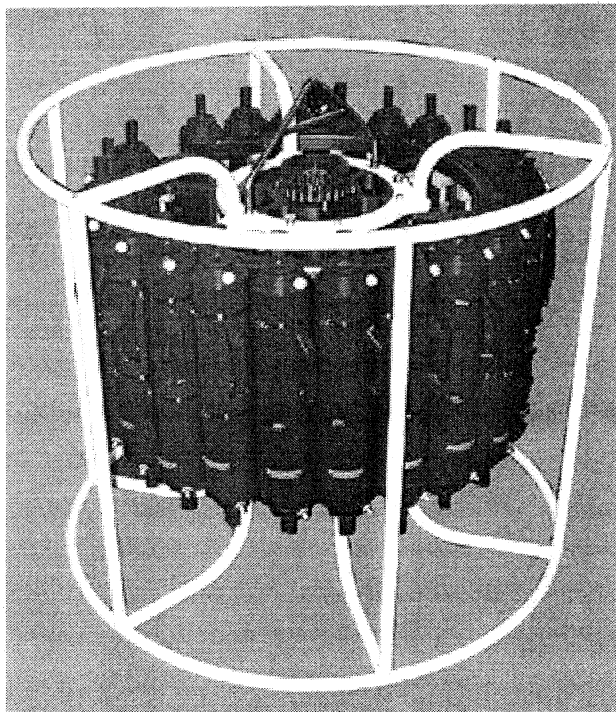


SBE 32 CAROUSEL WATER SAMPLER



Serial Number: 3249707-0645

User Manual, Version 015

Sea-Bird Electronics, Inc.
1808 136th Place NE
Bellevue, Washington 98005 USA
Tel: 425/643-9866
Fax: 425/643-9954

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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.

SEA-BIRD ELECTRONICS, INC. disclaims all product liability risks arising from the use or servicing of this system. SEA-BIRD ELECTRONICS, INC. has no way of controlling the use of this equipment or of choosing the personnel to operate it, and therefore cannot take steps to comply with laws pertaining to product liability, including laws which impose a duty to warn the user of any dangers involved in operating this equipment. Therefore, acceptance of this system by the customer shall be conclusively deemed to include a covenant by the customer to defend, indemnify, and hold SEA-BIRD ELECTRONICS, INC. harmless from all product liability claims arising from the use or servicing of this system.

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WARNING !!

**Do not submerge this instrument (S/N 3249707-0645)
beyond the depth rating of the lowest rated component listed below!**

Main Housing (Aluminum)

6800 meters

SYSTEM CONFIGURATION

11 March 2008

Model SBE 32	S/N 3249707-0645
Instrument Type	SBE 32 Carousel Water Sampler
Pylon Firmware Version	1.0B
Serial Interface Firmware Version	
Number of Bottle Positions	3
Number of Active Latch Positions	12
Bottle Size	5 Liter
Housing	6800 Meter (7075 Aluminum)
Auto-Fire Module	PN 90208, SN 0118

As delivered this SBE 32 Carousel underwater electronics assembly has a single external connector (see drawing 40678 in the SBE 32 manual). In this configuration it contains a SBE 9plus modem channel interface and can be used with the following SBE products:

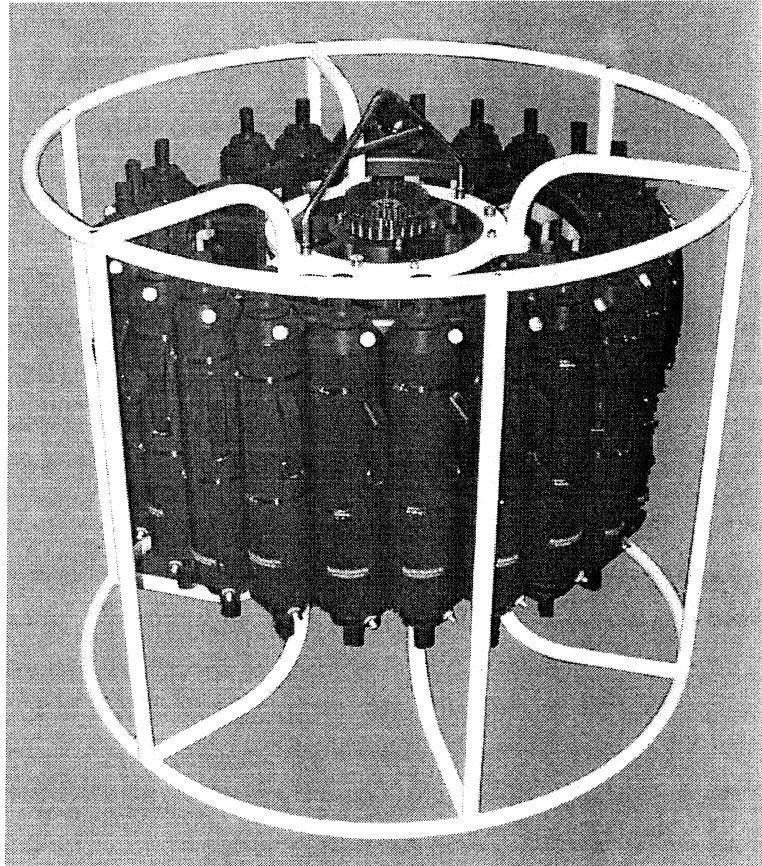
- SBE 911plus CTD system
- SBE 9plus with SBE 17plus V2 SEARAM Recorder & Auto Fire Module (AFM)
- PN 90208 Auto-Fire Module (AFM) with SBE 25 or SBE 19 CTDs

The baud rates for communications between items are:

SBE 32 and SBE9plus or AFM	300 baud, not changeable
----------------------------	--------------------------

Frame Assembly, all 12 and 24 place types	40713b
Frame Parts List, all 12 & 24 place types	40714d
CTD extension stand, CTD installation	40683
hub/adaptor/frame assembly detail	40684b
pylon & lifting bail assy detail (12/1.2-30L, 24/1.2-2.5L)	40685b
pylon & lifting bail assy detail (24/5-12L)	40697c

SBE 32 Carousel Water Sampler



User's Manual

Sea-Bird Electronics, Inc.
1808 136th Place NE
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Manual Version #015, 03/27/07
Firmware Version 1.0b and later
SEASAVE V7 Version 7.10 and later

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SBE 32 CAROUSEL WATER SAMPLER OPERATING AND REPAIR MANUAL

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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
- Auto Fire Module (AFM)

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

Sea-Bird Electronics, Inc.
1808 136th Place Northeast
Bellevue, Washington 98005 USA

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E-mail: seabird@seabird.com
Website: <http://www.seabird.com>

Business hours:
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 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, specifications, dimensions, end cap connectors, and system configuration.

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 latch array's modular construction 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 15 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 3 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 1.2 to 30 liters (specified at time of purchase). Typically, a Carousel built for bottles of one size accommodates bottles of all *smaller* sizes (exceptions: a full-size Carousel built for 5-liter bottles does not accommodate 2.5-liter bottles; a full-size or Subcompact Carousel built for 1.7-liter bottles does not accommodate 1.2-liter bottles).

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, the SBE 49 CTD (real-time use only), or the Neil Brown Mk III CTD. The SBE 32 holds 12, 24, or 36 bottles, ranging in size from 1.2 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, or SBE 49 CTD (real-time use only). 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, or SBE 49 CTD (real-time use only). The SBE 32SC holds 12 bottles, 1.7 or 2.5 liters.

Carousels can be controlled in several ways:

Operation	Carousel Size	CTD	Control
Real-Time	32, 32C	SBE 9plus	SBE 11plus Deck Unit
	32, 32C, 32SC	SBE 19 / 19plus / 25 / 49	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 9plus	SBE 17plus V2 SEARAM
	32, 32C, 32SC	SBE 19 / 19plus / 25 CTD or SBE 50 Pressure Sensor	Auto Fire Module (AFM)
	32, 32C, 32SC	None	Auto Fire Module (AFM)

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

Notes:

- Help files provide detailed information on the use of SEATERM, SeatermAF, SEASAVE V7, and SBE Data Processing.
- Separate software manuals on CD-ROM contain detailed information on the setup and use of SEASAVE V7 and SBE Data Processing.
- Sea-Bird also supplies an older version of SEASAVE, SEASAVE-Win32. However, all SEASAVE instructions in this manual are written for SEASAVE V7. See SEASAVE-Win32's manual and/or Help files if you prefer to use the older software.

Sea-Bird equipment is supplied with a powerful Win 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 that includes an Auto Fire Module (AFM) or SBE 17plus V2 SEARAM.
- **SEASAVE V7** – 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.

Specifications

Power Requirements	<i>Voltage:</i> 12 - 15 VDC <i>Current when charging capacitor:</i> 205 milliamps (for approximately 35 seconds on power-up and 3 seconds to recharge after each bottle firing) <i>Current when not charging capacitor:</i> 110 milliamps
Depth Rating	6800 meters (standard), 7000 or 10500 meters (optional)
Materials	<i>Frame:</i> painted aluminum <i>Latch/magnet assembly:</i> titanium, acetal plastic, and other corrosion-resistant materials <i>Housing (for electrical and release assembly and mount hub):</i> aluminum (standard), titanium (optional)

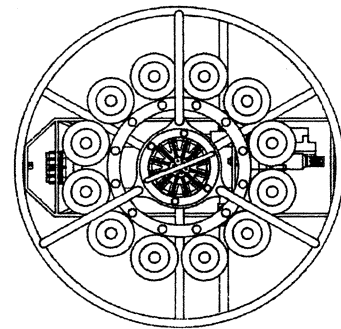
Dimensions and Weights

Carousel	Bottle Mount Stand		CTD Extension Stand		Total Package ¹	
	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 ²	See 2.5 liter	991 (39.0)	406 (16.0)	991 (39.0)	See 2.5 liter	
12 bottle, 1.7 liter ²	788 (31.0)				1201 (47.3)	68 (150)
12 bottle, 2.5 liter ²	1024 (40.3)				1438 (56.6)	79 (174)
12 bottle, 5 liter ²	820 (32.3)				1234 (48.6)	78 (172)
12 bottle, 8 liter ²	1024 (40.3)				1438 (56.6)	79 (174)
12 bottle, 10 liter ²	1189 (46.8)				1603 (63.1)	82 (182)
12 bottle, 12 liter ²	1316 (51.8)				1730 (68.1)	83 (184)
12 bottle, 20 liter ³	1351 (53.2)	1550 (61.0)		1549 (61.0)	1765 (69.5)	164 (363)
12 bottle, 30 liter ³	1351 (53.2)					171 (378)
24 bottle, 1.2 liter ²	See 2.5 liter	1143 (45.0)	406 (16.0)	1143 (45.0)	See 2.5 liter	
24 bottle, 1.7 liter ²	800 (31.5)				1214 (47.8)	95 (210)
24 bottle, 2.5 liter ²	1003 (39.5)				1417 (55.8)	106 (235)
24 bottle, 5 liter ³	869 (34.2)	1550 (61.0)	427 (16.8)	1549 (61.0)	1300 (51.3)	179 (397)
24 bottle, 8 liter ³	1072 (42.2)				1506 (59.3)	185 (410)
24 bottle, 10 liter ³	1224 (48.2)				1659 (65.3)	194 (430)
24 bottle, 12 liter ³	1351 (53.2)				1786 (70.3)	199 (440)
Compact (SBE 32C)						
12 bottle, 1.2 - 8 liter ²	965 (38.0)	966 (38.0)	-		973 (38.3)	68 (150)
Subcompact (SBE 32SC)						
12 bottle, 1.7 liter ²	788 (31.0)	699 (27.5)	-		800 (31.5)	50 (111)
12 bottle, 2.5 liter ²	991 (39.0)				1003 (39.5)	52 (114)

¹ Total Package:

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

Total package weight does not include bottles or CTD.

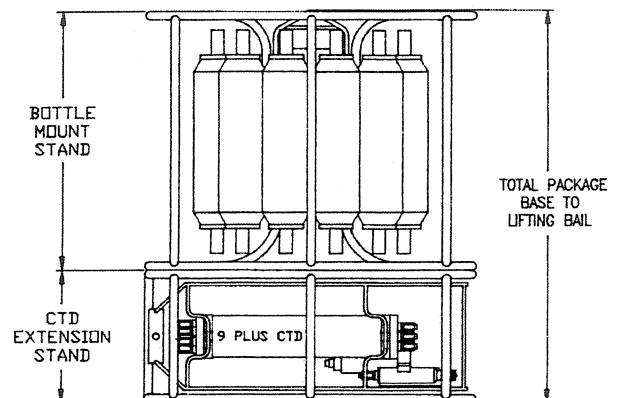


² Frame parts are 25.4 mm (1 inch) diameter for:

- Full size SBE 32 12-bottle through 12-liter bottle size,
- Full size SBE 32 24-bottle through 2.5-liter bottle size,
- Compact SBE 32C, and
- Sub-compact SBE 32SC all sizes.

³ Frame parts are 34.9 mm (1.375 inch) diameter for:

- Full size SBE 32 12-bottle larger than 12-liter bottle size, and
- Full size SBE 32 24-bottle larger than 2.5-liter bottle size.



