SBE 32 Carousel Water Sampler

User's Manual

Manual Version #010, 01/30/03
Firmware Version 1.0b and later

Limited Liability Statement

Extreme care should be exercised when using or servicing this equipment. It should be used or serviced only by personnel with knowledge of and training in the use and maintenance of oceanographic electronic equipment.

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Table of Contents

Section 1: Introduction

This section includes a description of the scope of this manual, contact information, and a list of what is included with a typical Carousel shipment.

About this Manual

This manual is to be used with the SBE 32 Carousel Water Sampler.

It is organized to guide the user in **preparing** the Carousel for operation. We've included an overview of system operation, detailed specifications, installation instructions, maintenance information, command descriptions, and helpful notes throughout the manual.

Depending on which CTD is used with the system, the Carousel can be operated and controlled by:
- SBE 11*plus* Deck Unit,
- SBE 33 Carousel Deck Unit,
- SBE 17*plus* V2 SEARAM, or
- 90208 Auto Fire Module

See the appropriate manual for details on operating the Carousel.

Sea-Bird welcomes suggestions for new features and enhancements of our products and/or documentation. Please e-mail any comments or suggestions to seabird@seabird.com.

How to Contact Sea-Bird

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Monday-Friday, 0800 to 1700 Pacific Standard Time
      (1600 to 0100 Universal Time)
Except from April to October, when we are on *summer time*
      (1500 to 0000 Universal Time)

Unpacking Carousel

> **Note:**
> The SBE 32C (compact model) and 32SC (sub-compact model) are shipped from Sea-Bird with the mechanical/electrical assembly fully assembled. The full-size SBE 32 must be assembled by the user, as described in *Section 3: Preparing Carousel for Deployment*.

A typical Carousel shipment includes:

- Mechanical /electrical assembly
  - ➢ Guard frame assembly: upper and lower guard rings, side bars, and (for SBE 9*plus* only) CTD extension stand
  - ➢ Upper and lower adapter plates
  - ➢ Hub and pylon, including electronics and latch assembly
  - ➢ Lifting bail
  - ➢ Associated hardware

- Cables - number and type is dependent on which CTD and controller is to be used with the Carousel

- Software, and electronic copies of this user manual and software manuals on CD-ROM

- This manual

- Spare parts kit

Section 2: Description of Carousel

This section describes the functions and features of the SBE 32 Carousel, including specifications and dimensions.

System Description

The SBE 32 Carousel Water Sampler is a versatile, reliable water sampling system. Each Carousel bottle position has its own lanyard release latch controlled by a magnetic trigger. When the microprocessor in the Carousel pylon receives a command to fire a bottle, it activates the magnetic trigger for the bottle position specified. Bottles may be fired sequentially or any order. The Carousel's unique design allows the lanyard release mechanism to be *cocked* with a touch of a finger before the lanyards are secured, permitting fast, convenient, safe, and reliable setup. Titanium, acetal plastic, and other corrosion resistant materials are used in the latch and magnet assembly. The modular construction of the latch array makes servicing easy.

The energy used to trip the magnetic trigger that controls each release latch is stored in an internal capacitor. When a fire command is received, the Carousel switches the capacitor to the selected magnetic trigger for 50 milliseconds. A fire-confirm circuit detects current flowing through the circuit. Receipt of a fire-confirm message from the Carousel verifies the bottle position selected and that energy was delivered to the magnetic trigger. The capacitor is charged to 75 volts with a current-limited DC/DC converter; time to recharge the capacitor is approximately 2 seconds. The Carousel electronics are electrically isolated from the CTD.

The Carousel is available in 12-, 24-, and 36-bottle configurations. It accepts standard water sample bottles, in sizes ranging from 1.7 to 30 liters (specified at time of purchase). A Carousel built for bottles of one size accommodates bottles of all *smaller* sizes.

The standard Carousel is rated to a depth of 6800 meters. Optional titanium pressure housings have depth ratings to 7000 or 10,500 meters.

The SBE 32 Carousel is available in three sizes:

- **Full-Size Carousel (SBE 32)** -
  The full-size Carousel is optimized for use with the SBE 9*plus* CTD, but can also be used with the SBE 19 / 19*plus* or 25 CTD or the Neil Brown Mk III CTD. The SBE 32 holds 12, 24, or 36 bottles, ranging in size from 1.7 to 30 liters.

- **Compact Carousel (SBE 32C)** -
  The SBE 32C has reduced height and slightly smaller diameter, for use where vertical clearance is limited, and can be used with the SBE 9*plus*, 19 / 19*plus*, or 25 CTD. The SBE 32C holds 12 bottles, ranging in size from 1.2 to 8 liters.

- **Subcompact Carousel (SBE 32SC)** -
  The SBE 32SC offers a small system, optimized for use with the SBE 19 / 19*plus* or 25 CTD. The SBE 32SC holds 12 bottles, 1.7 or 2.5 liters.

Carousels can be controlled in several ways:

	Carousel Size	CTD	Control
Real-Time	32, 32C	SBE 9*plus*	SBE 11*plus* Deck Unit
	32, 32C, 32SC	SBE 19 / 19*plus* / 25	SBE 33 Deck Unit
	32	Neil Brown Mk III	SBE 33 Deck Unit
	32, 32C, 32SC	None	SBE 33 Deck Unit
Autonomous (no conducting wire required)	32, 32C	SBE 9*plus*	SBE 17*plus* V2 SEARAM
	32, 32C, 32SC	SBE 19 / 19*plus* / 25 CTD or SBE 50 Pressure Sensor	Auto Fire Module (AFM) PN 90208
	32, 32C, 32SC	None	Auto Fire Module (AFM) PN 90208

Each of these combinations is described in more detail in *System Configurations* below.

Sea-Bird equipment is supplied with a powerful Win 95/98/NT/2000/XP software package, SEASOFT-Win32, which includes:

- **SEATERM** – terminal program for easy communication and data retrieval.

- **SeatermAF** – terminal program for easy communication and data retrieval for a system which includes a 90208 Auto Fire Module (AFM) or SBE 17*plus* V2 SEARAM.

- **SEASAVE** – program for acquiring, converting, and displaying real-time or archived raw data.

- **SBE Data Processing** - program for calculation and plotting of conductivity, temperature, pressure, auxiliary sensor data, and derived variables such as salinity and sound velocity.

Notes:
- Help files provide detailed information on the use of SEATERM, SEASAVE, and SBE Data Processing.
- Separate software manuals on CD-ROM contain detailed information on the setup and use of SEASAVE, SBE Data Processing, and SEASOFT-DOS.
- Sea-Bird also supplies a DOS software package, SEASOFT-DOS. SEASOFT-DOS is designed to run on IBM-compatible computers (XT/AT/386/486/Pentium). These programs usually perform correctly when run under Windows.

Specifications

| Power Requirements	*Voltage*: 12 - 15 VDC *Current when charging capacitor*: 205 milliamps (for approximately 35 seconds on power-up and 2 seconds to recharge after each bottle firing) *Current when not charging capacitor*: 110 milliamps
Depth Rating	6800 meters (standard), 7000 or 10500 meters (optional)
Materials	*Frame*: painted aluminum *Latch/magnet assembly*: titanium, acetal plastic, and other corrosion-resistant materials *Housing(for electrical and release assembly and mount hub)*: aluminum (standard), titanium (optional)

Dimensions and Weights

Carousel	Bottle Mount Stand		CTD Extension Stand		Total Package *	
	Height, mm (inches)	Diameter, mm (inches)	Height, mm (inches)	Diameter, mm (inches)	Height, mm (inches)	Weight, kg (lbs)
Full-Size (SBE 32)						
12 bottle, 1.2 liter	788 (31.0)	991 (39.0)	406 (16.0)	991 (39.0)	1201 (47.3)	68 (150)
12 bottle, 1.7 liter	788 (31.0)				1201 (47.3)	68 (150)
12 bottle, 2.5 liter	1024 (40.3)				1438 (56.6)	79 (174)
12 bottle, 5 liter	820 (32.3)				1234 (48.6)	78 (172)
12 bottle, 8 liter	1024 (40.3)				1438 (56.6)	79 (174)
12 bottle, 10 liter	1189 (46.8)				1603 (63.1)	82 (182)
12 bottle, 12 liter	1316 (51.8)				1730 (68.1)	83 (184)
12 bottle, 20 liter	1351 (53.2)	1550 (61.0)		1549 (61.0)	1765 (69.5)	164 (363)
12 bottle, 30 liter	1351 (53.2)				1765 (69.5)	171 (378)
24 bottle, 1.2 liter	800 (31.5)	1143 (45.0)	406 (16.0)	1143 (45.0)	1214 (47.8)	95 (210)
24 bottle, 1.7 liter	800 (31.5)				1214 (47.8)	95 (210)
24 bottle, 2.5 liter	1003 (39.5)				1417 (55.8)	106 (235)
24 bottle, 5 liter	869 (34.2)	1550 (61.0)	427 (16.8)	1549 (61.0)	1300 (51.3)	179 (397)
24 bottle, 8 liter	1072 (42.2)				1506 (59.3)	185 (410)
24 bottle, 10 liter	1224 (48.2)				1659 (65.3)	194 (430)
24 bottle, 12 liter	1351 (53.2)				1786 (70.3)	199 (440)
36 bottle, 12 liter	1654 (65.1)	2134 (84.0)	-		1661 (65.4)	339 (750)
Compact (SBE 32C)						
12 bottle, 1.2 - 8 liter	965 (38.0)	966 (38.0)	-		973 (38.3)	68 (150)
Subcompact (SBE 32SC)						
12 bottle, 1.7 liter	788 (31.0)	699 (27.5)	-		800 (31.5)	50 (111)
12 bottle, 2.5 liter	991 (39.0)				1003 (39.5)	52 (114)

*Total package height =
   bottle mount stand +
   CTD extension stand (if applicable) +
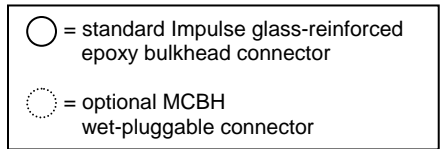   height of lifting bail above bottle mount stand

Height of lifting bail above bottle mount stand is approximately 8 mm (0.3 in.).

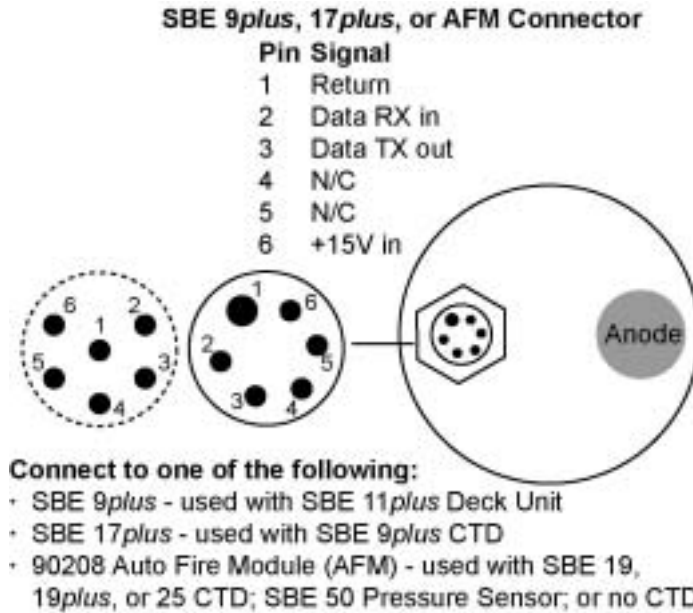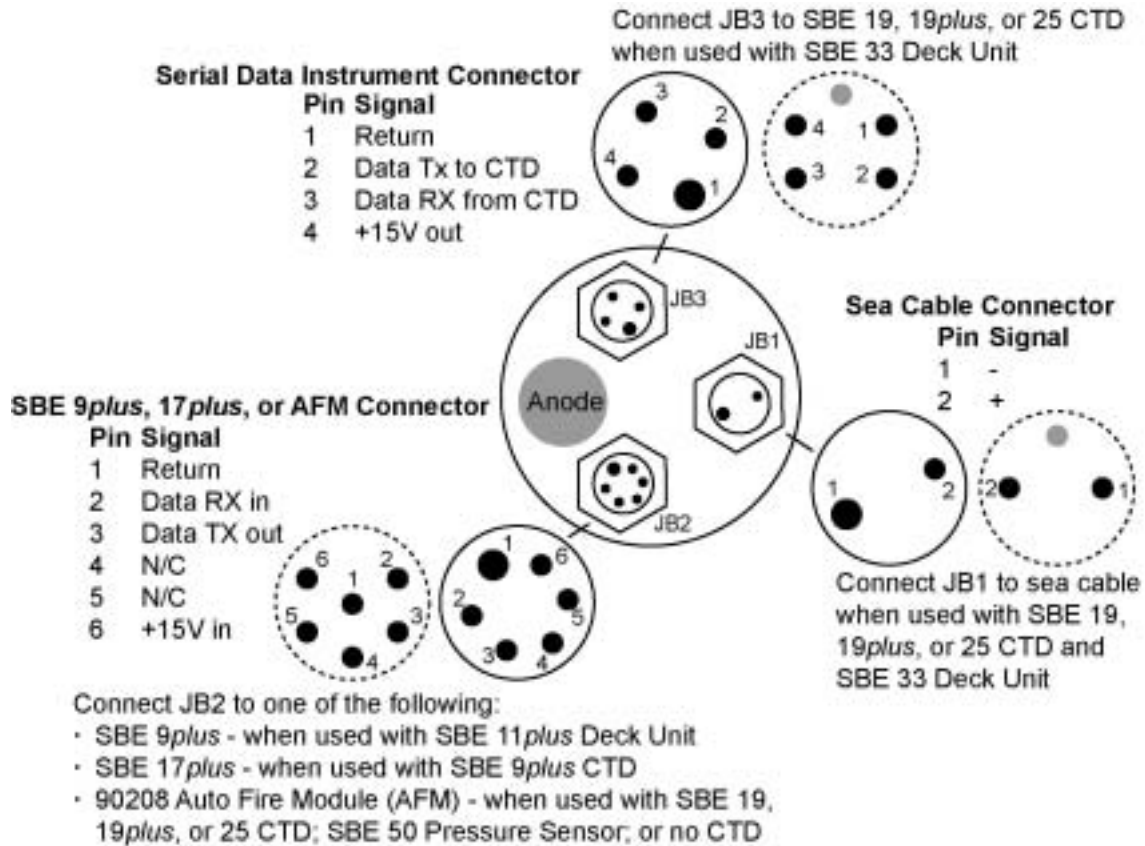Total package weight does not include bottles or CTD.

