanyard tension between 25 and 50 kg

For water bottles with lanyard tensions in this range, use a simple block-and-tackle type loop.

1. Cut a lanyard to 18 cm. Make two marks 1.6 cm from either end. The center section of the lanyard is 14.8 cm and the two end sections are 1.6 cm
2. Put the lanyard through the pylon.
3. Put a Nicopress sleeve on each end of the lanyard and align the sleeves with the marks so that there is approximately 15 cm of lanyard between the sleeves.
4. Do the steps for the lower tension system, with one difference: move the upper lanyard loop over the high-tension rigging and attach that to the trigger hook.



Section 8 General information

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

8.1 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.

8.2 Warranty

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

8.3 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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