End Cap Connectors

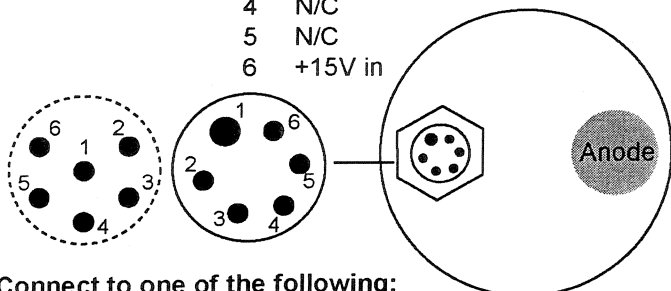
End cap connectors are located at the bottom of the pylon / hub assembly.

Standard Modem Interface

SBE 9plus, 17plus V2, 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 to one of the following:

- SBE 9plus - used with SBE 11plus V2 Deck Unit
- SBE 17plus V2 - used with SBE 9plus CTD
- Auto Fire Module (AFM) - used with SBE 19, 19plus, or 25 CTD; SBE 50 Pressure Sensor; or no CTD

○ = standard impulse glass-reinforced epoxy connectors:
2-pin XSG-2-BCL-HP-SS,
4-pin XSG-4-BCL-HP-SS, and
6-pin AG-306-HP-SS as applicable.

○ = optional MCBH (wet-pluggable) connectors (all with 3/8" length base, 1/2-20 thread)
2-pin MCBH-2MP (WB),
4-pin MCBH-4MP (WB), or
6-pin MCBH-6MP (WB) as applicable.
Note: Wet-pluggable connectors are available in anodized aluminum or titanium; connector type must match Carousel housing (standard aluminum or optional titanium).

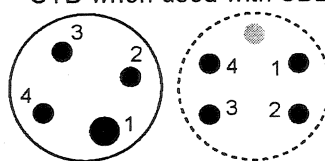
Standard Modem Interface and Optional Serial Interface

Serial Data Instrument Connector

Pin Signal

- | | |
|---|------------------|
| 1 | Return |
| 2 | Data Tx to CTD |
| 3 | Data RX from CTD |
| 4 | +15V out |

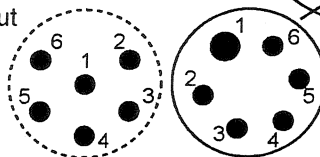
Connect JB3 to SBE 19, 19plus, 25, or 49 CTD when used with SBE 33 Deck Unit



SBE 9plus, 17plus V2, or AFM Connector

Pin Signal

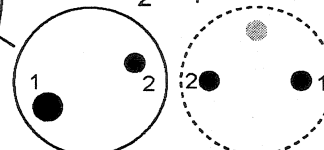
- | | |
|---|-------------|
| 1 | Return |
| 2 | Data RX in |
| 3 | Data TX out |
| 4 | N/C |
| 5 | N/C |
| 6 | +15V in |



Sea Cable Connector

Pin Signal

- | | |
|---|---|
| 1 | - |
| 2 | + |



Connect JB1 to sea cable when used with SBE 19, 19plus, 25, or 49 CTD and SBE 33 Deck Unit

Connect JB2 to one of the following:

- SBE 9plus - when used with SBE 11plus V2 Deck Unit
- SBE 17plus V2 - when used with SBE 9plus CTD
- Auto Fire Module (AFM) - when used with SBE 19, 19plus, or 25 CTD; SBE 50 Pressure Sensor; or no CTD

System Configurations

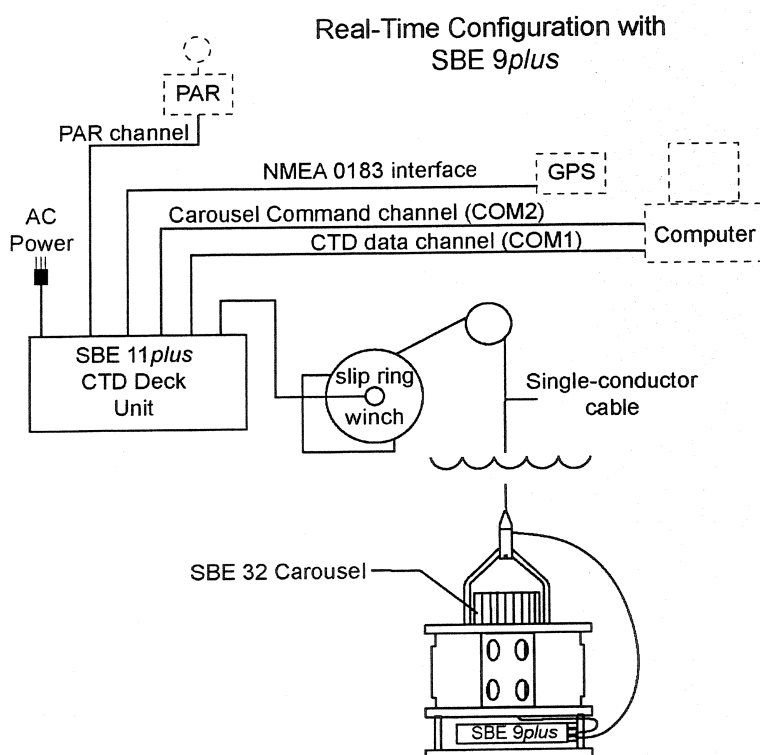
Note:

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 11plus Deck Unit -**

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



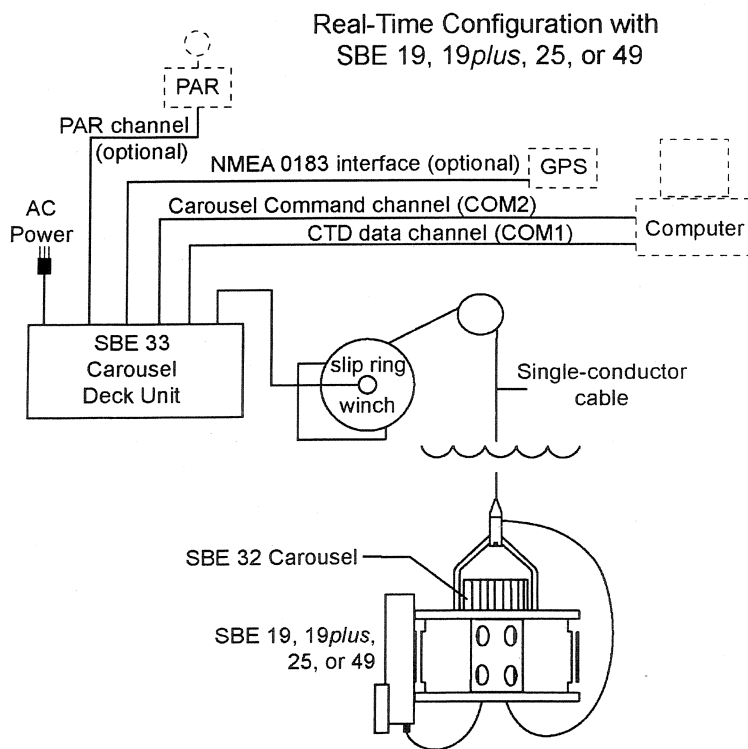
- **SBE 33 Carousel Deck Unit –**

Note:

When using the SBE 49 FastCAT with the SBE 33, SEASAVE (our real-time data acquisition software) does not allow acquisition of NMEA or Surface PAR data.

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 / 19plus, 25, or 49 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.

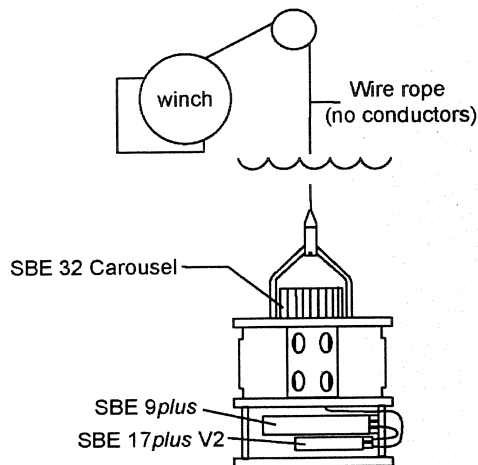
An optional interface in the SBE 32 and 33 is also available for a standard **Neil Brown Mk III CTD**. This option allows the Carousel to provide the compliant supply voltage to the Mk III, and extra power for fluorometers and other sensors not easily supported by the Mk III. NMEA and Surface PAR capabilities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



Autonomous Data Acquisition and Control (no conducting wire required)

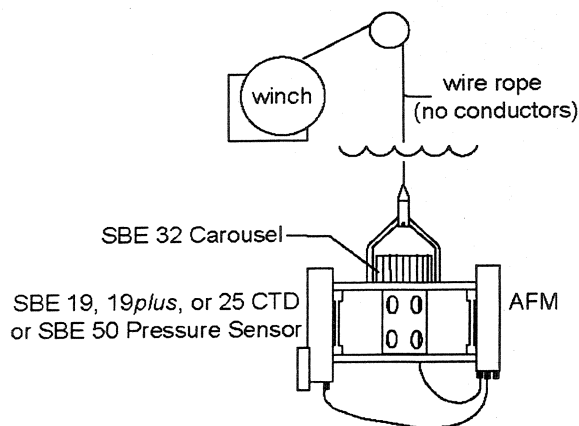
- **SBE 17plus V2 SEARAM -**

The SEARAM, mounted with the **SBE 9plus CTD**, allows the Carousel to operate autonomously on non-conducting cables. Using pressure data from the **SBE 9plus** 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 9plus** and the Carousel by the SEARAM's batteries, and data from the **SBE 9plus** is stored in the SEARAM memory.



- **Auto Fire Module (AFM) -**

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 / 19plus 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 batteries; bottle number, firing confirmation, and five scans of CTD data are recorded in AFM memory for each bottle fired.



Section 3: Preparing Carousel for Deployment

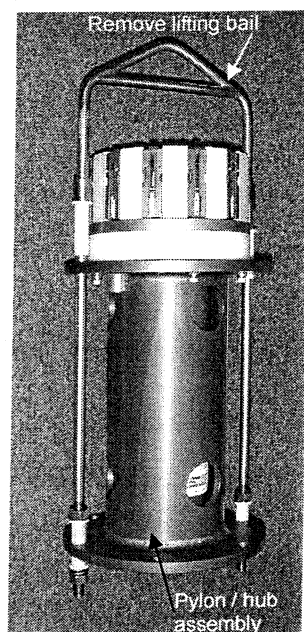
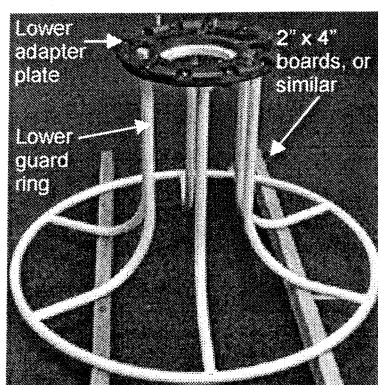
This section covers:

- Assembling the Carousel
- Installing the extension stand
- Mounting the instrument to the Carousel
- Mounting bottles to the Carousel
- Rigging and cocking lanyards

Assembling SBE 32

Note:

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



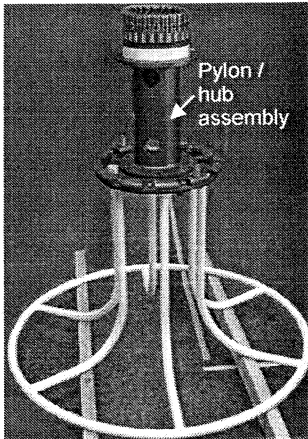
The SBE 32C (compact model) and 32SC (sub-compact model) are shipped from Sea-Bird fully assembled. **The assembly instructions apply only to the full-size SBE 32.**

Parts and assembly procedure vary, depending on the number of bottles. Instructions follow for:

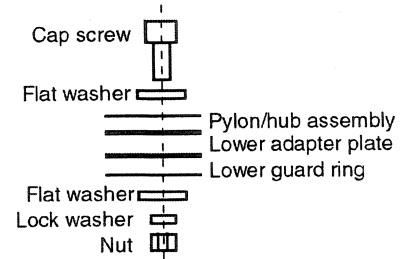
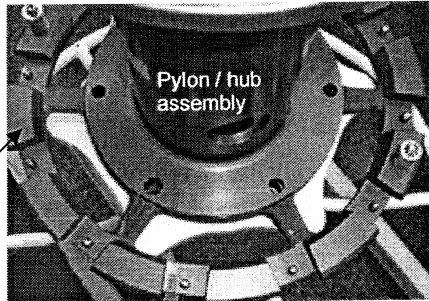
- 12-bottle SBE 32
- 24-bottle SBE 32

12-Bottle Full-Size SBE 32

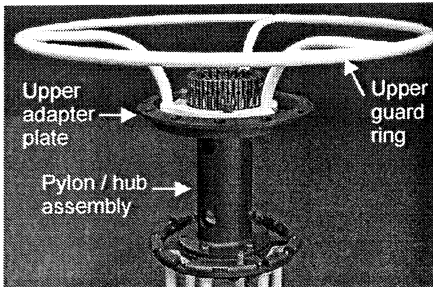
1. Place the lower guard ring on a flat surface on two boards. The boards lift the assembly for easy installation of the guard side bars (Step 7).
2. Set the lower adapter plate (adapter plate with bottle locator pins on its top surface) on the flange of the lower guard ring, aligning the mounting holes.
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.