9
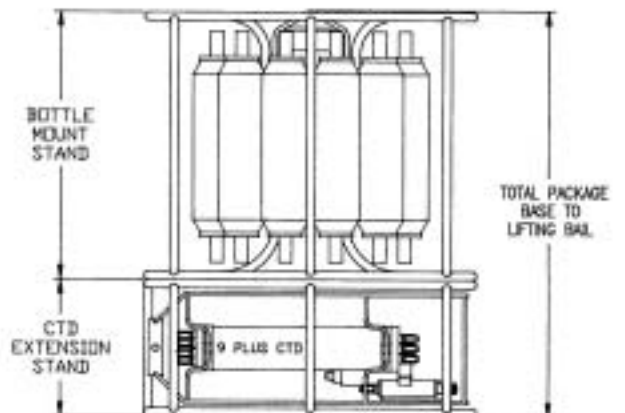
End Cap Connectors

The end cap connectors are located at the bottom of the pylon / hub assembly.

○ = standard Impulse glass-reinforced epoxy bulkhead connector

⋰ = optional MCBH wet-pluggable connector

Standard Modem Interface

SBE 9plus, 17plus, or AFM Connector

Pin	Signal
1	Return
2	Data RX in
3	Data TX out
4	N/C
5	N/C
6	+15V in

Anode

Connect to one of the following:
- SBE 9plus - used with SBE 11plus Deck Unit
- SBE 17plus - used with SBE 9plus CTD
- 90208 Auto Fire Module (AFM) - used with SBE 19, 19plus, or 25 CTD; SBE 50 Pressure Sensor; or no CTD

Standard Modem Interface and Optional Serial Interface

Connect JB3 to SBE 19, 19plus, or 25 CTD when used with SBE 33 Deck Unit

Serial Data Instrument Connector

Pin	Signal
1	Return
2	Data Tx to CTD
3	Data RX from CTD
4	+15V out

JB3

JB1

Anode

JB2

Sea Cable Connector

Pin	Signal
1	-
2	+

Connect JB1 to sea cable when used with SBE 19, 19plus, or 25 CTD and SBE 33 Deck Unit

SBE 9plus, 17plus, or AFM Connector

Pin	Signal
1	Return
2	Data RX in
3	Data TX out
4	N/C
5	N/C
6	+15V in

Connect JB2 to one of the following:
- SBE 9plus - when used with SBE 11plus Deck Unit
- SBE 17plus - when used with SBE 9plus CTD
- 90208 Auto Fire Module (AFM) - when used with SBE 19, 19plus, or 25 CTD; SBE 50 Pressure Sensor; or no CTD

System Configurations

Note:
For real-time operation, connection to two COM ports on the computer is required. COM1 (CTD data channel) and COM2 (Carousel command channel) are the defaults, and are shown in the diagrams for illustration only. You can use any two ports, in any order; set up the COM port configuration in SEASAVE to correspond.

Real-Time Data Acquisition and Control

- **SBE 11*plus* Deck Unit** -

  The Carousel is designed to be connected to the **SBE 9*plus* CTD** and powered and controlled via the SBE 911*plus* modem channel. Bottles may be closed using the push-buttons on the SBE 11*plus*, or via the RS-232C modem connector on the back of the SBE 11*plus* while acquiring real-time data with SEASAVE. The SBE 11*plus* includes a standard NMEA Interface to support NMEA 0183 protocol, and a standard interface for a Surface PAR sensor.
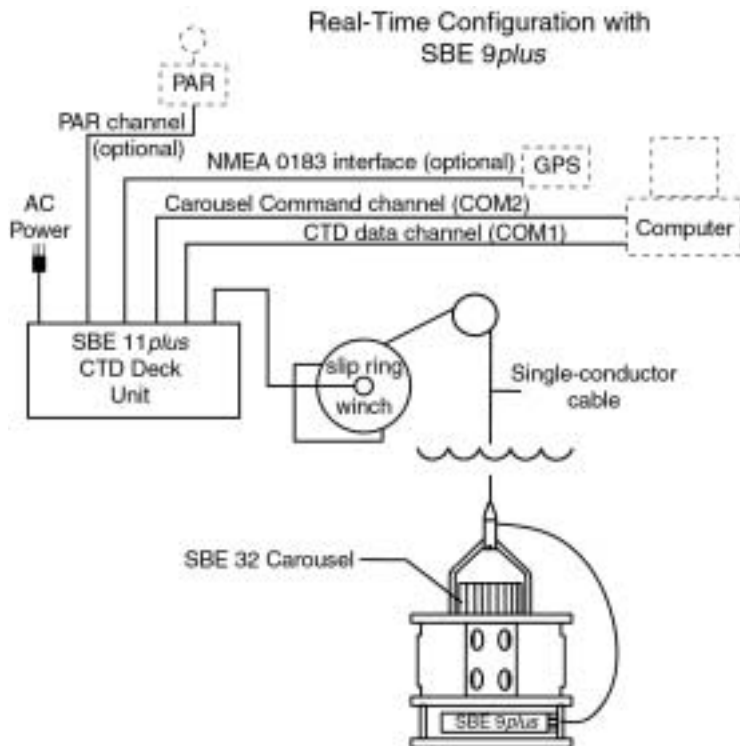
- **SBE 33 Carousel Deck Unit** –

  With an optional interface, the Carousel can be powered and controlled using the SBE 33, and can be used with or without a CTD (**SBE 19 / 19*plus* or 25 CTD**). The interface provides real-time data telemetry capability and surface power for these CTDs, and permits the control of the Carousel through the SBE 33 or via SEASAVE. When used without a CTD, bottles are closed with the SBE 33 front panel controls; depth determination must be approximated by monitoring the cable payout. The SBE 33 has an optional NMEA Interface to support NMEA 0183 protocol, and an optional interface for a Surface PAR sensor.

  An optional interface in the SBE 32 and 33 is also available for a standard **Neil Brown Mk III CTD**. This option allows the Carousel to provide the compliant supply voltage to the Mk III, and extra power for fluorometers and other sensors not easily supported by the Mk III. NMEA and Surface PAR capabilities in the SBE 33 are not available for this setup.

12
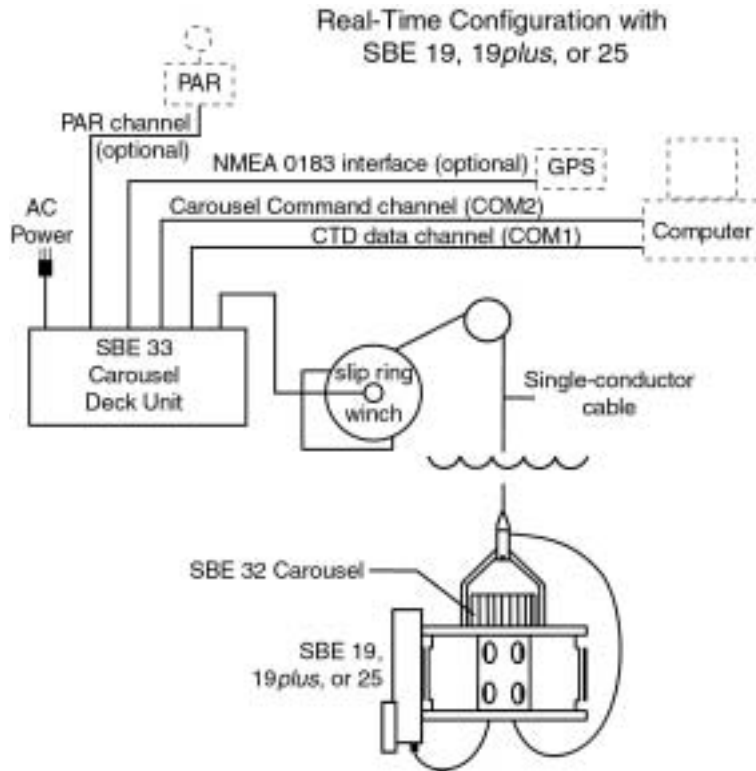
Autonomous Data Acquisition and Control
## (no conducting wire required)

- **SBE 17*plus* V2 SEARAM** -

  The SEARAM, mounted with the **SBE 9*plus* CTD**, allows the Carousel to operate autonomously on non-conducting cables. Using pressure data from the SBE 9*plus* and a programmable table of bottle closure pressures, the SEARAM signals the Carousel to close bottles on upcast. Built-in logic and user-input parameters provide control in determining when the upcast begins, preventing accidental bottle closure caused by temporary upward movements during downcast. Power is supplied to both the SBE 9*plus* and the Carousel by the SEARAM's batteries, and data from the SBE 9*plus* is stored in the SEARAM memory.
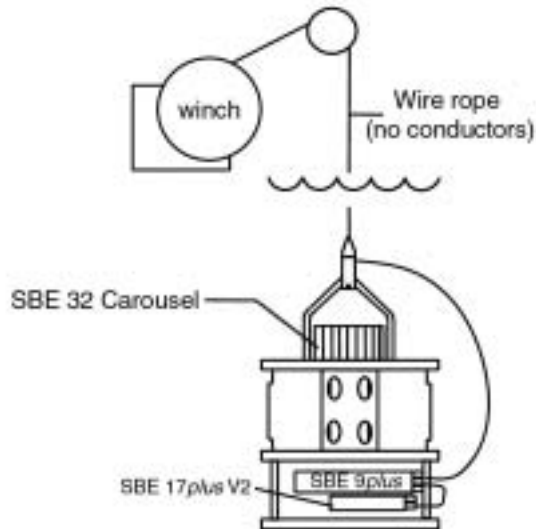
- **Auto Fire Module (AFM) PN 90208** -

  The AFM, mounted on or near the Carousel, allows the Carousel to operate autonomously on non-conducting cables, with or without a CTD. Used **without a CTD**, the AFM is programmed to fire bottles at pre-defined intervals of elapsed time. The point at which samples are taken is determined (approximately) by monitoring cable payout and elapsed time. Used with an **SBE 19 / 19*plus* or 25 CTD** or **SBE 50 Pressure Sensor**, the AFM monitors the pressure data recorded by the CTD (or transmitted by the SBE 50) in real-time, and fires bottles at predefined pressures (depths) on upcast or downcast, or whenever the system is stationary for a specified period of time. Power is supplied to the Carousel by the AFM's internal batteries; bottle number, firing confirmation, and five scans of CTD data are recorded in AFM memory for each bottle fired.

13
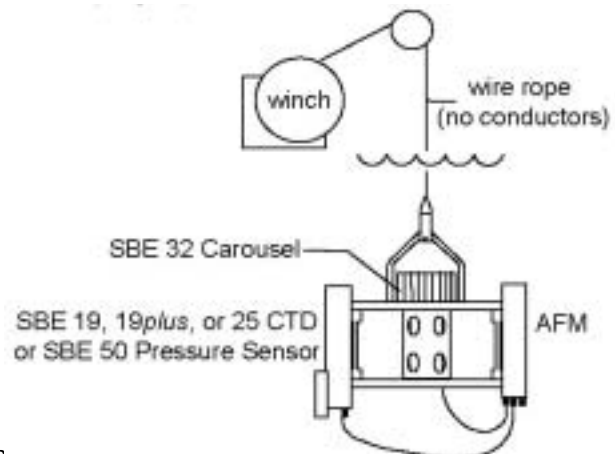
# Section 3: Preparing Carousel for Deployment

Assembling SBE 32

Note:
Place a small quantity of the NeverSeez Blue Moly compound (provided) on all screws, to prevent seizing.

The SBE 32C (compact model) and 32SC (sub-compact model) are shipped from Sea-Bird fully assembled. **The assembly instructions apply only to the full-size SBE 32.**

Parts and assembly procedure vary, depending on the number of bottles. Instructions follow for:
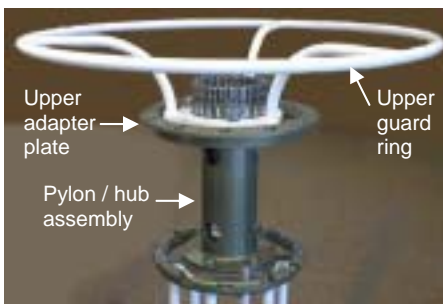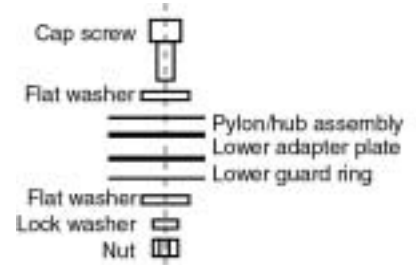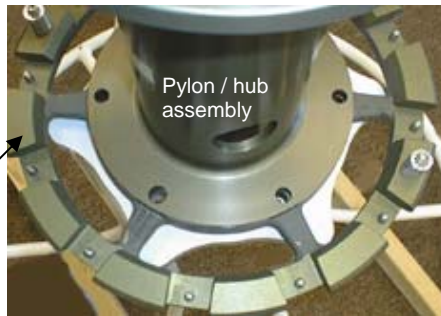- 12-bottle SBE 32
- 24-bottle SBE 32
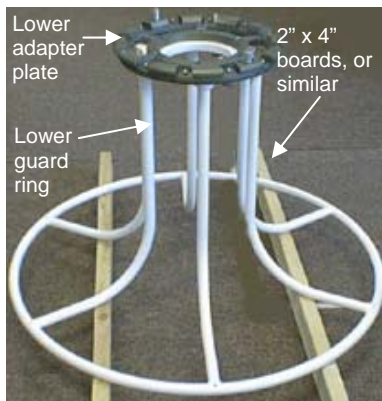
12-Bottle Full-Size SBE 32

Lower adapter plate
2" x 4" boards, or similar
Lower guard ring

1. Place the lower guard ring on a flat surface on two boards. The boards lift the assembly for easy installation of the guard side bars (Step 7).

2. Set the lower adapter plate (adapter plate with bottle locator pins on its top surface) on the flange of the lower guard ring, aligning the mounting holes.

3. The pylon/hub assembly is shipped as an assembly; six socket head cap screws, lock washers, and flat washers retain the pylon in the hub. The lifting bail is shipped installed on the pylon/hub assembly, to show the arrangement of hardware. Remove the lifting bail and associated hardware from the pylon/hub assembly for now, noting the arrangement of the lifting bail hardware for later reinstallation.

Remove lifting bail
Pylon / hub assembly

14

Pylon / hub assembly

Lower adapter plate

Pylon / hub assembly

Cap screw
Flat washer
Pylon/hub assembly
Lower adapter plate
Lower guard ring
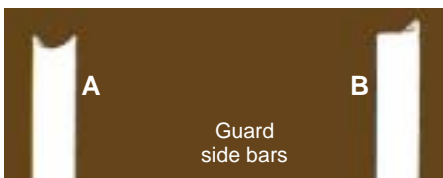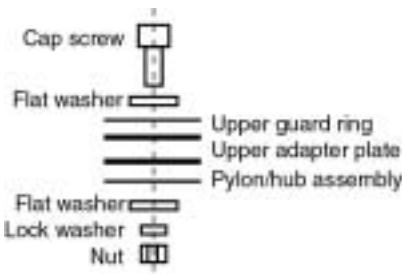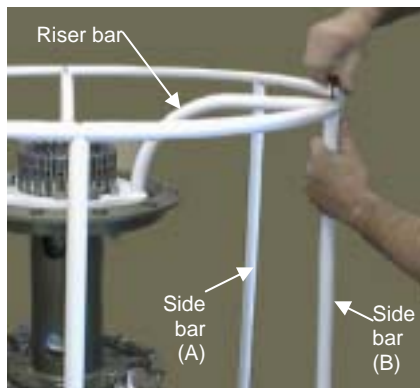Flat washer
Lock washer
Nut
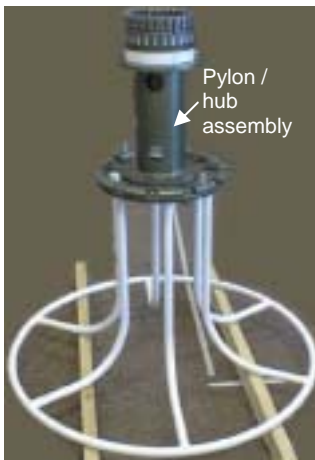
4. Set the pylon/hub assembly on the lower adapter plate, aligning the mounting holes. Secure the pylon/hub assembly and lower adapter plate to the lower guard ring through the four $^1/_2$" holes (the two oversized holes will be used for the lifting bail later). Use four $^1/_2$-13 x 3 $^1/_2$" socket head cap screws, $^1/_2$" flat washers, $^1/_2$" flat washers, $^1/_2$" split lock washers, and $^1/_2$-13 hex nuts. **Do not tighten completely.**

Upper adapter plate

Upper guard ring

Pylon / hub assembly

Cap screw
Flat washer
Upper guard ring
Upper adapter plate
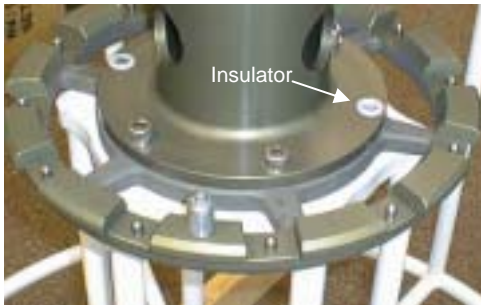Pylon/hub assembly
Flat washer
Lock washer
Nut

5. Set the upper adapter plate (adapter plate with holes to secure water bottles to Carousel) on the pylon/hub assembly, aligning the mounting holes.

6. Set the upper guard ring on the upper adapter plate, aligning the mounting holes. Secure the upper guard ring to the upper adapter plate and pylon/hub assembly through the four $^1/_2$" holes (the two oversized holes will be used for the lifting bail later). Use four $^1/_2$-13 x 3 $^1/_2$" socket head cap screws, $^1/_2$" flat washers, $^1/_2$" flat washers, $^1/_2$" split lock washers, and $^1/_2$-13 hex nuts. **Do not tighten completely.**
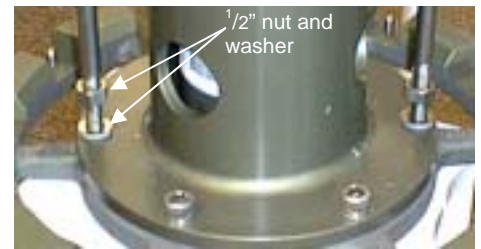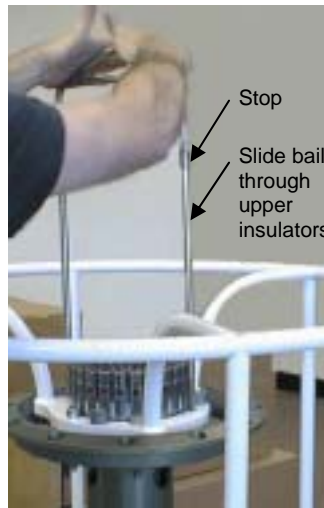

A   B

Guard side bars

7. Place the six guard side bars between the upper and lower guard rings. Note that there are two types of side bars: one for upper guard ring positions without a riser bar (A), and the other for positions with a riser bar (B).
   A. Connect the side bars to the upper guard ring, loosely installing the $^1/_4$-20 x 1$^1/_2$" flat head socket cap screws.
   B. Connect the side bars to the lower guard ring, installing the $^1/_4$-20 x 1$^1/_2$" flat head socket cap screws. Tighten these screws fully.
   C. Fully tighten the screws connecting the side bars and upper guard ring.

Riser bar

Side bar (A)

Side bar (B)

15

Insulator

8. Install the lifting bail:
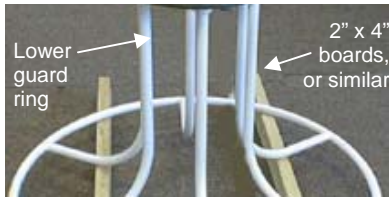   A. Install the plastic insulators: 2 longer insulators in the upper guard ring / upper adapter plate / pylon/hub assembly; 2 shorter insulators in the hub assembly /lower adapter plate / lower guard ring.
   B. Slide the lifting bail legs through the upper insulators.
   C. Before inserting into the lower insulators, place a $^1/_2$" nut on each leg of the lifting bail and thread the nuts to within 1" of the end of the threads. Place a $^1/_2$" flat washer on each leg, and then insert the bail legs into the lower insulators. Slide the bail into place until the stops above the upper insulators seat.
   D. Install the final 2 shorter insulators over the ends of the bail legs and into the bottom of the lower guard ring.
   E. Secure the bail leg to the lower guard ring with the $^1/_2$" nuts, split lock washers, and flat washers.
   F. Tighten the nuts above the lower guard ring connection until they seat on the insulators.

Stop on bail leg
Longer Insulator
Upper guard ring
Upper adapter plate
Pylon/hub assembly

Nut
Flat washer
Insulator

Pylon/hub assembly
Lower adapter plate
Lower guard ring
Insulator
Flat washer
Lock washer
Nut

Stop

Slide bail through upper insulators

$^1/_2$" nut and washer
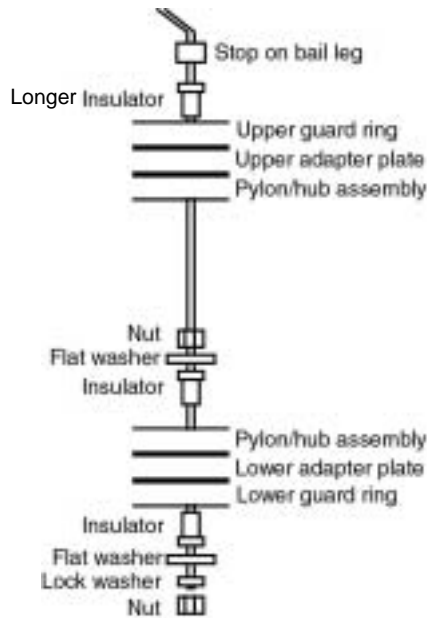
9. Fully tighten all hardware installed in Steps 1 through 8. **Make sure that all threads are protected with Never Seez Blue Moly.**

Lower guard ring

2" x 4" boards, or similar

3 1/2" long cap screw

Flat washer

Lower adapter plate
Lower guard ring

Flat washer
Lock washer
Nut

2 1/2" long cap screw

Flat washer

Pylon/hub assembly
Lower adapter plate

Flat washer
Lock washer
Nut

Rod

Flat washer, lock washer, and nut

Lower adapter plate
Lower guard ring

4" (102mm)

Flat washer and lock nut

24-Bottle Full-Size SBE 32

1. Place the lower guard ring on a flat surface on two boards. The boards lift the assembly for easy installation of the guard side bars (Step 7).

2. Set the lower adapter plate (adapter plate with bottle locator pins on its top surface) on the flange of the lower guard ring, aligning the mounting holes. Secure the adapter plate to the guard ring through six $^1/_2$" holes in the outer circle, using $^1/_2$-13 x **3$^1/_2$**" socket head cap screws, $^1/_2$" flat washers, $^1/_2$" flat washers, $^1/_2$" split lock washers, and $^1/_2$-13 hex nuts. **Do not tighten completely.**
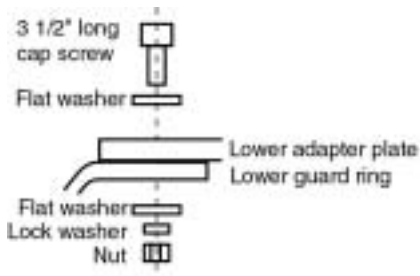
3. Set the pylon/hub assembly on the lower adapter plate, aligning the mounting holes. Secure the pylon/hub assembly to the lower adapter plate through the six $^1/_2$" holes, using $^1/_2$-13 x **2$^1/_2$**" socket head cap screws, $^1/_2$" flat washers, $^1/_2$" flat washers, $^1/_2$" split lock washers, and $^1/_2$-13 hex nuts. **Do not tighten completely.**
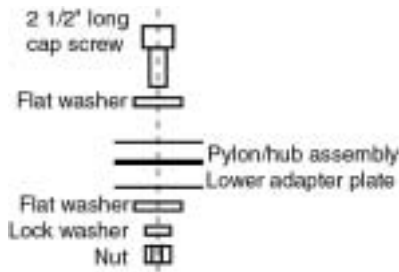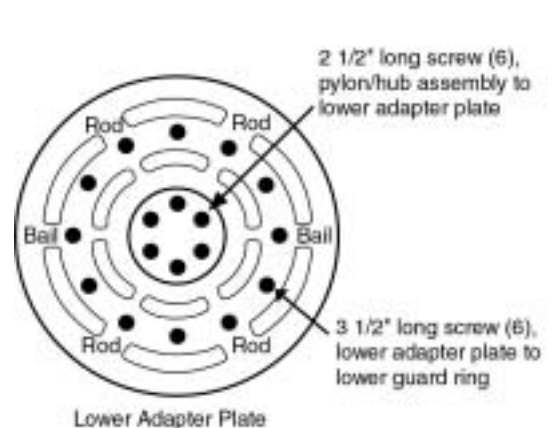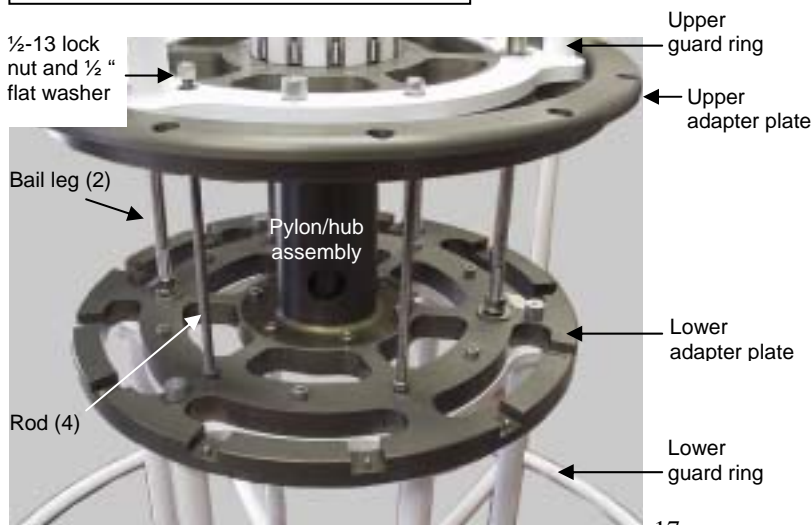
4. Install the four rods:
   A. The rods are shipped with hardware installed, to show the hardware arrangement. The bottom end of the rod has a lock nut, flat washer, flat washer, lock washer, and nut. The nut should be approximately 10 cm (4 inches) from the end of the rod. Remove the lock nut and flat washer from the bottom of the rod.
   B. Insert the rod through the lower adapter plate and lower guard ring until the flat washer, lock washer, and nut rest on the adapter plate. Secure the rod by installing the flat washer and lock nut on the underside of the lower guard ring.
   C. Remove the remaining flat washer and lock nut from the top end of the rod.
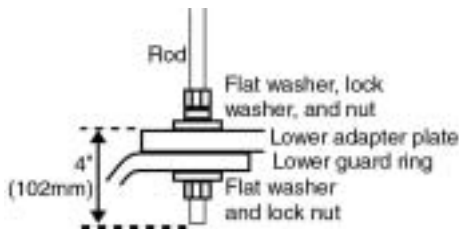
5. Slide the upper adapter plate through the rods until it rests on the pylon/hub assembly. Secure the adapter plate to the pylon/hub assembly through the six countersunk $^1/_2$" holes, using $^1/_2$-13 x 2 $^1/_2$" socket head cap screws, $^1/_2$" flat washers, and $^1/_2$-13 lock nuts.

6. Slide the upper guard ring through the rods until it rests on the upper adapter plate. Install the four $^1/_2$-13 lock nuts and $^1/_2$" flat washers on the rods.

Note: The lifting bail, shown in the photo, is not installed until Step 10.

½-13 lock nut and ½" flat washer

Upper guard ring

Upper adapter plate

Bail leg (2)

Pylon/hub assembly

Lower adapter plate

Rod (4)

Lower guard ring

2 1/2" long screw (6), pylon/hub assembly to lower adapter plate

Rod   Rod

Bail   Bail

Rod   Rod

3 1/2" long screw (6), lower adapter plate to lower guard ring

Lower Adapter Plate

17

Guard side bars

7. Place the six guard side bars between the upper and lower guard rings. Note that there are two types of side bars: one for upper guard ring positions without a riser bar (A), and the other for positions with a riser bar (B).
   A. Connect the side bars to the upper guard ring, loosely installing the $^{3}/_{8}$-16 x 2" flat head socket cap screws.
   B. Connect the side bars to the lower guard ring, installing the $^{3}/_{8}$-16 x 2" flat head socket cap screws. Tighten these screws fully.
   C. Fully tighten the screws connecting the side bars and upper guard ring.
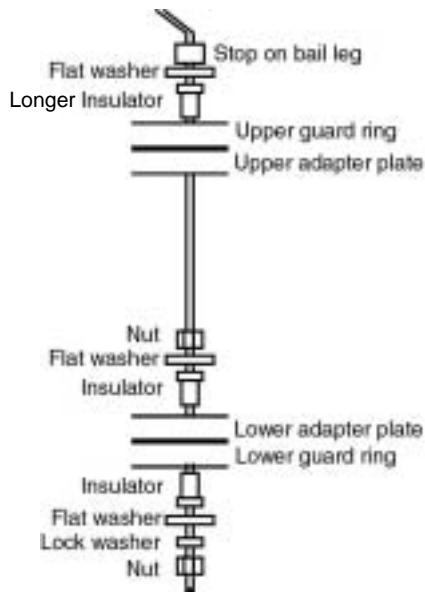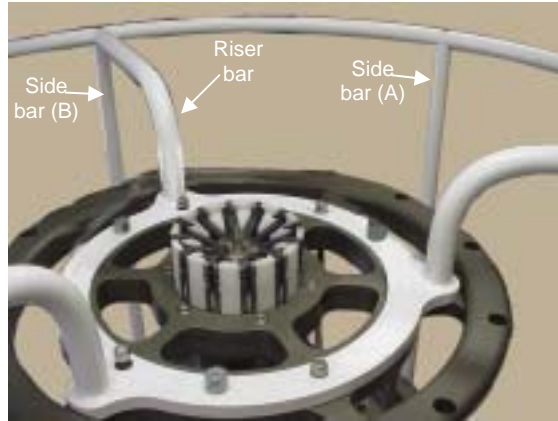

8. The lifting bail is shipped with the hardware installed on it, to show the hardware arrangement. Remove the hardware for now, noting the hardware arrangement for reinstallation.