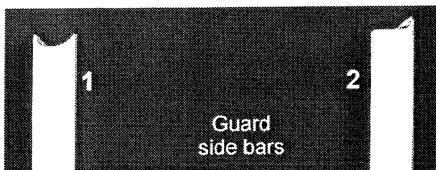
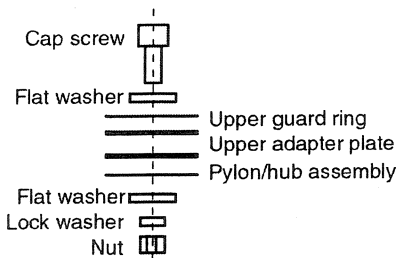
Lower adapter plate



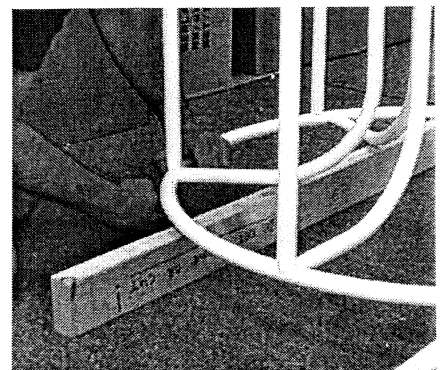
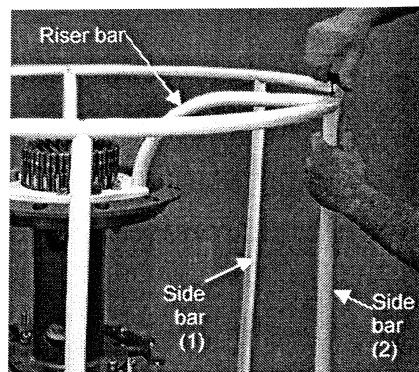
4. Set the pylon/hub assembly on the lower adapter plate, aligning the mounting holes. Secure the pylon/hub assembly and lower adapter plate to the lower guard ring through the four $\frac{1}{2}$ " holes (the two oversized holes will be used for the lifting bail later). Use four $\frac{1}{2}$ -13 x 3 $\frac{1}{2}$ " socket head cap screws, $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " split lock washers, and $\frac{1}{2}$ -13 hex nuts. **Do not tighten completely.**

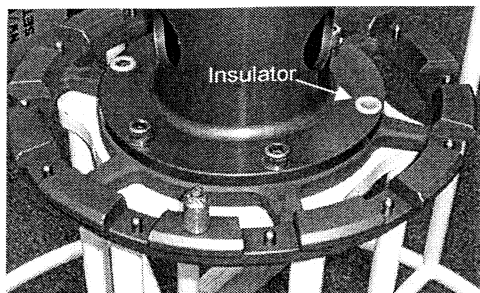


5. Set the upper adapter plate (adapter plate with holes to secure water bottles to Carousel) on the pylon/hub assembly, aligning the mounting holes.
6. Set the upper guard ring on the upper adapter plate, aligning the mounting holes. Secure the upper guard ring to the upper adapter plate and pylon/hub assembly through the four $\frac{1}{2}$ " holes (the two oversized holes will be used for the lifting bail later). Use four $\frac{1}{2}$ -13 x 3 $\frac{1}{2}$ " socket head cap screws, $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " split lock washers, and $\frac{1}{2}$ -13 hex nuts. **Do not tighten completely.**

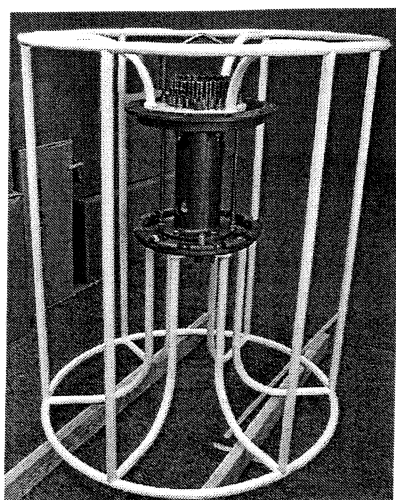
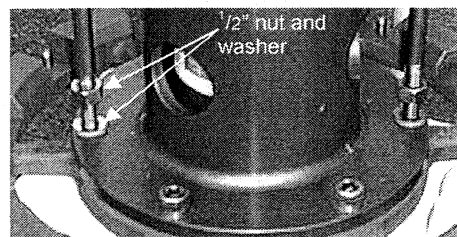
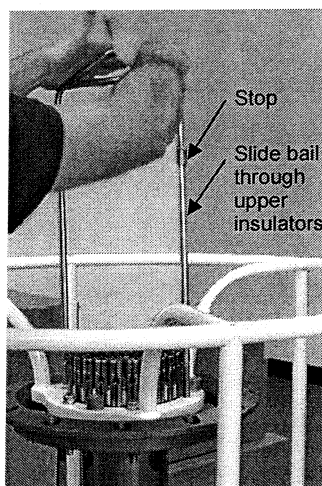
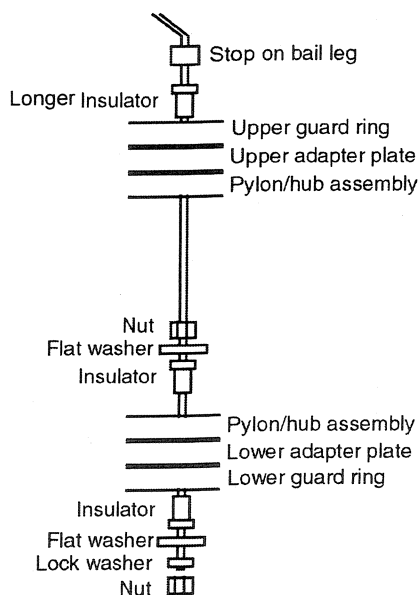


7. Place the six guard side bars between the upper and lower guard rings. Note that there are two types of side bars: one for upper guard ring positions without a riser bar (1), and the other for positions with a riser bar (2).
 - A. Connect the side bars to the upper guard ring, loosely installing the $\frac{1}{4}$ -20 x $1\frac{1}{2}$ " flat head socket cap screws.
 - B. Connect the side bars to the lower guard ring, installing the $\frac{1}{4}$ -20 x $1\frac{1}{2}$ " flat head socket cap screws. Tighten these screws fully.
 - C. Fully tighten the screws connecting the side bars and upper guard ring.



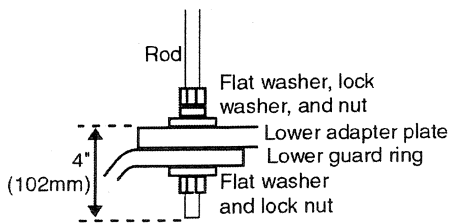
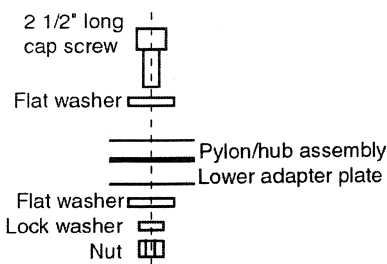
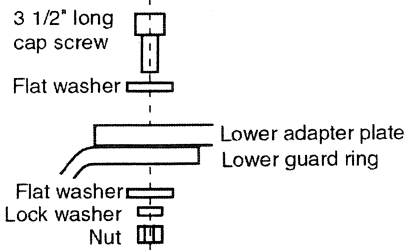
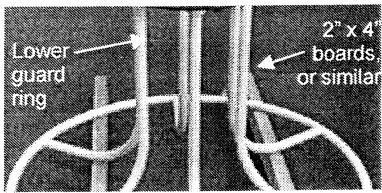


8. Install the lifting bail:
 - A. Install the plastic insulators:
 - two longer insulators in the upper guard ring / upper adapter plate / pylon/hub assembly;
 - two shorter insulators in the hub assembly / lower adapter plate / lower guard ring.
 - B. Slide the lifting bail legs through the upper insulators.
 - C. Before inserting into the lower insulators, place a $\frac{1}{2}$ " nut on each leg of the lifting bail and thread the nuts to within 1" of the end of the threads. Place a $\frac{1}{2}$ " 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 two 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 $\frac{1}{2}$ " nuts, split lock washers, and flat washers.
 - F. Tighten the nuts above the lower guard ring connection until they seat on the insulators.



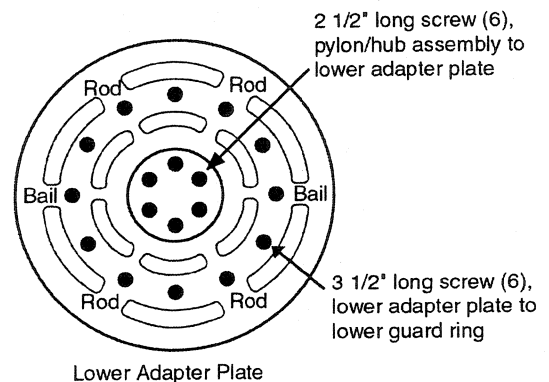
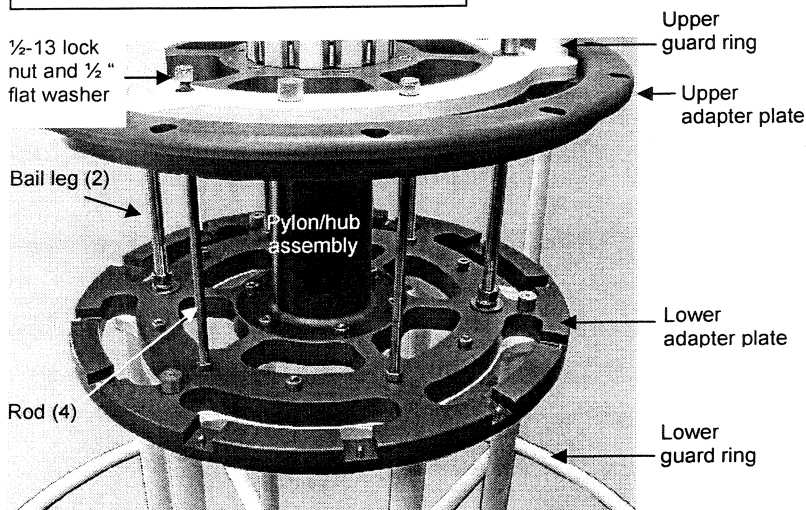
9. Fully tighten all hardware installed in Steps 1 through 8. **Make sure that all threads are protected with Never Seez Blue Moly.**

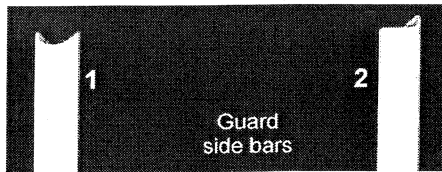
24-Bottle Full-Size SBE 32



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 $\frac{1}{2}$ " holes (every other hole in the adapter plate outer circle; see photo and illustration at bottom of page), using $\frac{1}{2}$ -13 x $3\frac{1}{2}$ " socket head cap screws, $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " split lock washers, and $\frac{1}{2}$ -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 $\frac{1}{2}$ " holes in the adapter plate inner circle, using $\frac{1}{2}$ -13 x $2\frac{1}{2}$ " socket head cap screws, $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " split lock washers, and $\frac{1}{2}$ -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 $\frac{1}{2}$ " holes, using $\frac{1}{2}$ -13 x $2\frac{1}{2}$ " socket head cap screws, $\frac{1}{2}$ " flat washers, and $\frac{1}{2}$ -13 lock nuts.
6. Slide the upper guard ring through the rods until it rests on the upper adapter plate. Install the four $\frac{1}{2}$ -13 lock nuts and $\frac{1}{2}$ " flat washers on the rods.

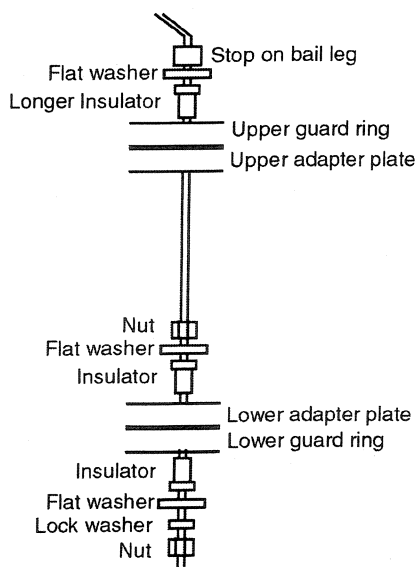
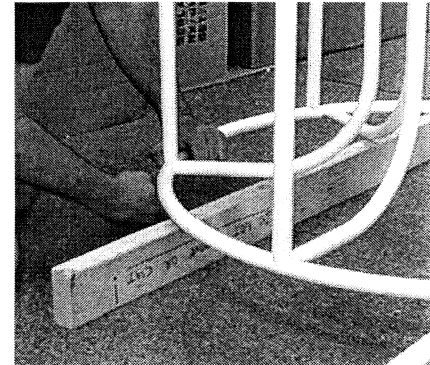
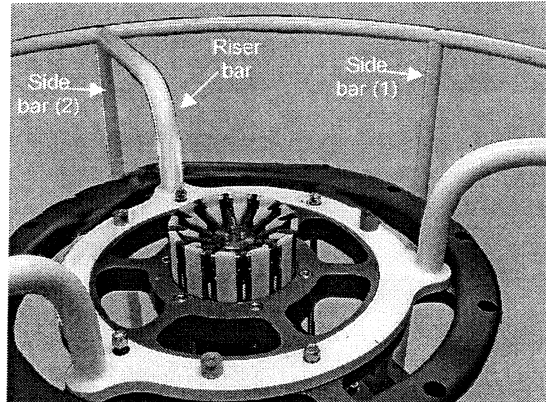
Note: The lifting bail, shown in the photo, is not installed until Step 10.