9. Install the lifting bail:
   A. Install the plastic insulators: two longer insulators in the upper guard ring; two shorter insulators in the lower adapter plate.
   B. Place the $^{3}/_{4}$" flat washers on the upper insulators.
   C. Slide the lifting bail through the flat washers and upper insulators.
   D. Before inserting into the lower insulators, place a $^{3}/_{4}$" nut on each leg of the lifting bail and thread the nuts to within 2.5 cm (1 inch) of the end of the threads. Place a $^{3}/_{4}$" flat washer on each leg, and then insert the bail legs into the lower insulators. Slide the bail into place until the stops above the upper insulators seat.
   E. Install the final 2 shorter insulators over the ends of the bail legs and into the bottom of the lower guard ring.
   F. Secure the bail leg to the lower guard ring with the $^{3}/_{4}$" nuts, flat washers, and split lock washers.
   G. Tighten the nuts above the lower adapter plate until they seat on the insulators.
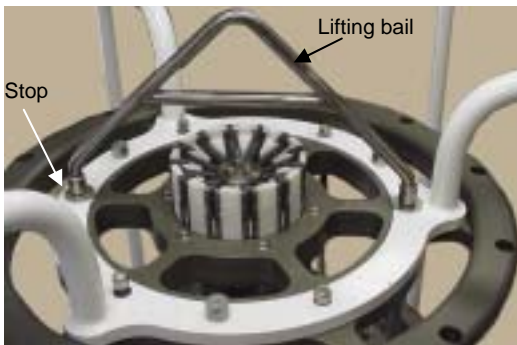
10. Fully tighten all hardware installed in Steps 1 through 9. **Make sure that all threads are protected with Never Seez Blue Moly.**

18

Installing CTD Extension Stand and Mounting SBE 9*plus* CTD

Carousel frame

U-bolt (place Teflon tape over bars before installing)

CTD extension stand

The CTD extension stand is optional, and is used with the full-size SBE 32 when deployed with an SBE 9*plus* CTD. Note that the SBE 9*plus* is mounted horizontally in the extension stand; see *Appendix II: CTD Plumbing* for pump placement and plumbing for a horizontal mount.
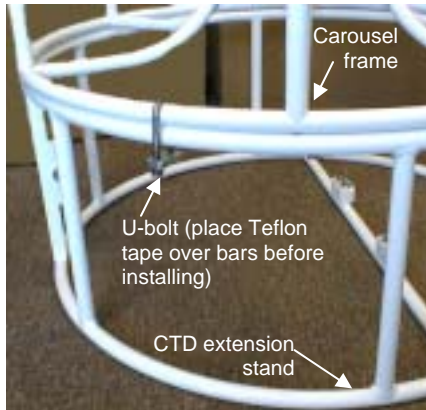
1. Mount the SBE 9*plus* in the extension stand as shown in drawing 40683.

2. Place the Carousel assembly on top of the CTD extension stand.

3. Secure the Carousel assembly to the CTD extension stand at 4 locations using the U-bolts.
    A. Wrap the supplied Teflon tape over the Carousel frame and extension stand at each of the U-bolt locations.
    B. Install the 4 U-bolts and hardware (1 flat washer and 2 lock nuts per U-bolt). **Make sure that all threads are protected with Never Seez Blue Moly.**

Mounting Instruments to Carousel

Notes:
- Sea-Bird can provide a special mounting fixture for vertical mounting in a bottle position.
- See *Appendix II: CTD Plumbing* for pump placement and plumbing configuration for horizontal or vertical mounting.

As described above, the SBE 9*plus* CTD is always mounted horizontally to the Carousel, using the CTD extension stand.

The SBE 19, 19*plus*, or 25 CTD can also be mounted in a horizontal position when used with a full-size SBE 32. These CTDs are mounted vertically in a bottle position on the Carousel when used with the SBE 32C or 32SC.

Additionally, a 90208 Auto Fire Module (AFM) or SBE 17*plus* V2 SEARAM can be mounted vertically in a bottle position.

Mounting Bottles to Carousel

Note:
The SBE 32C and 32SC Carousels are shipped from Sea-Bird with the bottles already mounted.

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

2. Depress the bottle plunger, and rotate the bottle until the bottle plunger engages in the upper adapter plate.

Upper adapter plate

Lower adapter plate

Pin
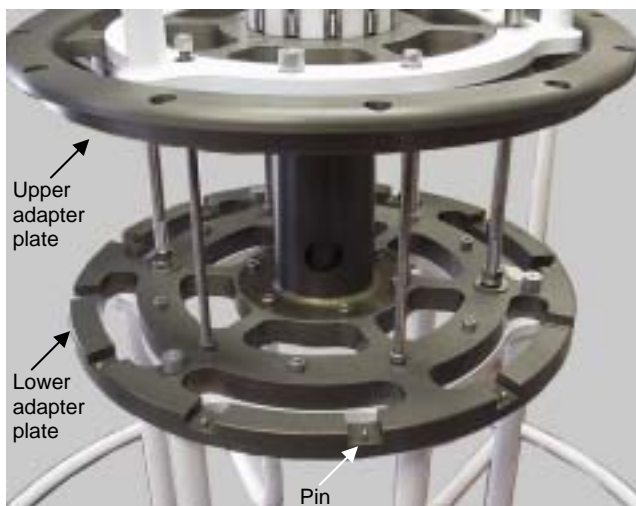
Rigging and Cocking Lanyards

If you order the Carousel and water bottles at the same time from Sea-Bird, Sea-Bird makes and installs the lanyards to fit your system. If not ordered at the same time, see *Appendix I: Making and Rigging Lanyards* for details.

Lanyard Tension Under 25 kg (55 lbs)

1. Unclip the lower lanyard from the middle lanyard.

Middle lanyard

Lower lanyard

2. Cock the release mechanism by pushing against each trigger until it clicks and locks in place.

   Note: In some cases, the trigger may not click in place due to residual magnetic force in the trigger release mechanism. If this happens, pull out on the trigger release with needle nose pliers, and then push against the trigger until it clicks in place.

White plastic trigger release:
- **Push** on trigger release to release (*uncock*) mechanism.
- If trigger will not lock in place due to residual magnetic force, **pull out** on trigger release with needle nose pliers. Then, push trigger until it clicks in place.

Upper lanyard

1 1/2" (3.8 cm)

Thermometer lanyard
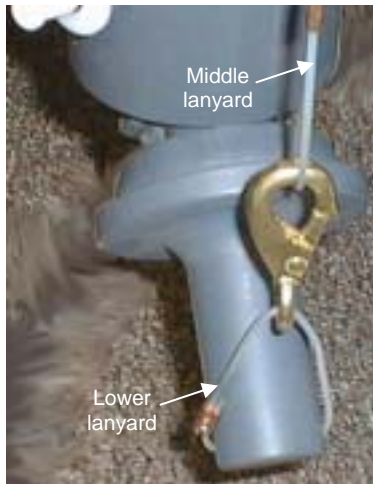
Middle lanyard

Nico-press sleeve
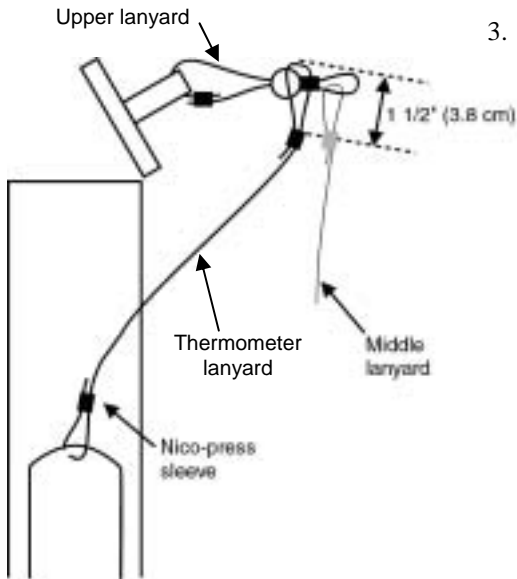
3. If deploying reversing thermometers, rotate the thermometer rack and place the thermometer lanyard loop over the upper lanyard, so that it rests against the upper lanyard ball.

4. Attach the upper lanyard to the trigger hook.
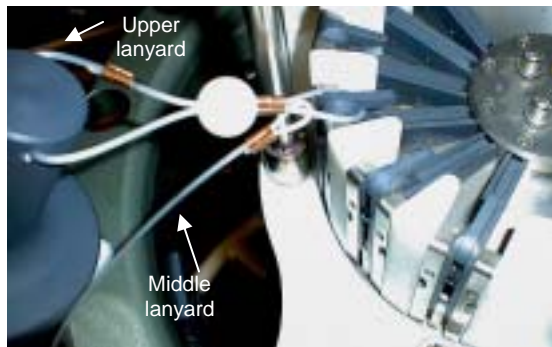
Upper lanyard

Middle lanyard

5. Clip the lower lanyard to the middle lanyard. The end cap handle should angle out away from the Carousel, not in towards the middle of the Carousel. Center the connection on the bottom end cap.
   - If the bottle has a handle, run the middle lanyard through the handle. This will 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, run the middle lanyard through the monofilament - the loop ensures a straighter path for the lanyard and positions the bottom end cap more favorably when it is in the cocked position.

Angling end cap handle away from center of Carousel

Middle lanyard

Lower lanyard

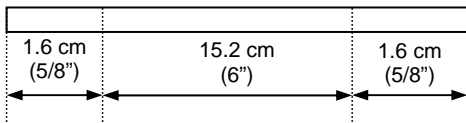**Correct** - connection centered on bottom end cap

**Incorrect** - connection on side of bottom end cap

Running middle lanyard through handle

21

Lanyard Tension Between 25 and 50 kg (55 and 110 lbs)

For water bottles with lanyard tensions in this range, rig the Carousel with a simple *block and tackle* type loop, reducing the tension on the trigger by half.

1.6 cm (5/8")	15.2 cm (6")	1.6 cm (5/8")

1. Cut a lanyard 18 cm (7 ¼ inches) long. Mark it in two places as shown.

2. Thread the lanyard through the pylon as shown. Place a nico-press sleeve on each end of the lanyard, aligning the sleeves with the marks so that there is approximately 15.2 cm (6 inches) of lanyard between the sleeves.

3. Follow the procedure above for a lower tension system, with the following exception: Slide the upper lanyard loop over the high tension rigging and attach the high tension rigging to the trigger hook.

22
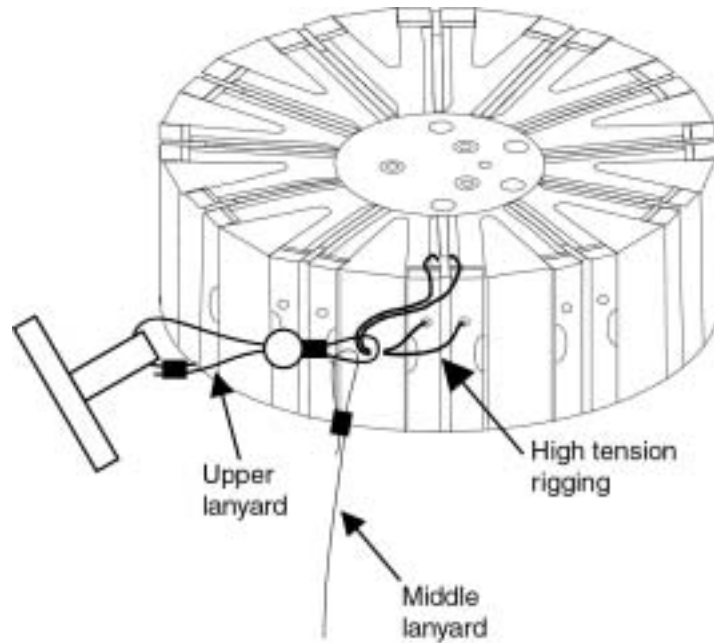
Section 4: Deploying and Operating Carousel

> **Note:**
> Separate software manuals (on CD-ROM) and Help files contain detailed information on installation, setup, and use of Sea-Bird's terminal programs, real-time data acquisition software, and data processing software.

This section includes discussions of:

- Software installation

- Commands to the Carousel

- System wiring, setup, and operation

Software Installation

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

1. Insert the CD in your CD drive.

2. Double click on **Seasoft-Win32.exe**.

3. Follow the dialog box directions to install the software.

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

Communications and Commands

Note:
When controlling the Carousel with the SBE 17*plus* V2, you can manually send these commands to the SBE 17*plus* V2 to test the system.

During normal operation, commands are sent automatically to the Carousel by the system controlling the Carousel's operation. These commands are included here for reference. All the command characters must be upper case (capital letters).

Command sent to Carousel	Decimal Code	Description
#SR	163 211 210	Go to home position (position #1).
#SF	163 211 198	Fire next position (sequential firing).
#SNx	163 211 206 **x**	Fire position **x** (first position is *1*), where **x** is in ASCII. For example: • #SN1 (decimal 163 211 206 177) - fire position 1 • #SN2 (decimal 163 211 206 178) - fire position 2 • #SN< (decimal 163 211 206 188) - fire position 12 • #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 communication 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 replies upon receipt of a reset (go to home position) or bottle fire command:

Reply from Carousel	Description
6 33 6	At home position, next bottle to fire is #1.
6 35 6	Received invalid bottle number.
6 45 6	Did not confirm bottle fire.
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

System Setup and Operation

System setup and operation is summarized below for each of the four methods of controlling the Carousel:

- SBE 11*plus* Deck Unit (real-time operation with SBE 9*plus* CTD)
- SBE 33 Deck Unit (real-time operation with SBE 19, 19*plus*, or 25 CTD)
- SBE 17*plus* V2 SEARAM (autonomous operation with SBE 9*plus* CTD)
- 90208 Auto Fire Module (autonomous operation with SBE 19, 19*plus*, or 25 CTD, SBE 50 Pressure Sensor, or with no CTD)

See the controller manual for detailed setup and operation instructions.

SBE 11*plus* Deck Unit

Wiring:

- Carousel 6-pin to SBE 9*plus* JT7
- SBE 9*plus* JT1 to *Sea Cable* on SBE 11*plus* Deck Unit
- See SBE 9*plus* manual for connections to auxiliary sensors, and see SBE 11*plus* manual for connections to computer and auxiliary equipment

Setup and Operation in SEASAVE:

1. In the Configure menu, select *Water Sampler Configuration*. Set the total number of bottles to be closed, water sampler type (SBE Carousel), firing sequence, and bottle positions (for table driven firing sequence).

2. (If using a NMEA navigation device) In the Configure menu, select *NMEA [Lat/Lon] Interface*. Select how to store the NMEA Interface data.

3. Perform any other desired setup in the Configure and ScreenDisplay menus.

4. In the RealTime Data menu, select *Start Acquisition*.
   A. Select the CTD configuration (.con) file.
   B. Enter the desired filename and location for the data file.
   C. Configure the computer COM ports:
      - *CTD Data COMM Port* connects to SBE 11*plus Interface (*RS-232 or IEEE-488)
      - *Deck Unit Modem Comm Port* connects to SBE 11*plus Modem Channel*
      - *CTD Data Baud Rate* is the baud rate that the SBE 11*plus* uses to transmit CTD data to the computer. Enter a value that matches your SBE 11*plus*. In older units (SBE 11 and 11*plus*), the baud is set by a dip switch in the deck unit to 19200 (default) or 9600. In newer units (SBE 11*plus* V2), the baud is always 19200.
   D. Click *Start Acquire*.

5. To fire a bottle from SEASAVE:
   - Press Ctrl F3, **or**
   - In the View menu, select *Fire Bottle Control*. The *Bottle Fire* dialog box appears (you can leave this open throughout the cast). Click *Fire Bottle*.

6. To fire a bottle from the SBE 11*plus* front panel:
   A. Press *Home/Arm*.
   B. Press *Fire*. Carousel fires bottle 1, and then fires in sequential order each time that *Fire* is pressed.

Note:
The .con file defines the CTD - auxiliary sensors integrated with the instrument, and channels, serial numbers, and calibration dates and coefficients for all integrated sensors (conductivity, temperature, pressure, and auxiliary sensors). Additionally, the .con file defines if optional NMEA Interface data is to be appended to the CTD data. SEASAVE (and our data processing software) uses the information in the .con file to interpret and process the raw data.
If the .con file does not match the actual instrument configuration, the software will not be able to interpret and process data correctly.

SBE 33 Deck Unit

Note:
The CTD optical isolation feature
(SBE 25 - standard; SBE 19 -
optional) must be disabled when
the CTD is used with the Carousel:
1. Open the CTD main housing.
2. Solder a jumper wire across the
   neon bulb on the *above board*.
See the CTD manual for details on
accessing the *above board* and for
the board schematic.
**This note is not applicable to the
SBE 19*plus*.**

Wiring:

- Carousel 2-pin to SBE 33
- Carousel 4-pin to CTD data I/O connector
- See CTD manual for connections to auxiliary sensors, and see
  SBE 33 manual for connections to computer and auxiliary equipment

Setup and Operation in SEASAVE:

1. In the Configure menu, select *Water Sampler Configuration*. Set the total
   number of bottles to be closed, water sampler type (SBE Carousel), firing
   sequence, and bottle positions (for table driven firing sequence).

2. (If using a NMEA navigation device) In the Configure menu, select
   NMEA [Lat/Lon] Interface. Select how to store the NMEA Interface data.

3. Perform any other desired setup in the Configure and
   ScreenDisplay menus.

4. In the RealTime Data menu, select *Start Acquisition*.

   A. Select the CTD configuration (.con) file.
   B. Enter the desired filename and location for the data file.
   C. Configure the computer COM ports.
      CTD Data COMM Port connects to SBE 33 *Serial Data*;
      Deck Unit Modem Comm Port connects to SBE 33 *Carousel Data*.
      Baud Rate between SBE 33 and Computer and *Baud Rate between
      SBE 32 and CTD* must agree with CTD setup and SBE 33 dip
      switch setting.
   D. Click *Start Acquire*.

5. If the CTD is not already on, SEASAVE prompts you to turn on the
   CTD's magnetic switch.

6. To fire a bottle from SEASAVE:

   - Press Ctrl F3, **or**
   - In the View menu, select *Fire Bottle Control*. The *Bottle Fire* dialog
     box appears (you can leave this open throughout the cast).
     Click *Fire Bottle*.

7. To fire a bottle from the SBE 33 front panel:

   A. Set the *Bottle to Fire* switch to 00 and then press *Reset*.
   B. To fire in random order, set the *Bottle to Fire* switch to the desired
      bottle and press *Fire*.
   C. To fire in sequential order, set the *Bottle to Fire* switch to 99 before
      firing the first bottle. Press *Fire*. Carousel fires bottle 1, and then fires
      in sequential order each time that *Fire* is pressed.

Note:
The .con file defines the CTD -
auxiliary sensors integrated with the
instrument, and channels, serial
numbers, and calibration dates and
coefficients for all integrated sensors
(conductivity, temperature, pressure,
and auxiliary sensors). Additionally,
the .con file defines if optional NMEA
Interface data is to be appended to
the CTD data. SEASAVE (and our
data processing software) uses the
information in the .con file to interpret
and process the raw data.
**If the .con file does not match
the actual instrument
configuration, the software will
not be able to interpret and
process data correctly.**

SBE 17*plus* V2 SEARAM

The SEARAM fires bottles on upcast only, at predefined pressures.

Wiring:

- Carousel 6-pin to SBE 17*plus* V2 6-pin connector that is directly across from switch plunger
- SBE 17*plus* V2 other 6-pin connector to SBE 9*plus*
- See SBE 9*plus* manual for connections to auxiliary sensors

Setup and Operation:

1. Connect the SEARAM to the computer with the data I/O cable.
   In SeatermAF:
   A. In the *Configure* menu, select the SBE 17*plus*.
      - Set communication parameters.
      - Set auto fire parameters and select/define the CTD configuration (.con) file.
   B. Click the Connect button.
   C. Set the time and date.
   D. Set memory parameters; note that the definition of auxiliary sensor channels must match the .con file.
   E. Click the Program button to send auto fire parameters to the SEARAM.
   F. Click the Arm button to enable the SEARAM to fire bottles.

2. Replace the I/O cable with the dummy plug and locking sleeve.

3. Push in the SEARAM's switch plunger to start logging.

> **Note:**
> The .con file defines the CTD - auxiliary sensors integrated with the instrument, and channels, serial numbers, and calibration dates and coefficients for all integrated sensors (conductivity, temperature, pressure and auxiliary sensors). The SEARAM uses the pressure sensor coefficients to calculate pressure from the CTD pressure frequency data. These pressures are used to determine when to close bottles, based on user-input bottle position and closure parameters. **If the .con file does not match the actual instrument configuration, the SEARAM will not be able to interpret and process data correctly.**

90208 Auto Fire Module (AFM)

The AFM closes bottles on upcast, on downcast, when stationary, or on elapsed time.

Wiring:

- Carousel 6-pin to AFM JB2 6-pin connector
- AFM JB1 to CTD or SBE 50 data I/O connector
- See CTD manual for connections to auxiliary sensors

Setup and Operation:

1. Connect the AFM to the computer with the data I/O cable. In SeatermAF:
   A. In the *Configure* menu, select the AFM with the applicable instrument.
      - Set communication parameters.
      - Set auto fire parameters and (if applicable) select/define the CTD configuration (.con) file.
   B. Click the Connect AFM button to communicate with the AFM.
   C. Set the date and time.
   D. Click the Program button to send auto fire parameters to the AFM.
   E. Click the Arm button to enable the AFM to fire bottles.

2. Replace the I/O cable with the dummy plug and locking sleeve.

3. Turn on the CTD's magnetic switch to start logging.

> **Note:**
> The .con file defines the CTD - auxiliary sensors integrated with the instrument, and channels, serial numbers, and calibration dates and coefficients for all integrated sensors (conductivity, temperature, pressure, and auxiliary sensors). For the SBE 19 (not 19*plus*) and 25, SeatermAF uses the pressure sensor coefficients to calculate raw pressure sensor output from the user's closure pressure entries in the Configuration Options dialog box. These pressures are used to determine when to close bottles, based on the user-input bottle position and closure parameters. **If the .con file does not match the actual instrument configuration, the AFM will not be able to interpret and process data correctly.**

Recovery

> **WARNING!**
> **Pressure housings may flood under pressure due to dirty or damaged o-rings, or other failed seals, causing highly compressed air to be trapped inside. If this happens, a potentially life-threatening explosion can occur when the instrument is brought to the surface.**
> **If the Carousel, CTD, or auxiliary equipment/sensors are unresponsive to commands or shows other signs of flooding or damage, carefully secure the instrument in a location away from people until it has been determined that abnormal internal pressure does not exist.**
> **Contact Sea-Bird for assistance with procedures for safely relieving internal pressure.**

Rinse the Carousel, CTD, and auxiliary equipment and sensors with fresh water.

Processing Data

SBE Data Processing can convert all of the raw data as well as create a water bottle (.ros) file from the raw data file. The .ros water bottle file contains data for the scans associated with each bottle firing as well as a user-selected range of scans before and after each bottle firing. Scan range data for creation of the water bottle file typically comes from one of the following sources:

> **Note:**
> If you use SEASAVE to acquire real-time data from an SBE 9*plus* CTD used with an SBE 11*plus* Deck Unit, both a .bl file and scans marked with a bottle confirm bit are available as the source for creation of the water bottle file.

- Bottle log (.bl) file – if you used SEASAVE to acquire real-time data. SEASAVE creates the .bl file. Each time a bottle fire confirmation is received, the bottle sequence number, position, date, time, and beginning and ending scan numbers (1.5-second duration for each bottle) are written to the .bl file.

- Scans marked with a bottle confirm bit in the data file – if you used the SBE 9*plus* with an SBE 11*plus* Deck Unit or with the SBE 17*plus* V2 SEARAM. The bottle confirm bit in the data file is set for all scans within a 1.5-second duration after a bottle firing confirmation is received from the Carousel.

- Auto fire module (.afm) file – if you used the AFM. The .afm file contains five scans of CTD or SBE 50 data recorded by the AFM for each bottle firing.

See the SBE Data Processing manual and/or Help files for data processing details.

Section 5: Routine Maintenance

This section reviews corrosion precautions, cleaning, connector mating, and removal of the latch assembly and center pylon.

Corrosion Precautions/Cleaning

Rinse the entire Carousel with fresh water after each cast.

The Carousel's trigger mechanism is titanium. The titanium is coated with Tiodizing; this product is similar to anodizing aluminum. **The Tiodized surface is water lubricating and should never be oiled with petroleum or silicon-based products**. Rinse the trigger mechanism with fresh water after each cast and clean it periodically with warm, soapy water. If the mechanism sticks after cleaning, remove the latch assembly and immerse the assembly in warm, soapy water. See *Removing / Replacing Latch Assembly*.

> **CAUTION:**
> **Do not use WD-40** or other petroleum-based lubricants, as they will damage the trigger mechanism.

Large zinc anodes provide corrosion protection. Check the anodes occasionally to verify that they are securely fastened and have not eroded:
- SBE 32C and 32SC - two each in lower adapter plate, lower guard ring, upper adapter plate, upper guard ring; one on pylon/hub assembly
- SBE 32 (full-size)
  12-bottle size - three each on lower guard ring and upper guard ring; two on lower adapter plate; one on pylon/hub assembly
  24-bottle size - three each in lower adapter plate, lower guard ring, upper adapter plate, upper guard ring; one on pylon/hub assembly
- CTD extension stand (if used) - two

> **Note:**
> The anti-seize compound is molybdenum disulfide and pure nickel flake in pressure-resistant premium grade grease, formulated *without* graphite, lead, or copper. See Bostik's website (http://www.bostik.com) for the most up-to-date specifications; a copy of the current product data sheet is in *Appendix III* for your convenience.

All screws that are exposed to seawater have been generously lubricated with an anti-seize compound, Never-Seez Blue Moly (available through marine hardware stores). When disassembling/reassembling the Carousel, re-lubricate these screws with Blue Moly or equivalent. This compound is electrically conductive, so be careful not to get it on circuit boards.
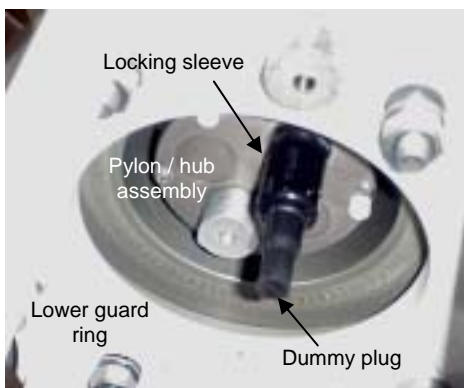
Connector Mating and Maintenance

> **CAUTION:**
> **Do not use WD-40** or other petroleum-based lubricants, as they will damage the connectors.