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 (1), and the other for positions with a riser bar (2).

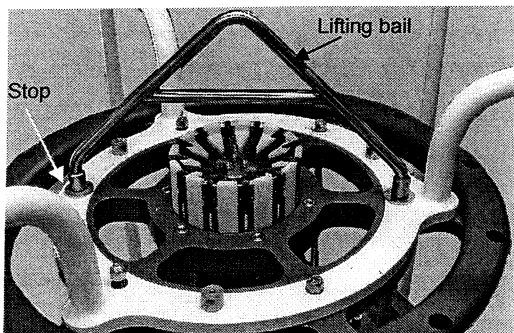
- Connect the side bars to the upper guard ring, loosely installing the $\frac{3}{8}$ -16 x 2" flat head socket cap screws.
- Connect the side bars to the lower guard ring, installing the $\frac{3}{8}$ -16 x 2" flat head socket cap screws. Tighten these screws fully.
- Fully tighten the screws connecting 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:

- Install the plastic insulators:
two longer insulators in the upper guard ring;
two shorter insulators in the lower adapter plate.
- Place the $\frac{3}{4}$ " flat washers on the upper insulators.
- Slide the lifting bail through the flat washers and upper insulators.
- Before inserting into the lower insulators, place a $\frac{3}{4}$ " 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 $\frac{3}{4}$ " 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.
- Install the final two shorter insulators over the ends of the bail legs and into the bottom of the lower guard ring.
- Secure the bail leg to the lower guard ring with the $\frac{3}{4}$ " nuts, split lock washers, and flat washers.
- Tighten the nuts above the lower adapter plate until they seat on the insulators.



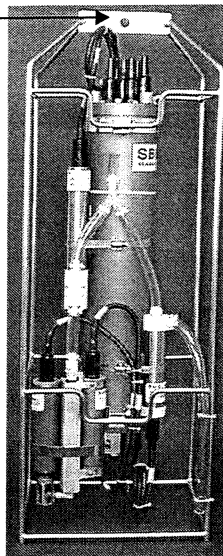
10. Fully tighten all hardware installed in Steps 1 through 9. **Make sure that all threads are protected with Never Seez Blue Moly.**

SBE 32 - Installing CTD Extension Stand and Mounting CTD

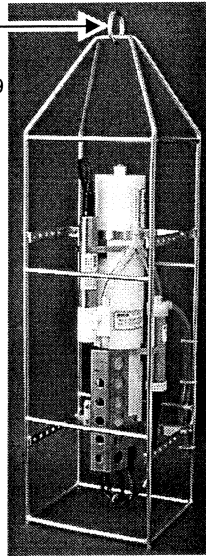
The CTD extension stand is provided with the full-size SBE 32 only. Note that the CTD is mounted horizontally in its cage in the extension stand; see *Appendix II: CTD Plumbing* for pump placement and plumbing for a horizontal mount.

1. Mount the CTD (in its cage) in the extension stand.
 - For CTDs with a *flat top cage* (most SBE *9plus* and SBE 25 cages) – Follow instructions that come with PN 50199 SBE *9plus* Carousel Mount Kit.
 - For CTDs with a *ring top cage* (all SBE 19 and 19*plus* cages, and some older SBE *9plus* and 25 cages) – Install PN 50124 CTD Cage to Extension Stand Mounting Adapter Kit on the *ring top* to reduce the ring diameter. Then, follow the instructions that come with PN 50199 SBE *9plus* Carousel Mount Kit, but omit the 23687 and 23688 mount insulators.

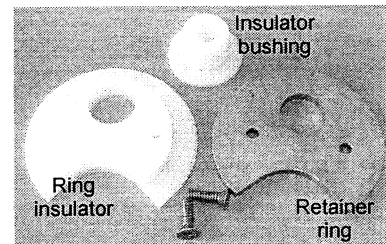
Flat top cage type mounts to CTD extension stand with 50199



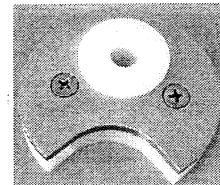
Ring top cage requires 50124 adapter kit in addition to 50199 to mount to CTD extension stand



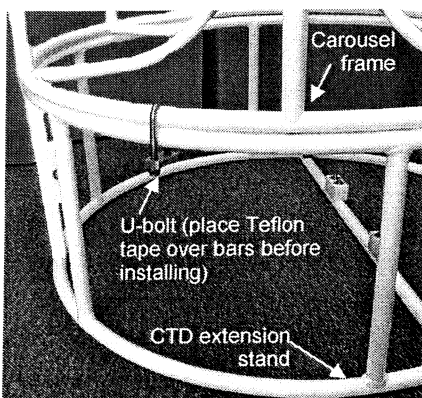
Note: Plumbing for vertical configuration shown; see *Appendix II: CTD Plumbing* for pump placement and plumbing for a horizontal mount before installing in extension stand.



50124 Adapter Kit for Ring Top Cage
Sandwich *ring top* between retainer ring and ring insulator; secure with screws. Insert insulator bushing through hole in retainer ring.



50124 Adapter Kit assembled
Note: Cage *ring top* not shown.

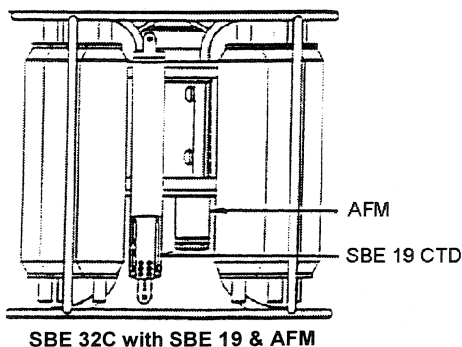


Note: CTD and CTD cage not shown

2. Place the Carousel assembly on top of the CTD extension stand.
3. Secure the Carousel assembly to the CTD extension stand using the U-bolts (4 U-bolts for 39-inch and 45-inch diameter stand frames; 6 U-bolts for 61-inch diameter stand frames).
 - A. Wrap the supplied Teflon tape over the Carousel frame and extension stand at each of the U-bolt locations.
 - B. Install the 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.**

SBE 32C and 32SC - Mounting CTD

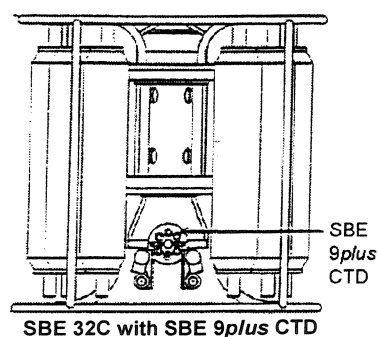
See *Appendix II: CTD Plumbing* for pump placement and plumbing for a horizontal or vertical mounting.



- **SBE 19, 19plus, or 25**

The SBE 19 or 19plus mounts vertically in one of the auxiliary mounting positions, using an accessory mounting fixture.

Similarly, the SBE 25 main housing mounts vertically in one of the auxiliary mounting positions; the SBE 25's standard sensors (SBE 3 temperature sensor, SBE 4 conductivity sensor, and SBE 5 pump) together mount vertically in a second auxiliary mounting position. An Auto Fire Module (AFM) and auxiliary sensors (fluorometer, transmissometer, etc.) mount vertically to any available auxiliary mounting positions.



- **SBE 9plus**

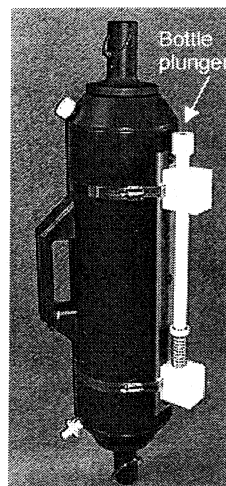
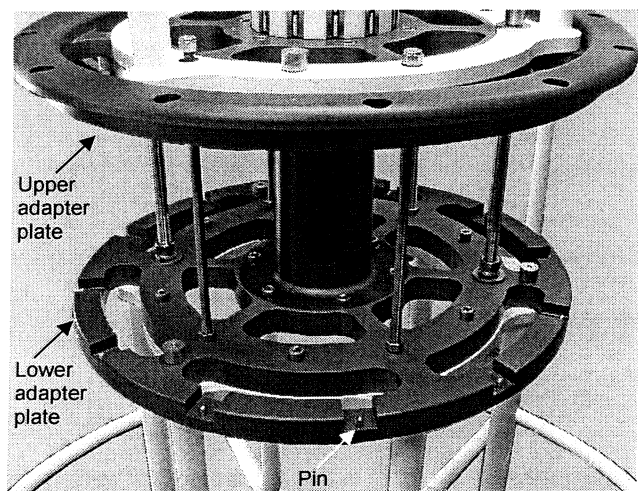
A mount bracket allows the SBE 9plus main housing and standard sensors (SBE 3 temperature sensor, SBE 4 conductivity sensor, and SBE 5 pump) to be mounted horizontally underneath and inside the bottle stand for the SBE 32C; auxiliary sensors (SBE 17plus V2 SEARAM, fluorometer, transmissometer, etc.) mount on the SBE 9plus main housing or vertically to any available auxiliary mounting positions. The SBE 9plus is not used with the SBE 32SC.

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.

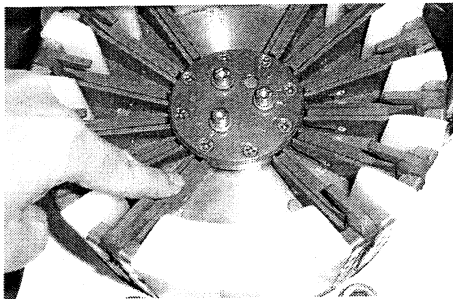
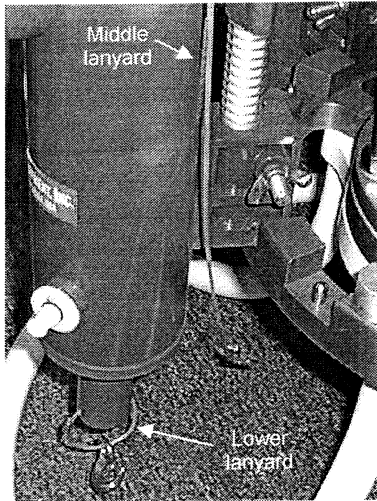


Rigging and Cocking Lanyards

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*.

Lanyard Tension Under 25 kg (55 lbs)

1. Unclip the lower lanyard from the middle lanyard.



Push trigger to cock release mechanism

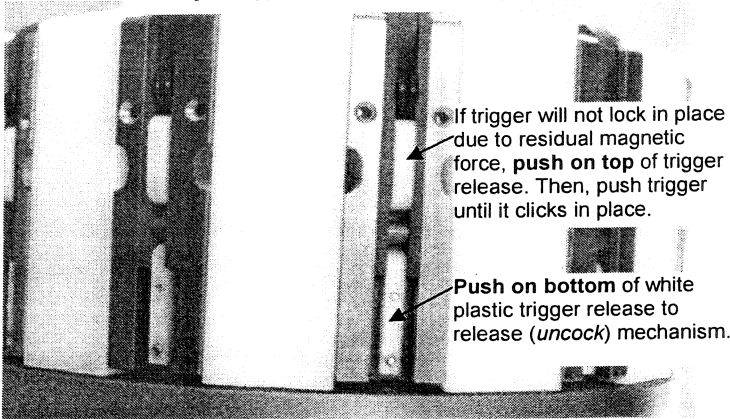
2. Cock the release mechanism by pushing against each trigger until it clicks and locks in place.

Note: In some cases, the trigger may not click in place due to residual magnetic force in the trigger release mechanism. If this happens:

New Style Trigger Release – Push on **top** of plastic trigger release. Then push against trigger until it clicks in place.

Old Style Trigger Release - Pull out on plastic trigger release with needle nose pliers, and then push against trigger until it clicks in place.

New Style Trigger Release Mechanism



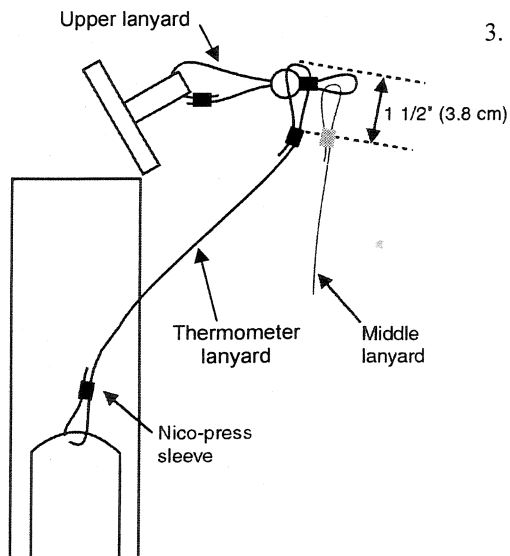
Old Style Trigger Release Mechanism



White plastic trigger release:

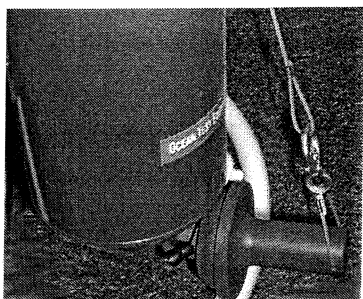
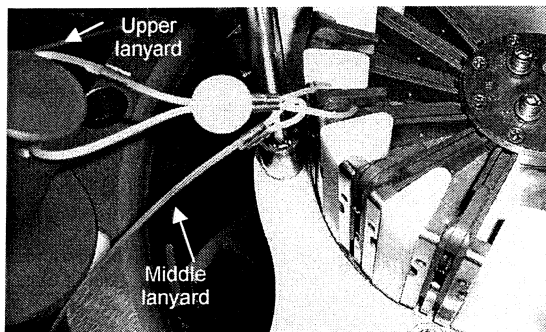
- If trigger will not lock in place due to residual magnetic force, **pull out** on trigger release with needle nose pliers. Then, push trigger until it clicks in place.
- **Push** on trigger release to release (*uncock*) mechanism.

Section 3: Preparing Carousel for Deployment



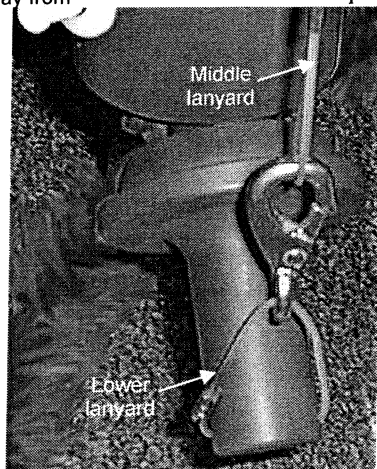
3. If deploying reversing thermometers, rotate the thermometer rack and place the thermometer lanyard loop over the upper lanyard, so that it rests against the upper lanyard ball.

4. Attach the upper lanyard to the trigger hook.

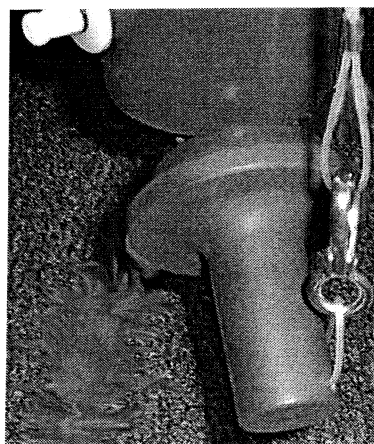


Angling end cap handle away from center of Carousel

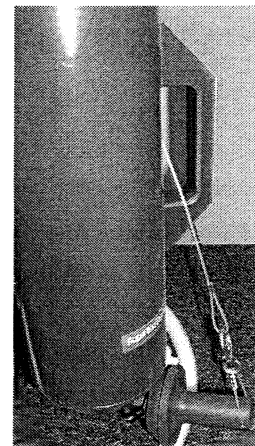
5. Clip the lower lanyard to the middle lanyard. The end cap handle should angle out away from the Carousel, not in towards the middle of the Carousel. Center the connection on the bottom end cap.
 - If the bottle has a handle, run the middle lanyard through the handle. This will prevent the loss of 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.



Correct - connection centered on bottom end cap



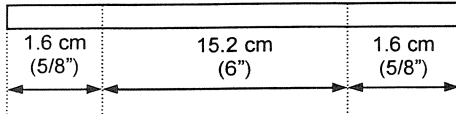
Incorrect - connection on side of bottom end cap



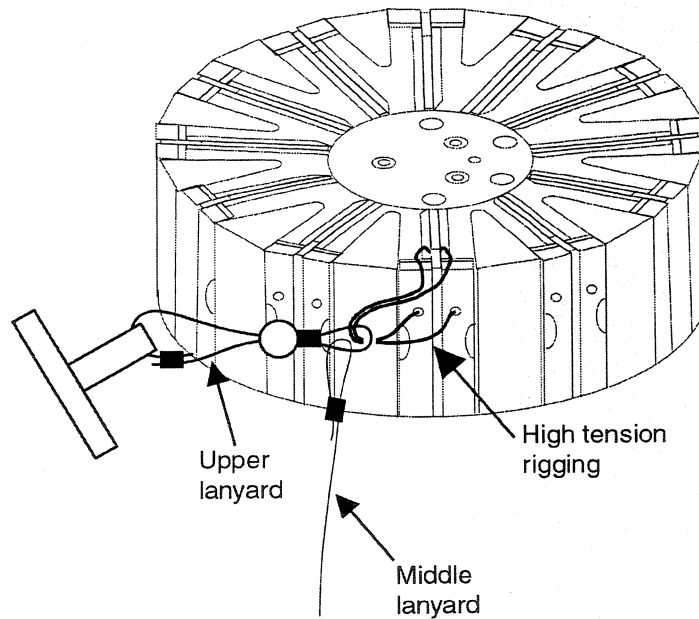
Running middle lanyard through handle

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. 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.



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:

- Optimizing data quality
- Software installation
- Commands to the Carousel
- System wiring, setup, and operation
- Recovery
- Processing data

Optimizing Data Quality

Taking Water Samples on Upcast

Most of our CTD manuals refer to **using downcast CTD data to characterize the profile**. For typical configurations, downcast CTD data is preferable, because the CTD is oriented so that the intake is *seeing* new water before the rest of the package causes any mixing or has an effect on water temperature.

If you take water samples on downcast, the pressure on an already closed bottle increases as you continue through the downcast; if there is a small leak, outside water is forced into the bottle, contaminating the sample with deeper water. Conversely, if you take water samples on upcast, the pressure decreases on an already closed bottle as you bring the package up; any leaking results in water exiting the bottle, leaving the integrity of the sample intact. Therefore, standard practice is to monitor real-time downcast data to determine where to take water samples (locations with well-mixed water and/or with peaks in the parameters of interest), and then **take water samples on upcast**.

Holding Water Sampler Stationary before Taking Samples

If the CTD/water sampler package does not stop before you fire a bottle, the water in the bottle is a mixture of water from many meters below the firing point (assuming you are taking water samples on upcast). If moving at 1 m/sec, a bottle's *flushing constant* is typically five to eight volumes, with water flushing slowly at the bottle inside wall and faster toward the bottle center. For a 5-liter bottle, the trapped sample contains a mixture of water from a cylinder in the water column with diameter equal to the bottle inner diameter and a volume of 25 - 40 liters (i.e., height of the cylinder is five to eight times the bottle height).

Therefore, standard practice is to **stop the package to allow the bottle to flush freely for several minutes before each bottle closing**.

Taking Samples in Well-Mixed Water to Check for Drift

Oceanographic conditions (for example, internal waves and currents) result in density surfaces moving continuously, causing water of a given salinity to move up and down. Therefore, standard practice is to monitor the real-time temperature / salinity / density structure during the downcast, **stopping the water sampler on upcast at depths where gradients are small before closing bottles that will be used to check for calibration drift.**

You can use the data associated with each bottle firing to check for calibration drift, by comparing data from the CTD / auxiliary sensors to lab measurements made on the water in the bottles.

Using Real-Time Control for Highest Quality Water Samples

If using an autonomous sampling system, the AFM (but not the SBE 17*plus*) can be programmed to sample when stationary, eliminating the flushing problem caused by sampling without first stopping. However, the lack of real-time data can still result in samples being taken in areas with large gradients, because the user can only estimate the depth of the gradients, **and** can only estimate the actual package depth from the cable payout.

For these reasons, water sampling with a real-time system (control via SBE 11*plus* or SBE 33 Deck Unit) is preferable to autonomous sampling (pre-programmed control via SBE 17*plus* or AFM). **Autonomous sampling does not provide water sample quality that is equal to that from real-time sampling; it is a compromise intended to serve users who do not have real-time capability on their vessel.**

Software Installation

Sea-Bird recommends the following minimum system requirements for SEASOFT: Windows 2000 or later, 500 MHz processor, 256 MB RAM, and 90 MB free disk space for 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. The installation program allows you to install the desired components. Install all the components, or just install SEATERM and SeatermAF (terminal programs), SEASAVE V7, and SBE Data Processing for now.

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. Commands are included here for reference. All command characters must be upper case (capital letters).

Command to Carousel	Description					
#SR	Go to home position (position #1).					
#SF	Fire next position (sequential firing).					
#SNx	Fire position x (first position is 1), where x is in ASCII.					
	Position	Command	Position	Command	Position	Command
	1	#SN1	13	#SN=	25	#SNI
	2	#SN2	14	#SN>	26	#SNJ
	3	#SN3	15	#SN?	27	#SNK
	4	#SN4	16	#SN@	28	#SNL
	5	#SN5	17	#SNA	29	#SNM
	6	#SN6	18	#SNB	30	#SNN
	7	#SN7	19	#SNC	31	#SNO
	8	#SN8	20	#SND	32	#SNP
	9	#SN9	21	#SNE	33	#SNQ
	10	#SN:	22	#SNF	34	#SNR
	11	#SN;	23	#SNG	35	#SNS
	12	#SN<	24	#SNH	36	#SNT
#SBx	(For Carousel with interface for operation with SBE 33 Deck Unit) Set Carousel to CTD communication baud rate x:					
	Baud Rate	Command	Baud Rate	Command		
	600 baud	#SB0	2400 baud	#SB2		
	1200 baud	#SB1	4800 baud	#SB3		

The Carousel sends one of these ASCII replies upon receipt of a reset (go to home position) or bottle fire command:

Reply from Carousel *	Description					
□!□	At home position, next bottle to fire is #1.					
□#□	Received invalid bottle number.					
□\$□	Did not confirm bottle fire.					
□ x □	Fired bottle x (first position is 1), where x is in ASCII.					
	Position	Reply	Position	Reply	Position	Reply
	1	□ 1 □	13	□ = □	25	□ I □
	2	□ 2 □	14	□ > □	26	□ J □
	3	□ 3 □	15	□ ? □	27	□ K □
	4	□ 4 □	16	□ @ □	28	□ L □
	5	□ 5 □	17	□ A □	29	□ M □
	6	□ 6 □	18	□ B □	30	□ N □
	7	□ 7 □	19	□ C □	31	□ O □
	8	□ 8 □	20	□ D □	32	□ P □
	9	□ 9 □	21	□ E □	33	□ Q □
	10	□ : □	22	□ F □	34	□ R □
	11	□ ; □	23	□ G □	35	□ S □
	12	□ < □	24	□ H □	36	□ T □

* Note: The □ characters (they are decimal 6, which is not a printable ASCII character) may not appear, depending on the terminal program you are using.

System Setup and Operation

System setup and operation is summarized below for each method 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*, 25, or 49 CTD)
- SBE 17*plus* V2 SEARAM (autonomous operation with SBE 9*plus* CTD)
- 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:

1. In **SEATERM**, set up the 11*plus*.
2. In **SEASAVE**, perform any desired setup in the Configure Inputs and Configure Outputs menus. Details are provided here only for items related to the use of the Carousel:
 - In the Configure Inputs dialog box, click on the Instrument Configuration tab. Open an existing configuration (.con) file for the 911*plus*, or create a new .con file.
 - In the Configure Inputs dialog box, click on the Serial Ports tab.
 - For CTD Serial Port, select the port connected to the *SBE 11 Interface* channel (sends commands to and receives replies from 9*plus*), and the associated baud rate. In older units (11 and 11*plus*), the baud is set by a dip switch in the deck unit to 19200 (default) or 9600. In newer units (11*plus* V2), the baud is always 19200.
 - For Water Sampling and 911 Pump Control Serial Port, select the port connected to the *Modem Channel* (sends commands to and receives replies from the water sampler).
 - In the Configure Inputs dialog box, click on the Water Sampler tab. Set the water sampler type (SBE Carousel), total number of bottles to be closed, firing sequence, and bottle positions (for table driven firing sequence).
3. Set up the desired display windows using the Display menu.
4. In the Real-Time Data menu, select *Start*.
 - A. Enter the desired name and location for the output data file.
 - B. Make any other desired selections.
 - C. Click *Start* to begin data acquisition.
5. To fire a bottle from SEASAVE:
 - Press Ctrl F3, or
 - In the Real-Time Control 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 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 NMEA and/or Surface PAR 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

Wiring:

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 19plus.

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 NMEA and/or Surface PAR 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.