Locking sleeve
Pylon / hub assembly
Lower guard ring
Dummy plug

Mated connectors do not require periodic disassembly or other attention. Inspect connectors that are unmated for signs of corrosion product around the pins. When remating:
1. Lightly lubricate the inside of the dummy plug/cable connector with silicone grease (DC-4 or equivalent).
2. **Standard Connector** - Install the plug/cable connector, aligning the raised bump on the side of the plug/cable connector with the large pin (pin 1 - ground) on the Carousel. Remove any trapped air by *burping* or gently squeezing the plug/connector near the top and moving your fingers toward the end cap.   **OR**
   MCBH Connector – Install the plug/cable connector, aligning the pins.
3. Place the locking sleeve over the plug/cable connector. Tighten the locking sleeve finger tight only. **Do not overtighten the locking sleeve and do not use a wrench or pliers.**

Verify that a cable or dummy plug is installed for each connector on the system before deployment.
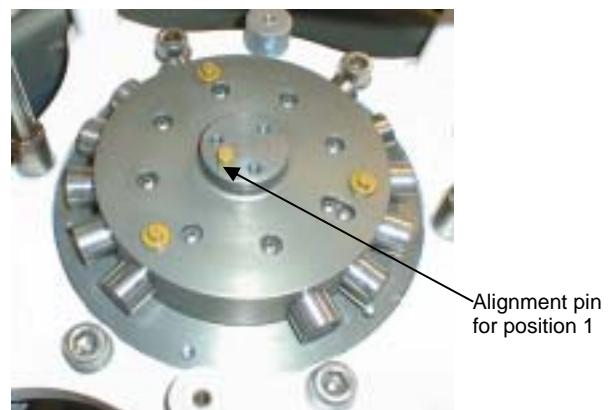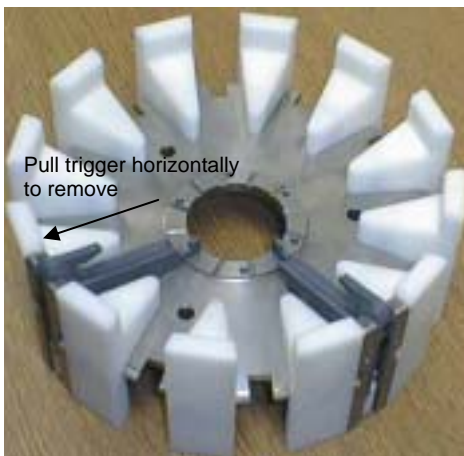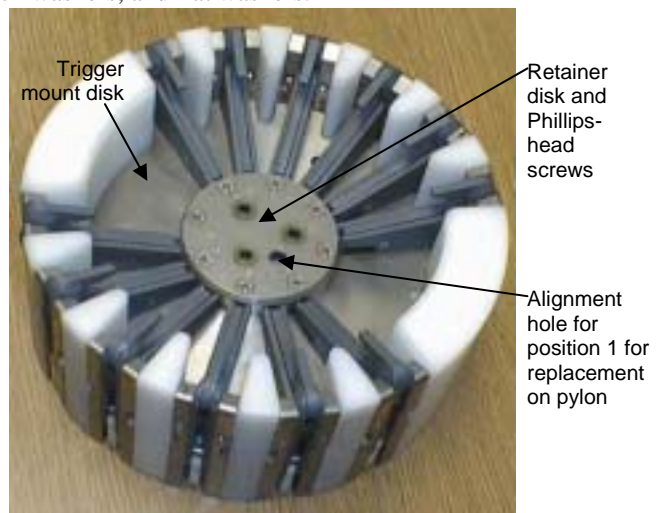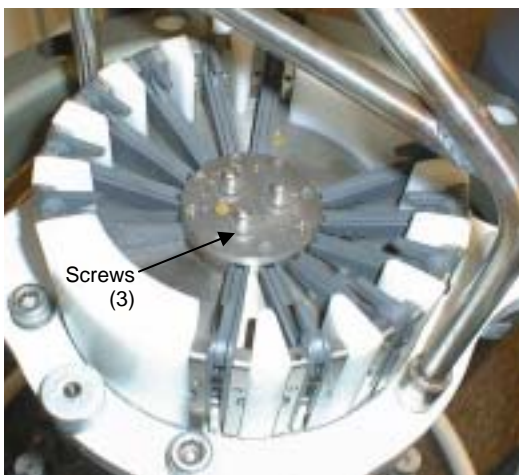
29

Removing/Replacing Latch Assembly

Removing Latch Assembly

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

2. Remove individual triggers if desired:
   A. Mark the location of trigger 1 (from the retainer disk) on the trigger mount disk to aid in reassembly.
   B. Remove the Phillips-head screws (eight for 32C and 32SC, six for full-size 32). Lift the retainer disk from the top of the latch assembly.
   C. Pull the desired trigger(s) horizontally from the trigger mount disk. Mark the trigger(s) to aid in reassembly.

Replacing Latch Assembly

1. Replace the triggers on the trigger mount disk.

2. Place the retainer disk on the triggers, aligning the mark you made for trigger 1 on the trigger mount disk with trigger 1 on the retainer disk. Verify that the triggers are properly seated in the grooves and that the disk is flat. Reinstall the Phillips-head screws loosely. Tighten the screws, working in a diagonal pattern to ensure the disk remains properly seated.

3. Line up the latch assembly alignment hole with the pylon alignment pin. Seat the latch assembly on the pylon. Reinstall the three socket hex head screws, lock washers, and flat washers.

Screws (3)

Trigger mount disk

Retainer disk and Phillips-head screws

Alignment hole for position 1 for replacement on pylon

Pull trigger horizontally to remove

Alignment pin for position 1

Removing Center Pylon

CAUTION:
Disconnect cables from the connector end cap before disassembly, to avoid breaking instruments.

Note:
There are plastic insulators on the underside of the following connections:
- Lower guard ring/adapter plate/hub assembly - for lifting bail
- Top flange of hub assembly - for pylon

Verify that the insulators have not fallen out before reinstalling the pylon and lifting bail.

1. Remove the lifting bail.
   A. Remove the lifting bail hardware from under the lower guard ring.
   B. Begin to pull the lifting bail up, until it is above the lower guard ring/adapter plate/hub assembly connection.
   C. Remove the hardware from the legs of the lifting bail.
   D. Pull the lifting bail out of the upper guard ring.

2. Remove the six socket ¼" hex head cap screws, lock washers, and flat washers from the underside of the top flange of the pylon / hub assembly. Pull the latch assembly with the pylon up and out of the Carousel frame.
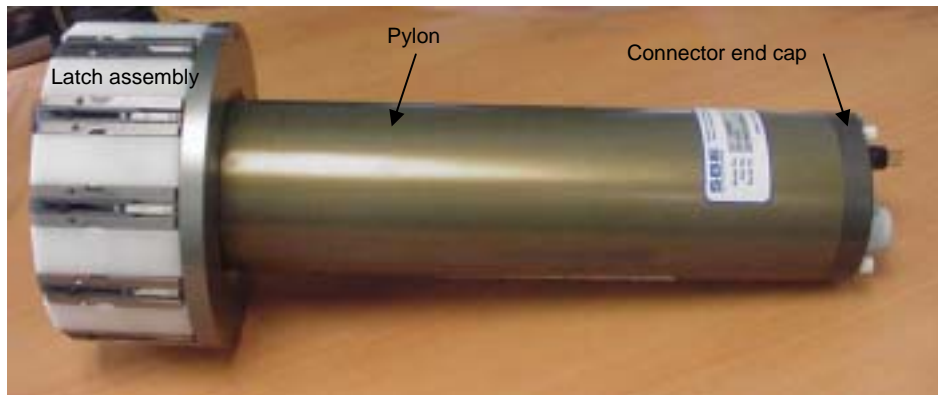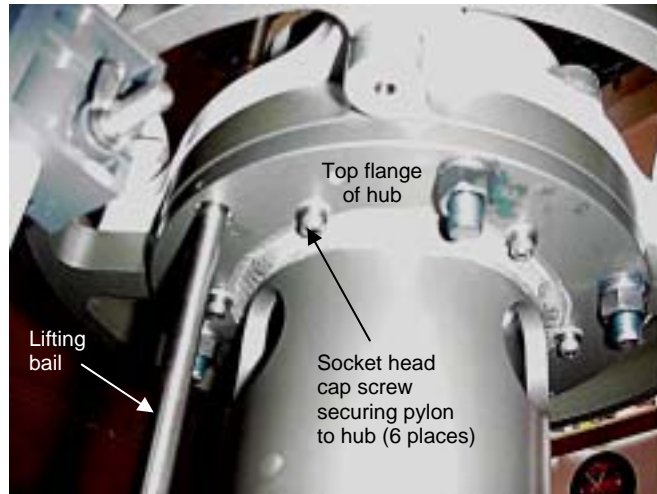
Glossary

PCB – Printed Circuit Board.

SBE Data Processing – Sea-Bird's Win 95/98/NT/2000/XP data processing software, which calculates temperature, conductivity, pressure, and auxiliary sensor data, and derives variables such as salinity and sound velocity.

Scan – One data sample containing temperature, conductivity, pressure, and optional auxiliary inputs.

SEASAVE – Sea-Bird's Win 95/98/NT/2000/XP software used to acquire, convert, and display real-time or archived raw data.

SEASOFT-DOS – Sea-Bird's complete DOS software package, which includes software for communication, real-time data acquisition, and data analysis and display.

SEASOFT-Win32– Sea-Bird's complete Win 95/98/NT/2000/XP software package, which includes software for communication, real-time data acquisition, and data analysis and display. SEASOFT-Win32 includes **SEATERM**, **SeatermAF**, **SEASAVE**, **SBE Data Processing**, and Plot39.

SEATERM – Sea-Bird's Win 95/98/NT/2000/XP terminal program used to communicate with the SBE 11*plus* or 33 Deck Unit to set up the instruments.

SeatermAF – Sea-Bird's Win 95/98/NT/2000/XP software used to communicate with the SBE 17*plus* V2, or with the AFM and a CTD (SBE 19, 19*plus*, or 25) or SBE 50 Pressure Sensor connected to the AFM to set up the instruments.

Appendix I: Making and Rigging Lanyards

Note:
Lanyard making and rigging directions in this Appendix are for a bottle tension less than 25 kg (55 lbs). If the tension is more, see *Lanyard Rigging and Cocking* in *Section 3: Preparing Carousel for Deployment* for rigging modifications before proceeding.

Lanyards are made from heavy-weight nylon monofilament, 2 mm (0.080 inch) diameter. Monofilament used for gasoline-powered line trimmers (*weed eaters*) is suitable and readily available at most home and garden stores.

Lanyard loops are made with crimped copper sleeves (nico-press type). Available from Sea-Bird or from industrial suppliers, the copper sleeves can be installed with pliers made for crimping on soldered electrical connections. If copper sleeves or similar products are unavailable, the monofilament may be knotted; take care that there are no loose ends or large knots that may jam or hang up and hinder bottle closure.

To cock the lanyards in preparation for deployment, see *Lanyard Rigging and Cocking* in *Section 3: Preparing Carousel for Deployment.*

Lower Lanyard

1. Cut a lanyard and mark in two places as shown.
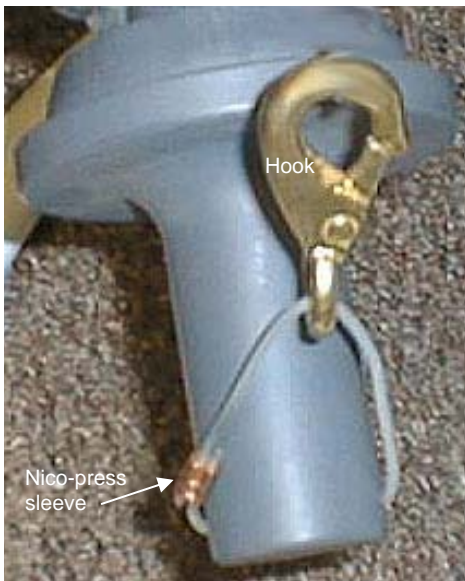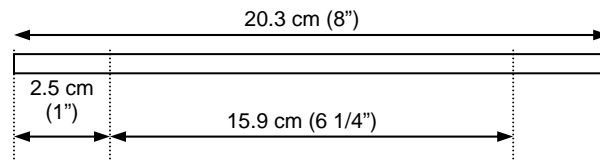
2. Feed the lanyard through the hole in the bottom end cap.

3. Thread the lanyard through the hole in a brass snap hook.

4. Feed one end of the lanyard through the nico-press sleeve. Feed the other end of the lanyard through the sleeve from the opposite direction. Align the marks on one side of the sleeve.

5. Crimp the sleeve in two places.

6. Cut excess lanyard material next to the sleeve at a 45-degree angle to make a smooth termination.

7. 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 help the lanyard take the desired *set*.
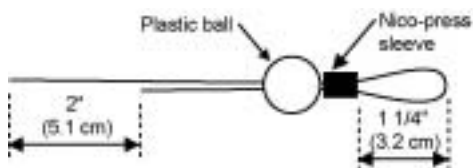

33
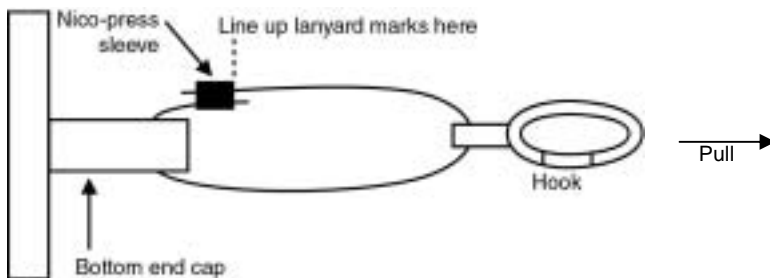
Upper Lanyard

The overall lanyard length is dependent on the bottle type and size and the size of the Carousel. Some trial and error will be needed to determine the correct length. General directions follow.

1. Cut a lanyard and mark in two places as shown.
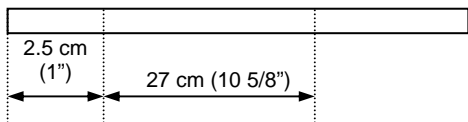
2. Feed both ends of the lanyard through one end of a nico-press sleeve, leaving a loop (this loop will hook onto the pylon for rigging). Adjust the lanyard ends so that one end hangs below the other by 5.1 cm (2 inches). Adjust the nico-press sleeve position so that the loop measures 3.2 cm (1 ¼ inches) from the end of the sleeve to the end of the loop. **Do not crimp the sleeve**.

3. The plastic lanyard ball has a hole drilled through it; the opening on one side is slightly larger than the other. Feed both ends of the lanyard through the larger hole and work the ball up on the lanyard until it rests against the nico-press sleeve.
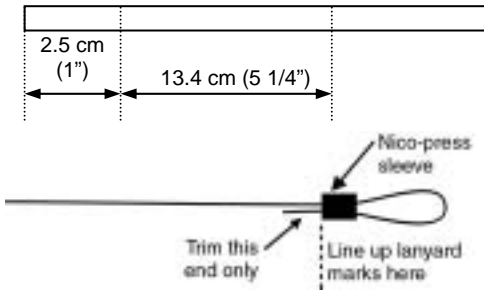
4. Feed the longer end of the lanyard through the hole in the top end cap.
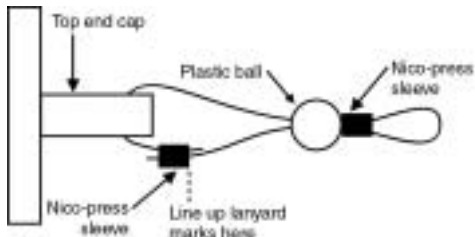
5. Feed the ends of the lanyard through the nico-press sleeve in opposite directions. Align the marks on one side of the sleeve. Crimp this sleeve only; **do not crimp the other sleeve yet**. Cut excess lanyard material next to the sleeve at a 45-degree angle to make a smooth termination.

6. Adjust the ball and other sleeve so that the tension is taken up evenly by both legs of the lanyard. Crimp the sleeve now.