- Carousel 2-pin to *Sea Cable* on SBE 33 Deck Unit
- 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:

1. In SEATERM, set up the SBE 33 and CTD.
2. In SEASAVE, perform any desired setup in the Configure Inputs and Configure Outputs menus. Details are provided here only for items related to the use of the Carousel:
 - In the Configure Inputs dialog box, click on the Instrument Configuration tab. Open an existing configuration (.con) file for the CTD, or create a new .con file.
 - In the Configure Inputs dialog box, click on the Serial Ports tab.
 - For CTD Serial Port, select the port connected to the *SBE 33 Serial Data* connector (sends commands to and receives replies from the CTD, through the Carousel), and the associated baud rate, data bits (7), and parity (even). The baud rate must agree with the SBE 33 dip switch setting.
 - For Water Sampling and 911 Pump Control Serial Port, select the port connected to the *Carousel Data* connector (sends commands to and receives replies from the Carousel).
 - In the Configure Inputs dialog box, click on the Water Sampler tab. Set the water sampler type (SBE Carousel), total number of bottles to be closed, firing sequence, and bottle positions (for table driven firing sequence).
3. Set up the desired display windows using the Display menu.
4. In SEASAVE's RealTime Data menu, select *Start Acquisition*.
 - A. Enter the desired name and location for the output data file.
 - B. Make any other desired selections.
 - C. Click *Start* to begin data acquisition. If the CTD is not already on, SEASAVE prompts you to turn on the CTD's magnetic switch.
5. To fire a bottle from SEASAVE:
 - Press Ctrl F3, or
 - In the Real-Time Control 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 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:

When using the **SBE 49 FastCAT** with the SBE 33:

- SEASAVE does not allow acquisition of NMEA or Surface PAR data.
- If the SBE 49 is not set to **AutoRun=Y** (start sampling automatically when power is applied), start sampling by sending the SBE 49 the **Start** command in SEATERM before you run SEASAVE.

SBE 17plus V2 SEARAM

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

Wiring:

- Carousel 6-pin to SBE 17plus V2 6-pin connector that is directly across from switch plunger
- SBE 17plus V2 6-pin connector that is clockwise from switch plunger to SBE 9plus JT7
- See SBE 9plus 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 17plus.
 - 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.**

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 19plus) 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!

If the Carousel, CTD, or auxiliary equipment/sensors stop working while underwater, are unresponsive to commands, or show other signs of flooding or damage, carefully secure the instrument away from people until you have determined that abnormal internal pressure does not exist or has been relieved.

Pressure housings may flood under pressure due to dirty or damaged o-rings, or other failed seals. When a sealed pressure housing floods at great depths and is subsequently raised to the surface, water may be trapped at the pressure at which it entered the housing, presenting a danger if the housing is opened before relieving the internal pressure.

Instances of such flooding are rare. However, a housing that floods at 5000 meters depth holds an internal pressure of more than 7000 psia, and has the potential to eject the end cap with lethal force. A housing that floods at 50 meters holds an internal pressure of more than 85 psia; this force could still cause injury.

If you suspect the Carousel is flooded, point the Carousel in a safe direction away from people, and loosen the 4 screws on the connector end cap about $\frac{1}{2}$ turn. If there is internal pressure, the end cap will *follow* the screws out, and the screws will not become easier to turn. In this event, loosen 1 bulkhead connector very slowly, at least 1 turn. This opens an o-ring seal under the connector. Look for signs of internal pressure (hissing or water leak). If internal pressure is detected, let it bleed off slowly past the connector o-ring. Then, you can safely remove the end cap.

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:

- *Bottle log (.bl) file* - if you used SEASAVE to interface with SBE 9*plus* with SBE 11*plus* Deck Unit and Carousel, or SBE 19, 19*plus*, 25, or 49 with SBE 33 Deck Unit and Carousel. For these systems, 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 bottle confirm bit in data file* – if you used SBE 9*plus* with an SBE 17*plus* SEARAM and a Carousel. For this system, the bottle confirm bit in the input 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 maintenance
- Removal of the latch assembly and center pylon

Corrosion Precautions / Cleaning

Rinse the entire Carousel with fresh water after each cast.

The 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 it 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 on lower adapter plate, lower guard ring, upper adapter plate, and 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 on lower adapter plate, lower guard ring, upper adapter plate, and upper guard ring; one on pylon/hub assembly
- CTD extension stand (for full size SBE 32) - two

Note:

Blue Moly (available through marine hardware stores) 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-us.com/TDS/TDSFiles/NSBlueMoly.pdf>) 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. When disassembling / reassembling the Carousel, re-lubricate these screws with Blue Moly or equivalent. Blue Moly is electrically conductive, so be careful not to get it on circuit boards.

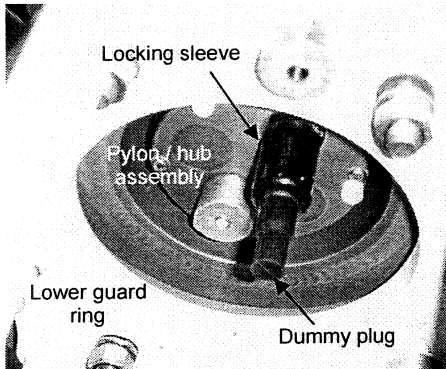
Connector Mating and Maintenance

CAUTION:

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

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.**

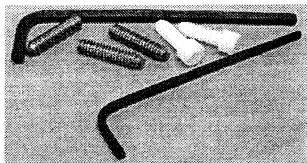


Verify that a cable or dummy plug is installed for each connector on the system before deployment.

Removing / Replacing Latch Assembly

Removing Latch Assembly

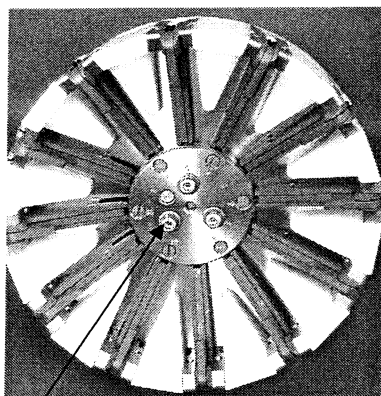
Jackscrew
kit provided
with
Carousel



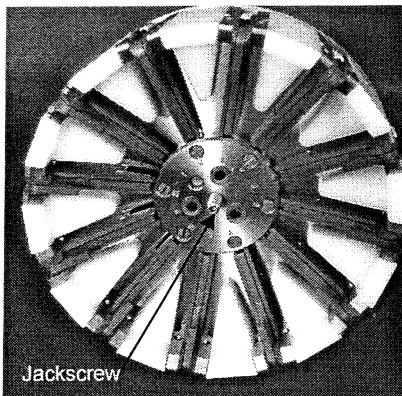
1. Remove the three socket hex head screws, lock washers, and flat washers from the top of the latch assembly.
2. (Carousels built 2006 and later) Insert a jackscrew in the center hole. As you turn the jackscrew, the latch assembly will push away from the pylon.
3. Lift the latch assembly off the pylon.
4. 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

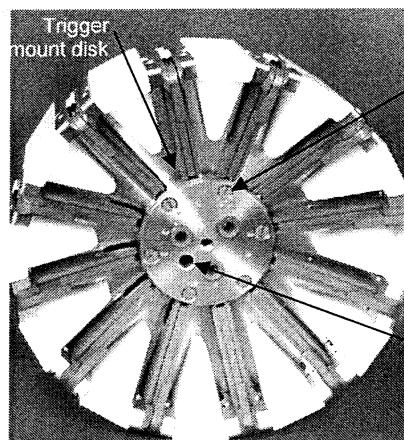
1. Replace the triggers on the trigger mount disk.
2. Place the retainer disk on the triggers, aligning the mark you made for trigger 1 on the trigger mount disk with trigger 1 on the retainer disk. Verify that the triggers are properly seated in the grooves and that the disk is flat. Reinstall the Phillips-head 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.



Socket hex head screws (3)

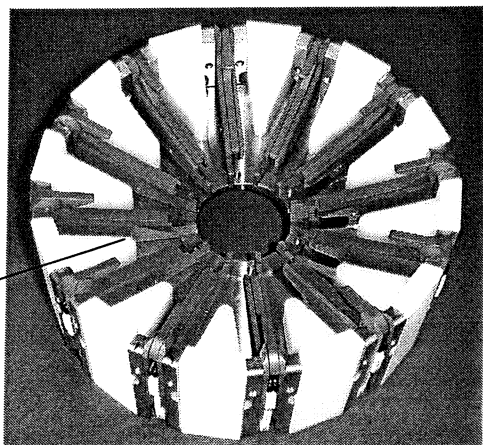


Jackscrew

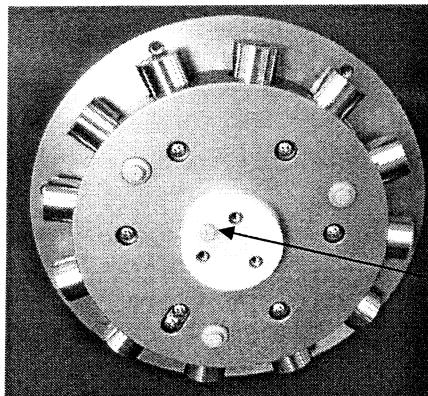


Retainer disk and Phillips-head screws

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.

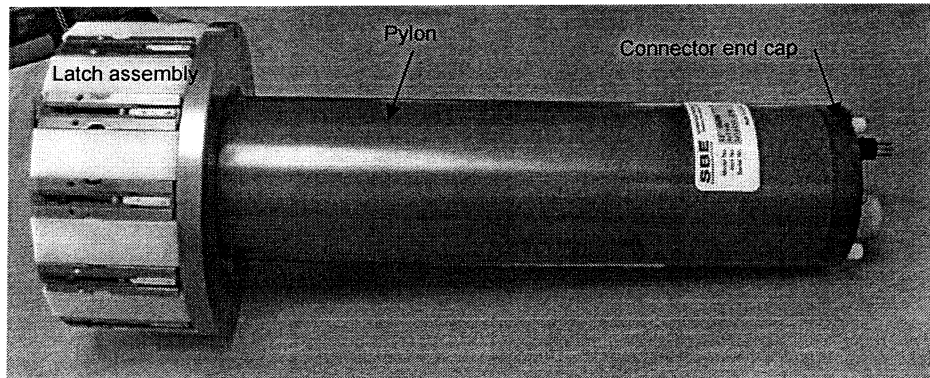
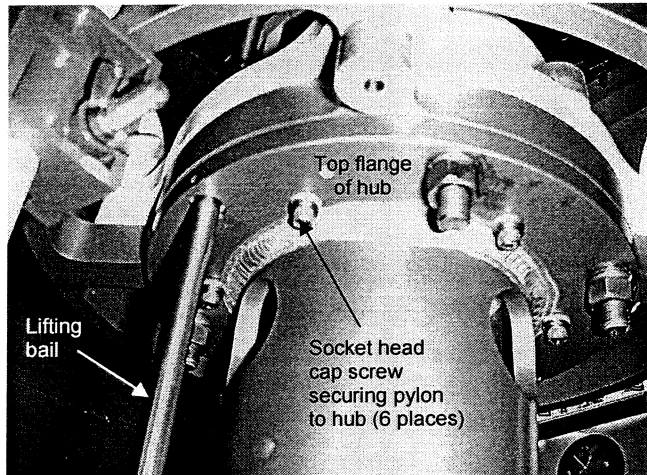
Note:

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 $\frac{1}{4}$ " 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 2000/XP data processing software, which calculates and plots temperature, conductivity, pressure, and auxiliary sensor data, and derived variables such as salinity and sound velocity.

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

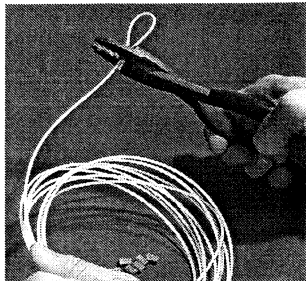
SEASAVE V7 – Sea-Bird’s Win 2000/XP software used to acquire, convert, and display real-time or archived raw data.

SEASOFT-Win32 – Sea-Bird’s complete Win 2000/XP software package, which includes software for communication, real-time data acquisition, and data analysis and display. SEASOFT-Win32 includes *SEATERM*, *SeatermAF*, *SEASAVE V7*, *SBE Data Processing*.

SEATERM – Sea-Bird’s Win 95/98/NT/2000/XP terminal program used to communicate with the SBE 11*plus* or 33 Deck Unit and the SBE 19, 19*plus*, 25, or 49 CTD 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:

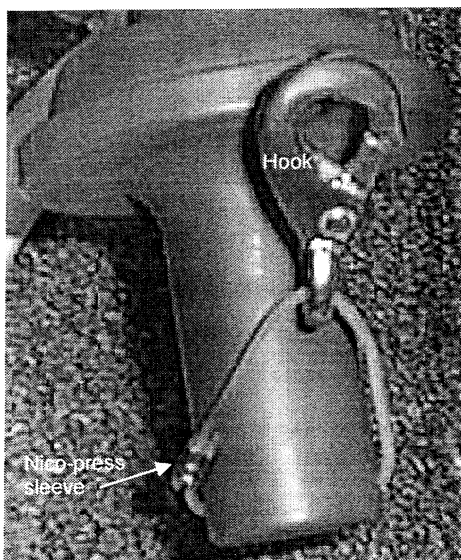
Lanyard making and rigging directions in this Appendix are for a bottle tension less than 25 kg (55 lbs). If the tension is more, see *Lanyard Rigging and Cocking in Section 3: Preparing Carousel for Deployment* for rigging modifications before proceeding.

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.

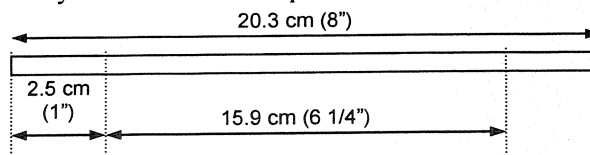
Lanyard loops are made with crimped copper sleeves (nico-press type). Available from Sea-Bird or from industrial suppliers, the copper sleeves can be installed with pliers made for crimping on soldered electrical connections. If copper sleeves or similar products are unavailable, the monofilament may 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*.

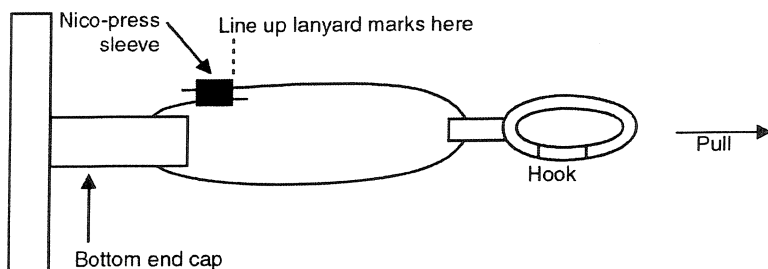
Lower Lanyard



1. Cut a lanyard and mark in two places as shown.



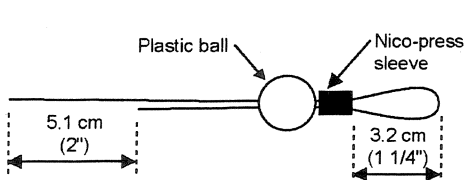
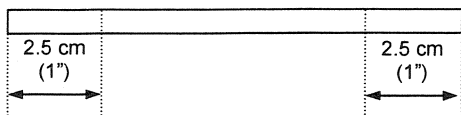
2. Feed the lanyard through the hole in the bottom end cap.
3. Thread the lanyard through the hole in a brass snap hook.
4. Feed one end of the lanyard through the nico-press sleeve. Feed the other end of the lanyard through the sleeve from the opposite direction. Align the marks on one side of the sleeve.
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.



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.

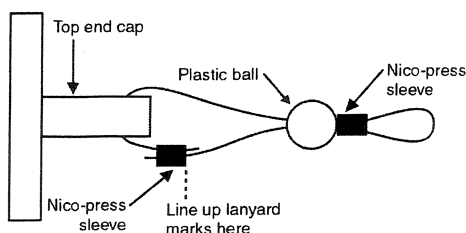
1. Cut a lanyard and mark in two places as shown.



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 1/4 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.

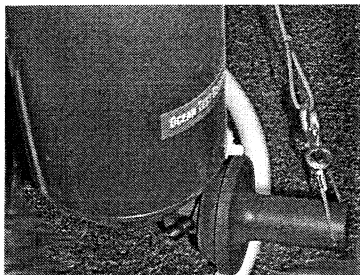
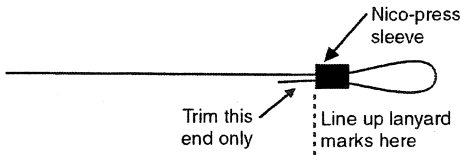
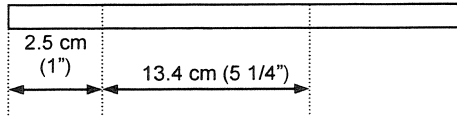
4. Feed the longer end of the lanyard through the hole in the top end cap.



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.

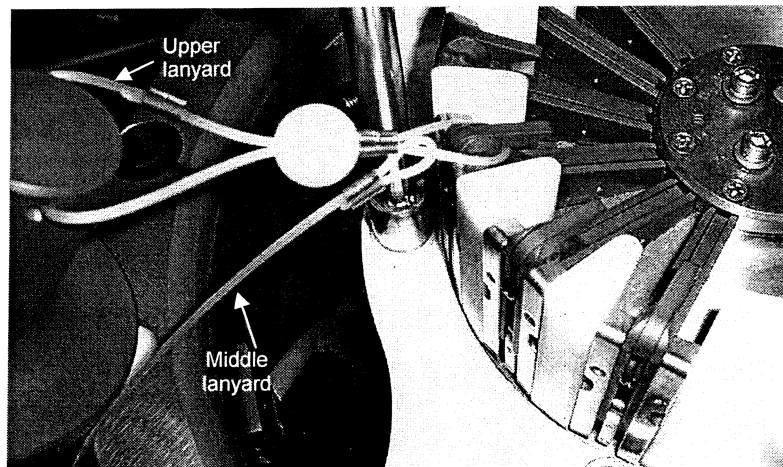
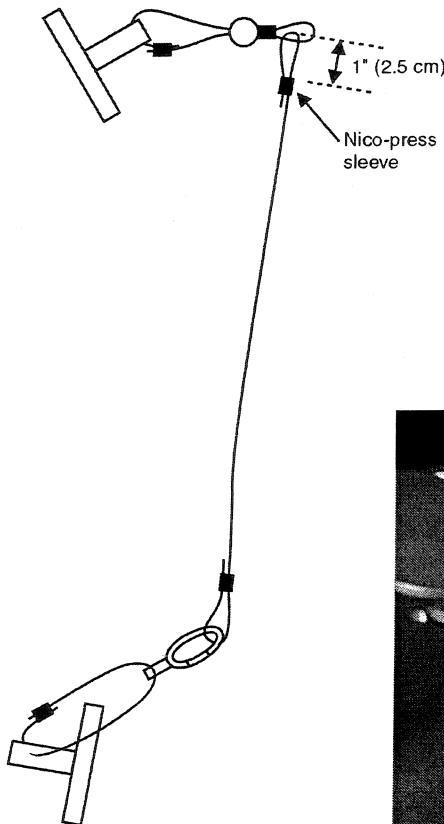
Middle Lanyard

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



Angling end cap handle away from center of Carousel

1. Cut a lanyard to the following approximate size:
 - 12-bottle Carousel - 31 cm (12 inches) longer than the bottle
 - 24-bottle Carousel - 61 cm (24 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 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. Open both bottle end caps:
 - A. 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.
 - B. Place another wooden spacer in the bottom bottle mouth. Angle the end cap handle away from the center of the Carousel.
 - C. Verify that the bottle end caps are cocked at the correct angles.
4. Clip the middle lanyard loop into the lower lanyard snap hook.
5. If the bottle has a handle, run the end of the middle lanyard through the handle to prevent loss of either end cap if the rubber tubing between the end caps breaks.
6. Thread the end of the middle lanyard through a nico-press sleeve.
7. 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.
8. 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.
9. Remove the wooden spacers. Both end caps should be held in the proper *cocked* position. If not, remake the middle lanyard, adjusting measurements as required.



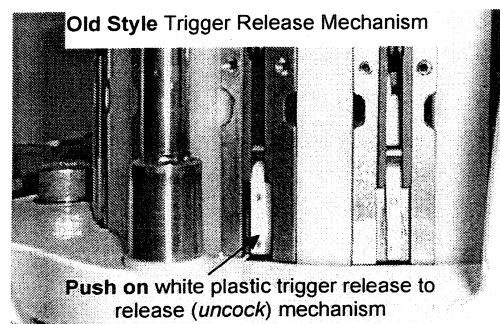
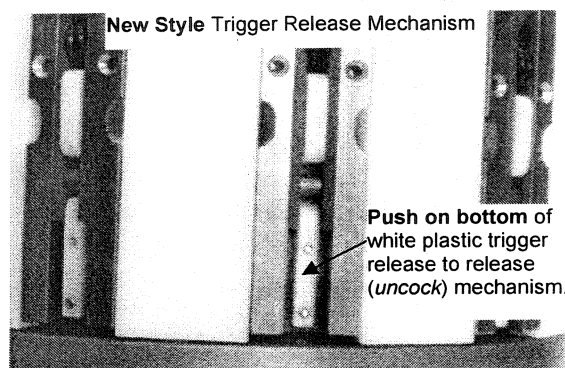
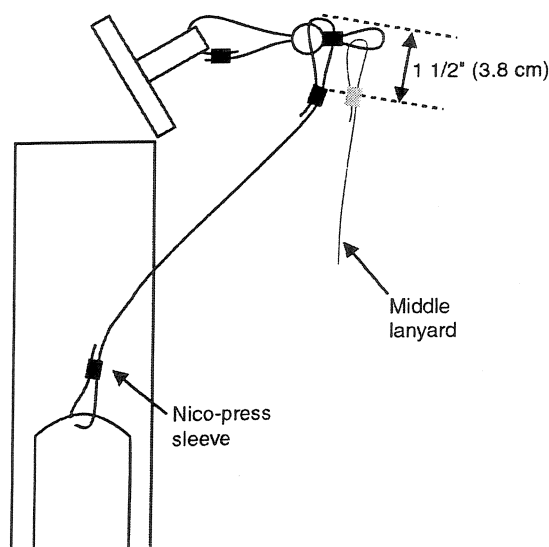
Reversing Thermometer Lanyard

The reversing thermometer lanyard attaches to the upper lanyard. Overall lanyard length is dependent on bottle size and 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 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 thermometer in the *cocked* position, thread one end of the lanyard through a nico-press sleeve, through the top hole in the thermometer, and back through the sleeve. Adjust the sleeve until the loop fits snugly around the 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 sleeve. Adjust the lanyard length until all slack is taken out of the lanyard and the loop takes up tension on the upper lanyard ball. Adjust the 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 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 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 thermometer lanyard after the bottle fires using a rubber band or some additional lanyard material.



Appendix II: CTD Plumbing

Note:

An SBE 19, 19*plus*, or 25 CTD 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 plumbing guidelines for the SBE 9*plus* apply to these CTDs as well, except as noted.

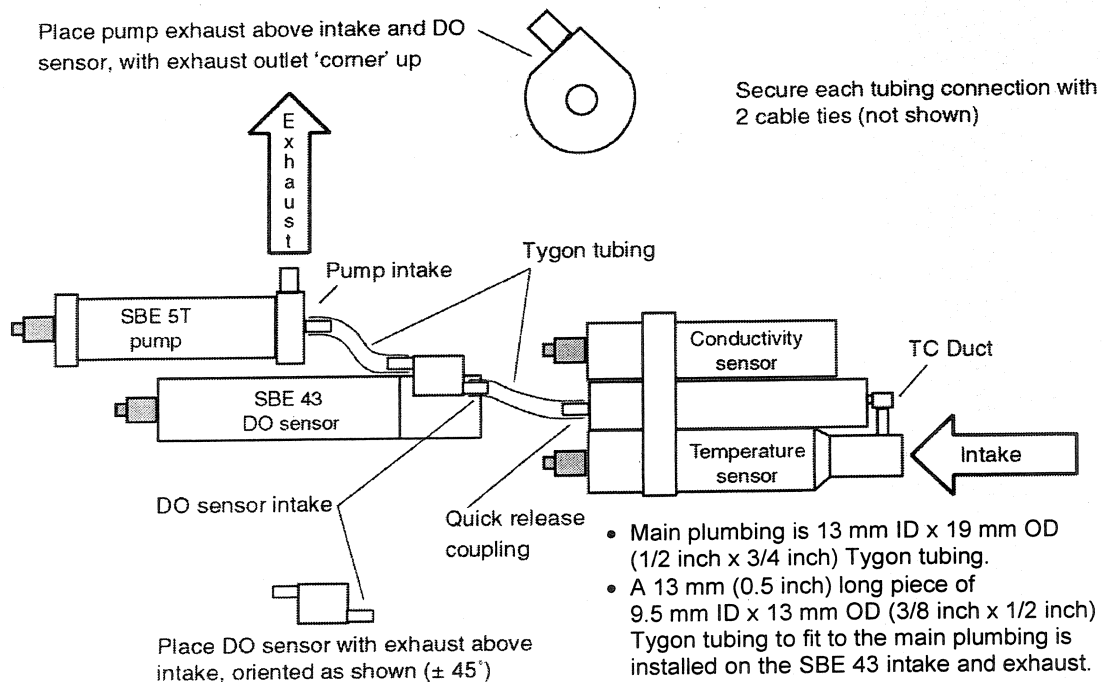
An SBE 9*plus* CTD that is deployed with the Carousel is mounted in a horizontal position. Pump placement and plumbing for a horizontal mount is different than that for a vertical mount. This appendix covers converting a vertical mount CTD for horizontal use with a Carousel, and converting a horizontal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

Failure to place the pump and plumbing properly can trap air, preventing the pump from working properly.

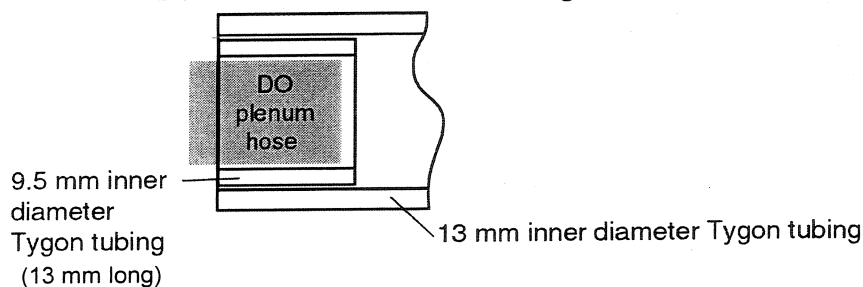
Horizontal Mount

- Place the dissolved oxygen (DO) sensor intake above the conductivity sensor exhaust.
- Place the pump intake above the DO sensor exhaust.
- Orient the pump with the exhaust outlet *corner* up.
- If the system does not include a DO sensor, connect the tubing from the conductivity cell directly to the pump intake.