7. Test the assembly by placing the lanyard loop over the appropriate trigger hook. The end cap should be held in the correct *cocked* position. If not, remake the lanyard, adjusting measurements as required.
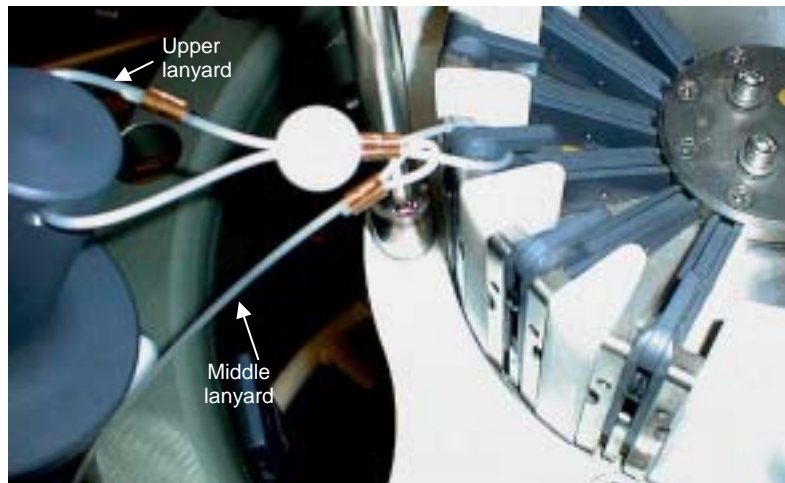
Middle Lanyard

The middle lanyard connects the upper and lower lanyards. The overall lanyard length is dependent on the bottle size. Some trial and error will be needed to determine the correct length. General directions follow.

1. Cut a lanyard approximately 31 cm (12 inches) longer than the bottle. Mark it in two places as shown.

2. Feed both ends of the lanyard through one end of a nico-press sleeve, leaving a loop (loop will hook onto the bottom end cap hook). Align the marks on the side of the sleeve opposite the loop. Crimp the sleeve. Cut excess lanyard material next to the sleeve at a 45-degree angle to make a smooth termination.

3. Place the upper lanyard's loop on the trigger hook so that it is in its *cocked* position. Place a 5.1 cm (2 inch) wide wooden spacer in the top bottle mouth for safety.

4. Place the other wooden spacer in the bottom bottle mouth. The end cap handle should angle out away from the Carousel, not in towards the middle of the Carousel.

5. Clip the middle lanyard loop into the lower lanyard snap hook.

6. If the bottle has a handle, run the end of the middle lanyard through the handle. This will prevent the loss of either end cap in the event that the rubber tubing between the two end caps breaks.

7. Verify that the bottle end caps are cocked at the correct angle.

8. Thread the end of the middle lanyard through a nico-press sleeve.

9. Thread the end of the middle lanyard through the loop on the upper lanyard. Bring the end of the middle lanyard back through the nico-press sleeve, capturing the loop in the upper lanyard.

10. Adjust the middle lanyard length so that it takes up the tension on the bottom end cap. Adjust the nico-press sleeve position so that the upper loop is approximately 2.5 cm (1 inch) long. Crimp the sleeve. Cut excess lanyard material at a 45-degree angle to make a smooth termination.

11. Remove the wooden spacers. Both the top and bottom end caps should be held in the proper *cocked* position. If they are not, remake the middle lanyard, adjusting measurements as required.

Angling end cap handle away from center of Carousel

35

Reversing Thermometer Lanyard

The reversing thermometer lanyard attaches to the upper lanyard. Overall lanyard length is dependent on the bottle size and the type of thermometer. Some trial and error is needed to determine the correct length. General directions follow.

1. Place the upper lanyard's loop on the trigger hook so that it is in its *cocked* position. Place a 5.1 cm (2 inch) wide wooden spacer in the bottle mouth for safety.

2. Measure the distance from the hole in the reversing thermometer to the ball on the upper lanyard. Add approximately 15.2 cm (6 inch) to this length and cut a piece of lanyard.

3. Holding the reversing thermometer in the *cocked* position, thread one end of the lanyard through a nico-press sleeve, through the top hole in the reversing thermometer, and back through the nico-press sleeve. Adjust the sleeve until the loop fits snugly around the reversing thermometer hole. Crimp the sleeve. Cut excess lanyard material next to the sleeve at a 45-degree angle to make a smooth termination.

4. Run the other end of the lanyard through a nico-press sleeve, **around** the upper lanyard loop (**do not go *through* the loop**), and back through the nico-press sleeve. Adjust the lanyard length until all the slack is taken out of the lanyard and the loop takes up tension on the upper lanyard ball. Adjust the nico-press sleeve position so that the loop is approximately 3.8 cm (1.5 inches) long. Crimp the sleeve. Cut excess lanyard material next to the sleeve at a 45-degree angle to make a smooth termination.

5. With the wooden spacer still in place for safety, release the trigger hook by pushing on the white plastic release. The reversing thermometer lanyard should fall away from the upper lanyard and the thermometer should spin to its *reading* position.

Note:
Once the bottle associated with a reversing thermometer has fired, the reversing thermometer lanyard is free and could potentially interfere with the proper deployment of another bottle position. Depending on thermometer and bottle type, devise a method to *capture* the reversing thermometer lanyard after the bottle fires using a rubber band or some additional lanyard material.

1 1/2" (3.8 cm)

Middle lanyard

Nico-press sleeve

White plastic trigger release

36
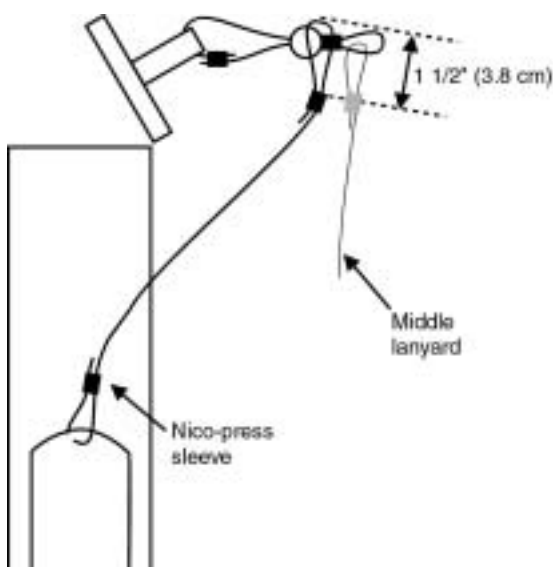
# Appendix II: CTD Plumbing

> **Note:**
> An SBE 19, 19*plus*, or 25 used with the full-size SBE 32 can also be mounted horizontally; they are mounted vertically when used with the SBE 32C or 32SC. The guidelines for the SBE 9*plus* apply to these CTDs as well.

An **SBE 9***plus* CTD that is deployed with the Carousel is mounted in a horizontal position. Pump placement and plumbing for a horizontal mount is different than that for a vertical mount. This appendix covers converting a vertical mount CTD for horizontal use with a Carousel, and converting a horizontal mount CTD from the Carousel to a stand-alone vertical mount.

Horizontal Mount

- Configure the system as follows:
  - ➢ Place the dissolved oxygen (DO) sensor intake above the temperature / conductivity sensors.
  - ➢ Place the pump above the DO sensor.
  - ➢ If the system does not include a DO sensor, connect the tubing from the conductivity cell directly to the pump intake.
  - ➢ Orient the pump with the exhaust outlet *corner* up.
  - ➢ Failure to configure the system in this manner can trap air, preventing the pump from working properly.
- Place a 12 mm (0.5 inch) long piece of the 9.5 mm ID Tygon tubing at the DO sensor intake and exhaust. Slide the larger diameter tubing (13 mm ID) over the smaller diameter tubing to provide tight seals.

The details are shown schematically below and in photos on the next page.
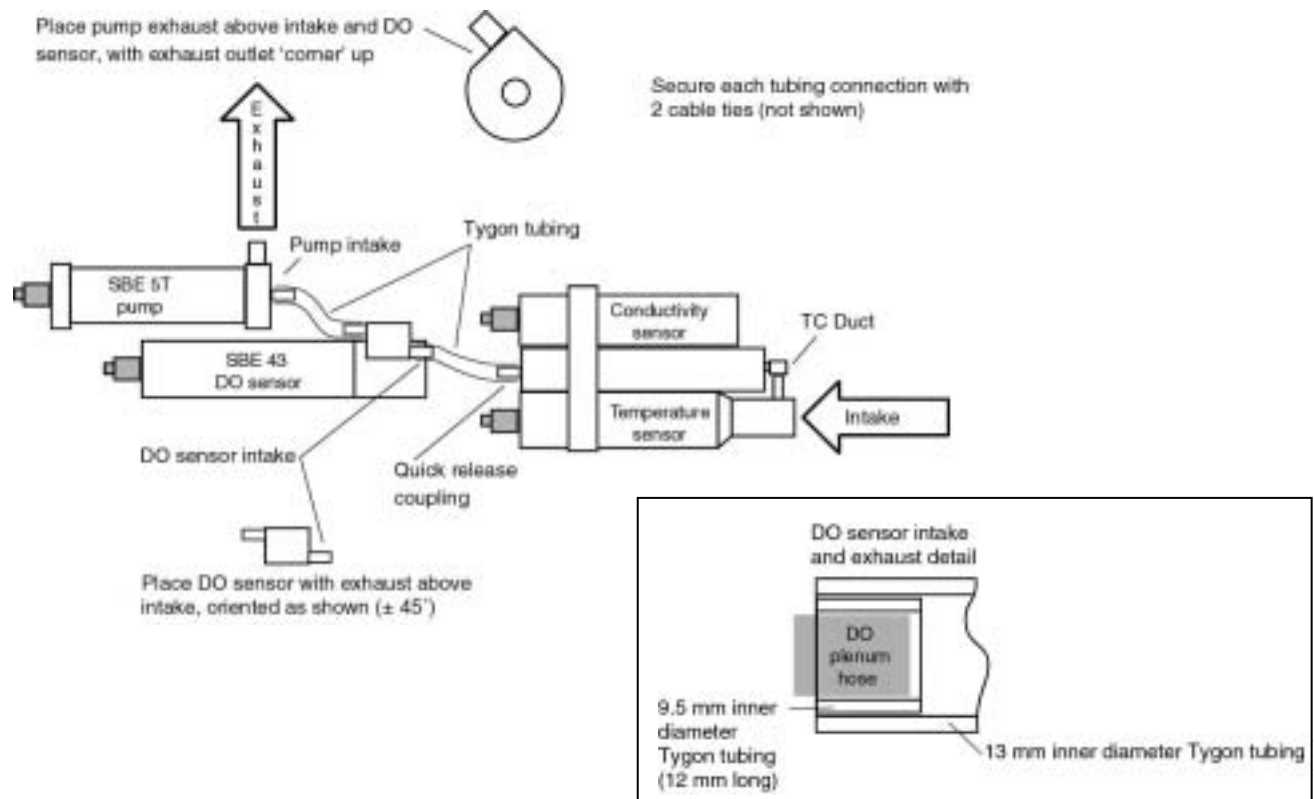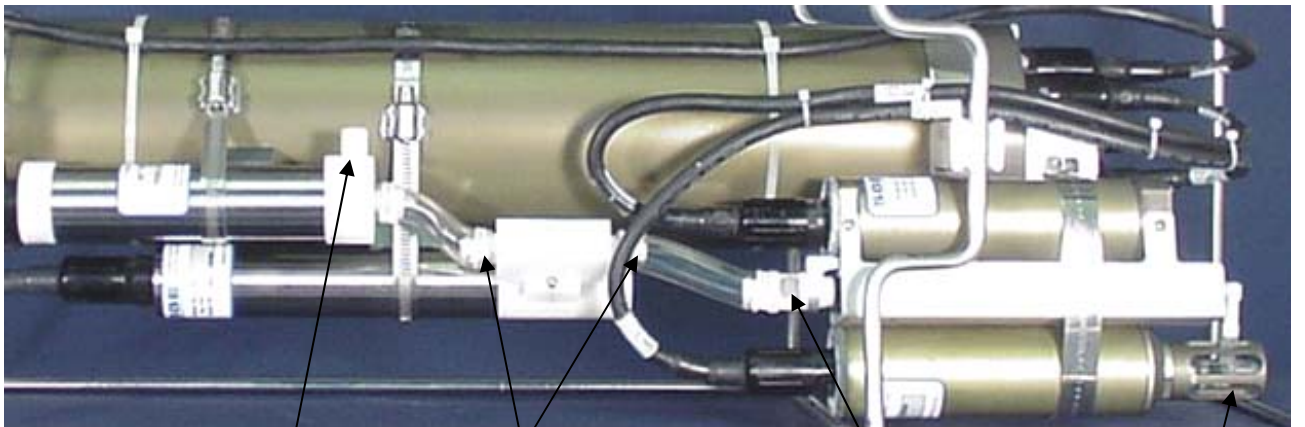
Overall View
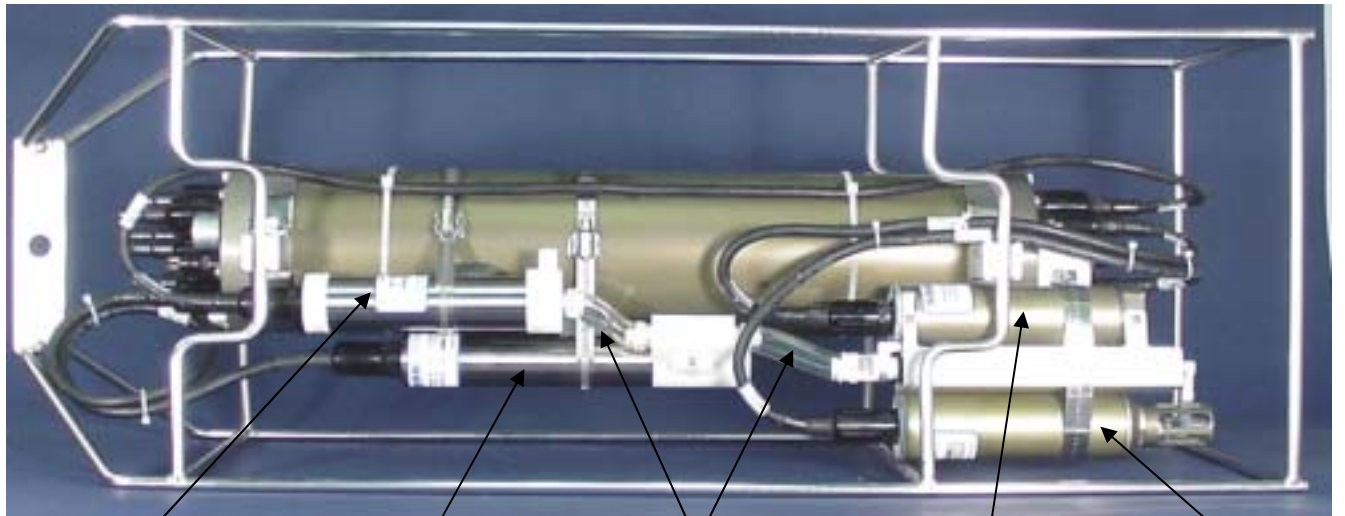
Pump
(vertically above
DO sensor)

DO sensor
(plenum intake vertically
above temperature/
conductivity sensors)

Tygon
tubing

Conductivity sensor

Temperature sensor

Details

Pump exhaust –above DO
sensor and TC Duct intake,
oriented as shown below

Slide larger diameter
Tygon tubing over
smaller diameter
Tygon tubing to provide
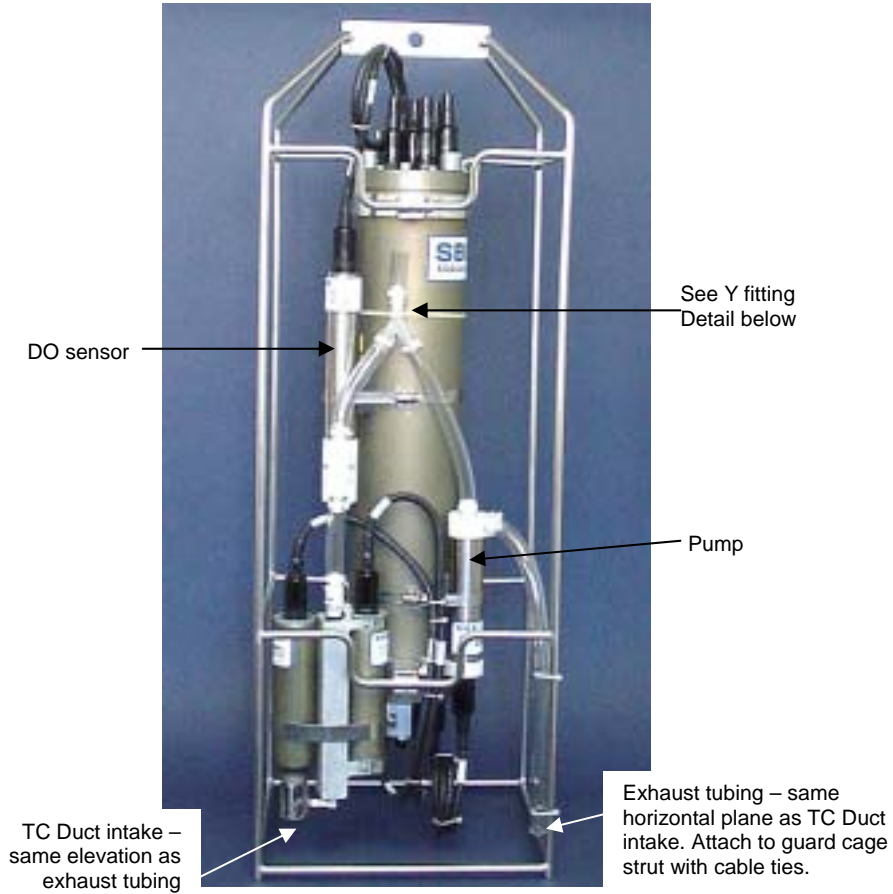tight seal at DO sensor

Quick release
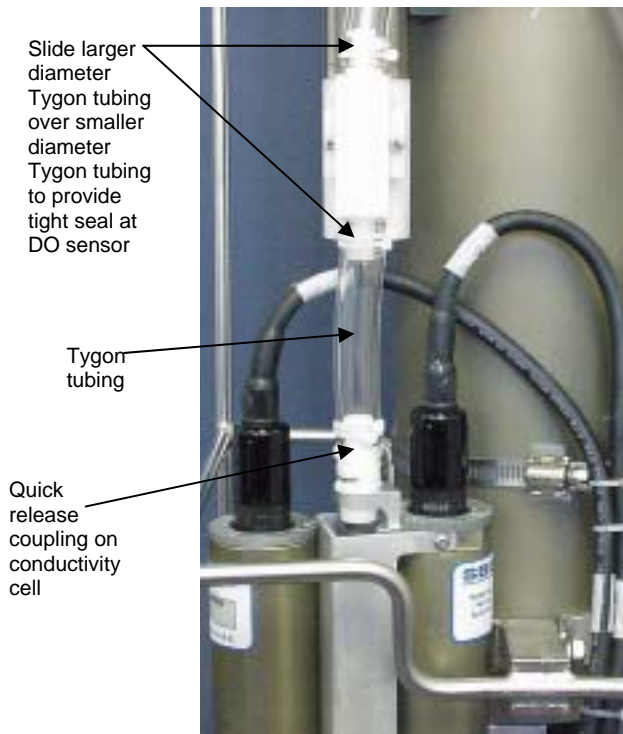coupling on
conductivity cell

TC Duct intake

Orient with *corner*
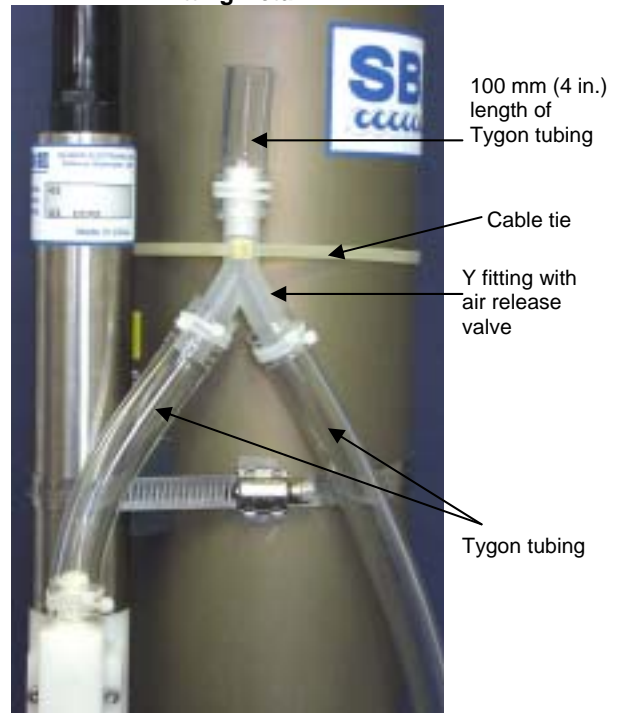vertically above
pump intake

38

Vertical Mount

Note:
Exhaust tubing is usually omitted by Sea-Bird for an SBE 19, 19*plus*, or 25.

- Configure the system as follows:
  - ➢ Place the intake and exhaust on the same horizontal plane. Attach exhaust tubing from the pump to the cage, as shown in the schematic below. Failure to place the exhaust tubing properly can lead to acceleration of water in the plumbing, with resulting errors in conductivity data.
  - ➢ Place the exhaust away from the intake, so the exhaust water is not pulled into the intake. If the exhaust is too close to the intake, it will cause errors in temperature data, because the pump transfers heat to the exhaust water.
  - ➢ If the system does not include a dissolved oxygen (DO) sensor, connect the tubing from the conductivity cell directly to the Y-fitting.
  - ➢ Failure to configure the system in this manner can trap air, preventing the pump from working properly.
- Place a 12 mm (0.5 inch) long piece of the 9.5 mm ID Tygon tubing at the DO sensor intake and exhaust. Slide the larger diameter tubing (13 mm ID) over the smaller diameter tubing to provide tight seals.

The details are shown schematically below and in photos on the next page.

Air release valve detail

0.5 mm (0.02 in.)

Note: Periodically clean air release valve to ensure proper functioning.

39

Overall View

DO sensor

See Y fitting
Detail below

Pump

TC Duct intake –
same elevation as
exhaust tubing

Exhaust tubing – same
horizontal plane as TC Duct
intake. Attach to guard cage
strut with cable ties.

**Temperature/Conductivity to
DO Sensor Detail**

Slide larger
diameter
Tygon tubing
over smaller
diameter
Tygon tubing
to provide
tight seal at
DO sensor

Tygon
tubing

Quick
release
coupling on
conductivity
cell

Y Fitting Detail

100 mm (4 in.)
length of
Tygon tubing

Cable tie

Y fitting with
air release
valve

Tygon tubing

40

Appendix III: Electronics Disassembly/Reassembly

Jackscrew kit

Sea-Bird provides a jackscrew kit with the Carousel, to assist in removal of the connector end cap. The kit contains:

- 2 Allen wrenches
- 3 jackscrews

Disassembly

Connector end cap

Do not remove this screw

Remove plastic hex-head screws and install jackscrews in their place (3 places)

Remove Phillips-head screws and washers (4 places)

1. Remove the pylon from the pylon / hub assembly, as described in *Removing Center Pylon* in *Section 5: Routine Maintenance*.

2. Wipe the outside of the connector end cap and housing dry, being careful to remove any water at the seam between them.

3. Remove the end cap and electronics:

   A. Remove the four Phillips-head screws and washers securing the end cap to the housing. Do not remove the fifth screw, which is an electrical connector.
   B. Remove the three plastic hex-head screws from the end cap using the larger Allen wrench. Insert the three jackscrews in these three holes in the end cap. When you begin to feel resistance, use the smaller Allen wrench to continue turning the screws. Turn each screw 1/2 turn at a time. As you turn the jackscrews, the end cap will push away from the housing. When the end cap is loosened, pull it and the PCB assembly out of the housing.
   C. Remove any water from the O-ring mating surfaces inside the housing with a lint-free cloth or tissue. Be careful to protect the O-rings from damage or contamination.
   D. Disconnect the Molex connector connecting the PCB assembly to the Carousel.
   E. Remove the jackscrews from the end cap.

Reassembly

Note:
Before delivery, a desiccant package is inserted in the housing, and the electronics chamber is filled with dry Argon gas. These measures help prevent condensation. To ensure proper functioning:
1. Install a new desiccant bag each time you open the electronics chamber. If a new bag is not available, see *Application Note 71: Desiccant Use and Regeneration (drying)*.
2. If possible, dry gas backfill each time you open the housing. If you cannot, wait at least 24 hours before redeploying, to allow the desiccant to remove any moisture from the housing.

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

2. Reconnect the Molex connector to the PCB assembly. Verify the connector holds and pins are properly aligned

3. Carefully fit the PCB assembly into the housing, aligning the holes in the end cap and housing.

4. Reinstall the four Phillips-head screws and washers to secure the end cap to the housing.

5. Reinstall the three plastic hex head screws in the end cap.

6. Reinstall the pylon in the hub, and reinstall the lifting bail.

Appendix IV:
Never-Seez Blue Moly Data Sheet

See Bostik's website (http://www.bostik.com) for the most up-to-date specifications.

NEVER·SEEZ®
Anti-Seize & Lubricating Compound

PRODUCT DATA

Blue Moly

Product Description

Never-Seez Blue Moly is a superior lubricating and anti-seize compound formulated to provide maximum parts protection in a wide range of applications. The exclusive combination of molybdenum disulfide and pure nickel flake suspended in a premium-grade grease provides both excellent lubricity and extreme pressure resistance. Blue Moly is especially recommended for those applications in which graphite, lead, and copper are prohibited or undesirable. The addition of special corrosion inhibitors allows Blue Moly to be used in harsh environments.

Product Benefits

- Excellent protection against extreme pressure.
- Excellent temperature protection, up to 1500°F.
- Unique blue color allows for easy visual inspection.
- Contains no graphite, lead or copper, therefore Blue Moly can be used in applications where these are undesirable or prohibited.

Product Applications

- Metal fittings
- Aircraft components
- Valves
- Stainless steel fasteners and slow moving parts
- Automotive engine bolts and body fasteners
- Stainless steel flange and pump bolts
- Chemical processing machinery
- Gasket dressing
- Assembly of dissimilar metals

Limitations

- Never-Seez Blue Moly is not recommended for high speed bearings. Never-Seez Red Bearing Lubricant is suggested for these applications.
- For temperature resistance to 2400°F, use Never-Seez Pure Nickel Special.

Other Anti-Seize Lubricants from Bostik

- Regular Grade
- Nuclear Grade, Nickel Special
- Pure Nickel Special
- High Temp Stainless
- High Temp Stainless, Nuclear Certified
- Marine Grade
- Black Moly Lubricant
- Red Bearing Lubricant
- White Food Grade with PTFE
- High Temperature Bearing Lubricant
- Pipe Compound with Teflon*

Technical Specifications

Color	Blue	
Temperature Range, °F	-150 to 1500	
Solvent Resistance	Excellent in fresh or salt water	
Particle Size, mil	2 maximum	
Specific Gravity	1.14 to 1.20	
		ASTM Test Method
NLGI Grade	1/2	D-217
Worked Penetration (60 Strokes)	300-350	D-217
Flash Point, °F	585	D-92
Dropping Point, °F	560	D-566
Copper Corrosion Test (212°F, 24 hours)	No Corrosion	D-130-83
Coefficient of Friction, k factor	.150	
Coefficient of Friction (4 ball), 167°F	.0824	D-2266
Extreme Pressure, psi	N/A	

Ingredients: Contains a special, high-quality bearing grease with nickel flake, molybdenum sulfide and aluminum flake.

Shelf Life: NEVER-SEEZ Blue Moly does not deteriorate with age when stored unopened at temperatures below 120°F. Quality and performance are guaranteed for five years from the date of manufacture on unopened containers.

Use in accordance with Material Safety Data Sheet.

Ordering Information

BLUE MOLY

STOCK NUMBER	DESCRIPTION	SIZE
NB-160	Flat Top	1 lb.
NB-8	Flat Top	8 lb.
NBBT-8	Brush Top	8 oz.
NPBT-16	Brush Top	1 lb.
NB-42B	Pail	42 lb.

Bostik Findley, Inc.
211 Boston Street
Middleton, MA 1949-2128 U.S.A.
Technical Service: 888-603-8558
FAX: 978-750-7293
http://www.bostikfindley-us.com

Appendix V: Replacement Parts

Part Number	Part	Application Description	Quantity in Carousel
17198*	6-pin AG-206 to 6-pin AG-206 cable, 2.0 m (6.6 ft) long	From Carousel to SBE 9*plus*, SBE 17*plus*, or AFM	1
80591*	2-pin RMG-2FS to 2-pin MS3106A-12S-3P cable, 2.4 m (8 ft) long	From Carousel to SBE 33 (test cable)	1
17292*	4-pin RMG-4FS to 4-pin RMG-4FS, 2.0 m (6.6 ft) long	From Carousel to SBE 19, 19*plus*, or 25	
17043*	Locking sleeve	Locks cable or dummy plug in place	4
17044*	2-pin dummy plug	For when 2-pin connector not used	1
17046*	4-pin dummy plug	For when 4-pin connector not used	1
17047*	6-pin dummy plug	For when 6-pin connector not used	1
50092	SBE 16/19 Jackscrew Kit	For removing connector end cap	1
50133	Pylon spares kit	Spare hardware for pylon	-
50113	SBE 32 spares kit	Spare hardware for full-size, 12-position Carousel (SBE 32)	-
50116	SBE 32 spares kit	Spare hardware for full-size, 24-position Carousel (SBE 32)	-
50142	SBE 32C spares kit	Spare hardware for Compact Carousel (SBE 32C)	-
50195	SBE 32SC spares kit	Spare hardware for Sub-Compact Carousel (SBE 32SC)	-

* For standard Impulse glass-reinforced epoxy bulkhead connectors

Index