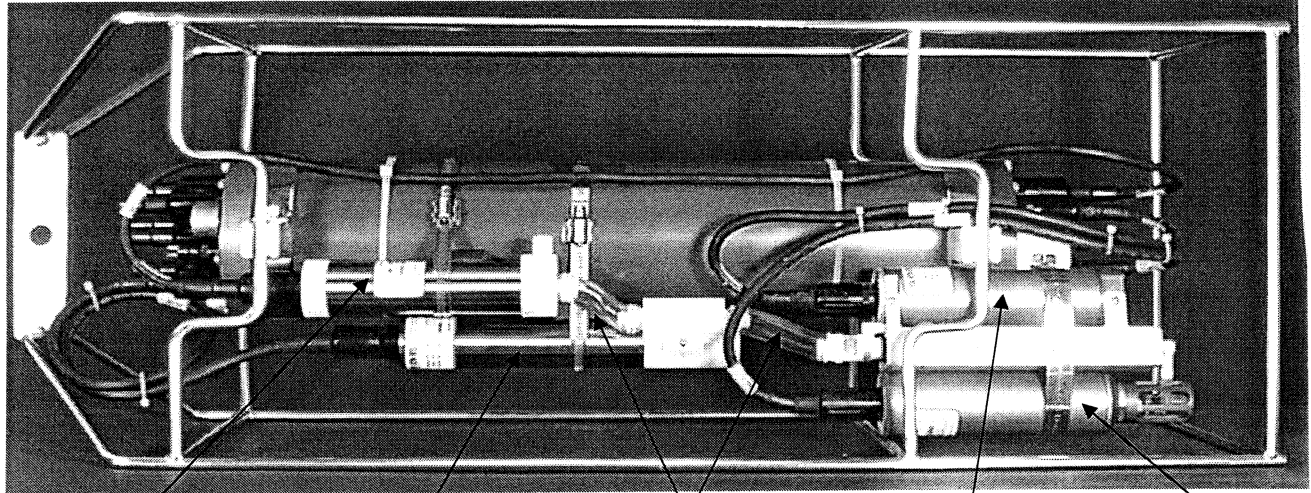
The details are shown schematically below and in photos on the next page.



DO sensor intake and exhaust tubing detail



Overall View



Pump
(intake vertically
above DO sensor
exhaust)

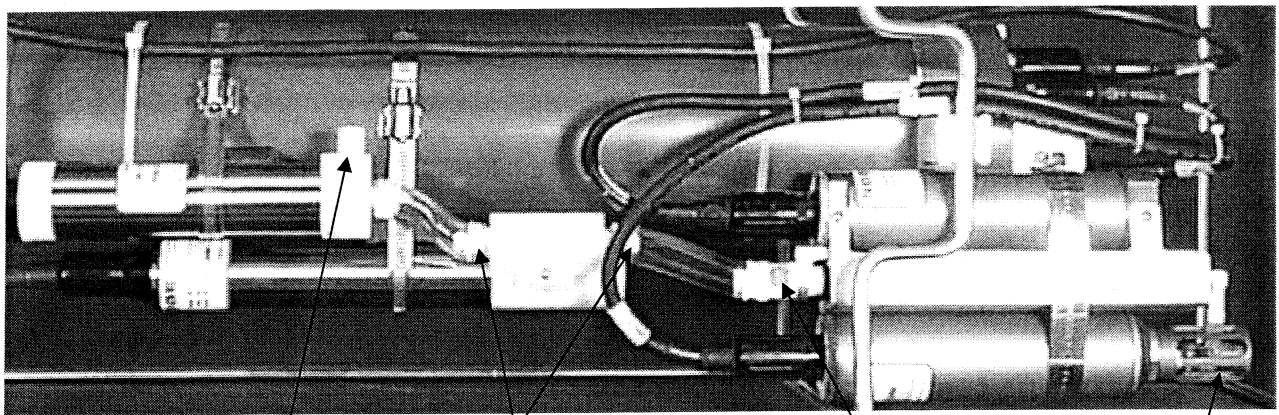
DO sensor (plenum
intake vertically above
temperature/conductivity
sensor exhaust)

Tygon
tubing

Conductivity sensor

Temperature sensor

Details



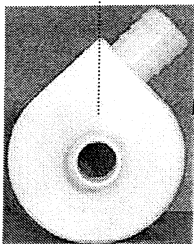
Pump exhaust –above DO
sensor and TC Duct intake,
oriented as shown below

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



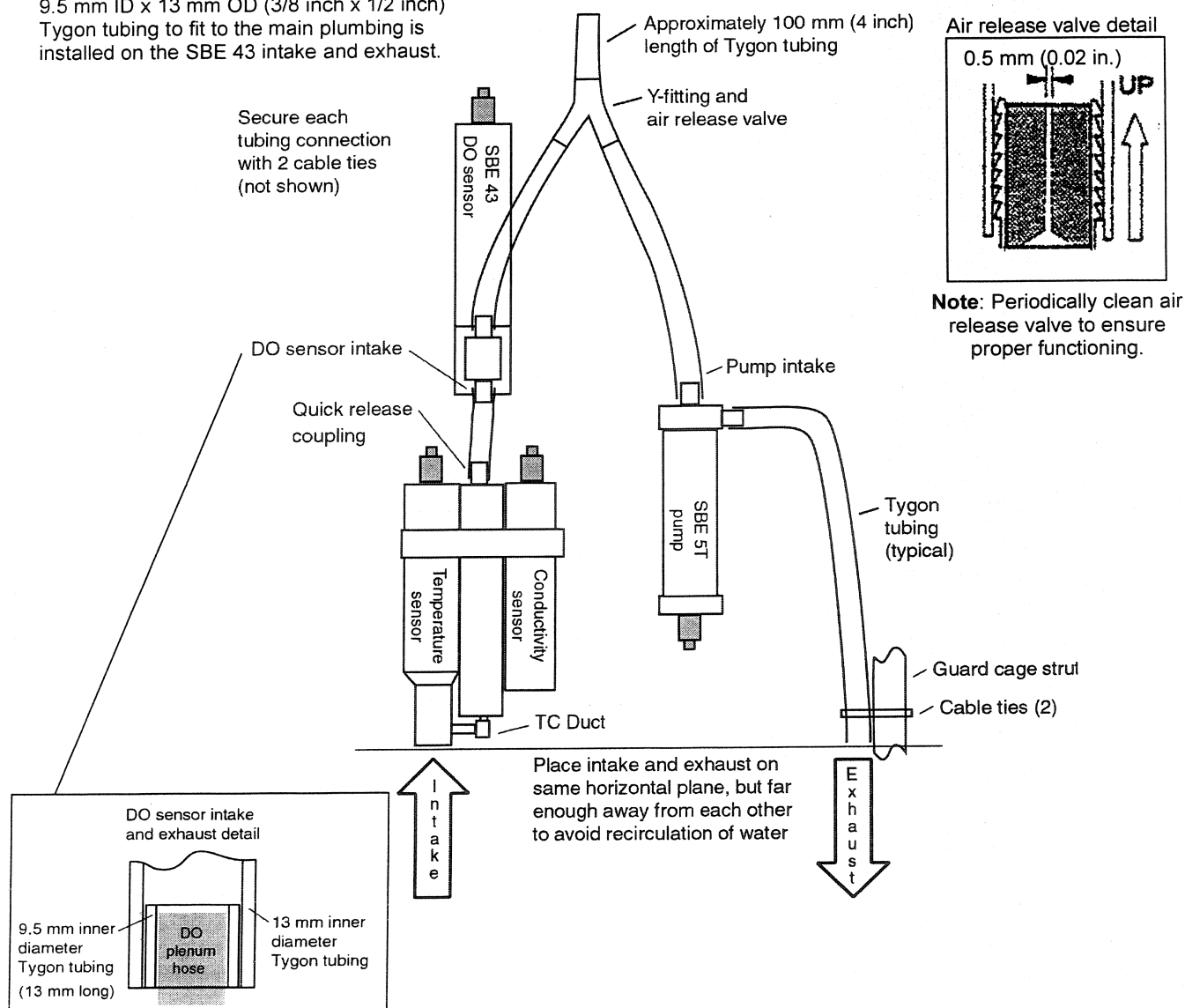
Vertical Mount

Note:

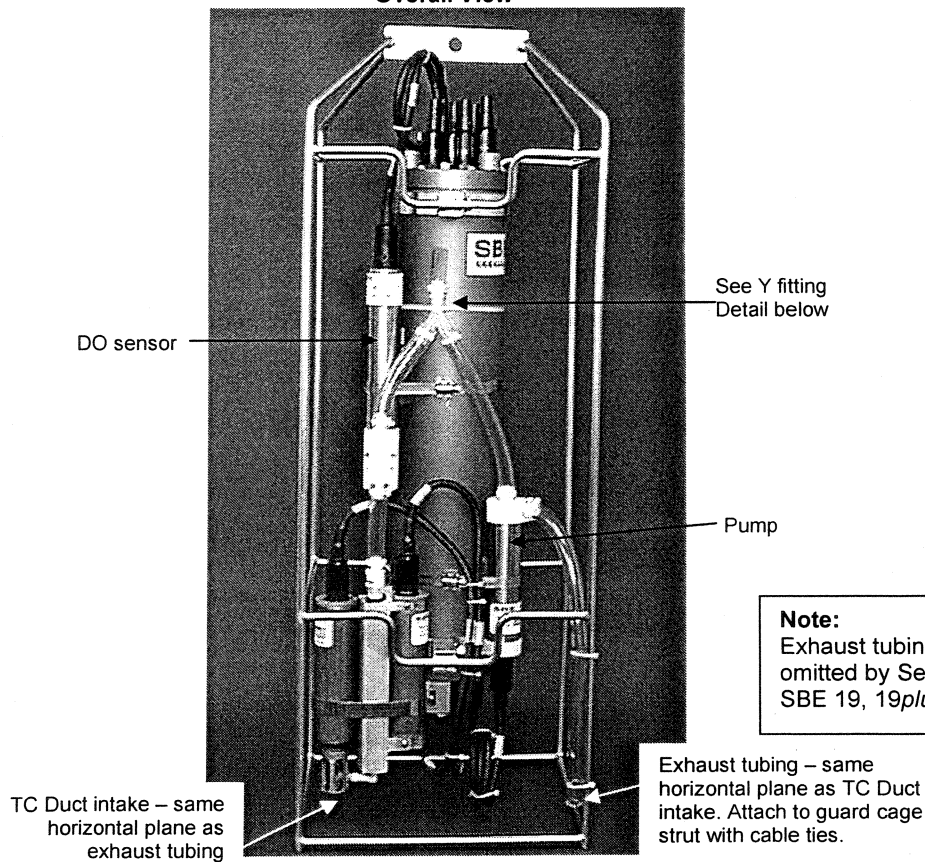
Exhaust tubing is usually omitted by Sea-Bird for an SBE 19, 19*plus*, or 25.

- (For the 9*plus* only) 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.
- The details are shown schematically below and in photos on the next page.

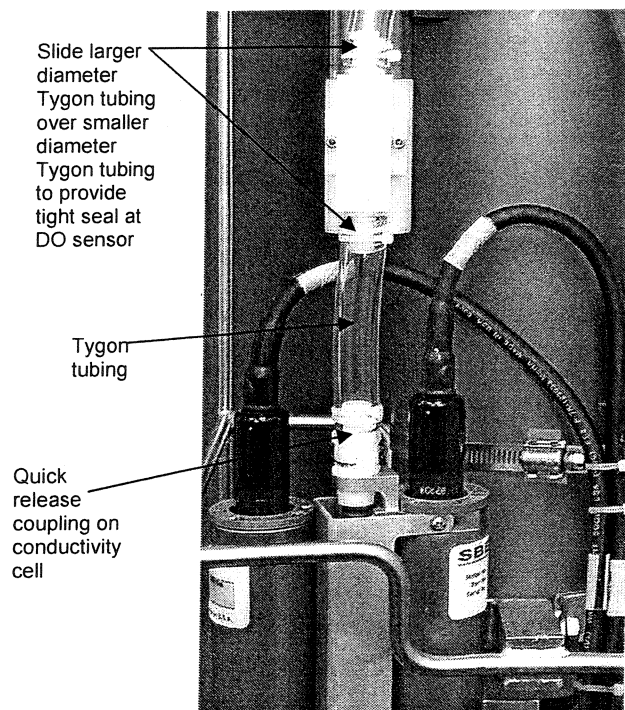
- Main plumbing is 13 mm ID x 19 mm OD (1/2 inch x 3/4 inch) Tygon tubing.
- A 13 mm (0.5 inch) long piece of 9.5 mm ID x 13 mm OD (3/8 inch x 1/2 inch) Tygon tubing to fit to the main plumbing is installed on the SBE 43 intake and exhaust.



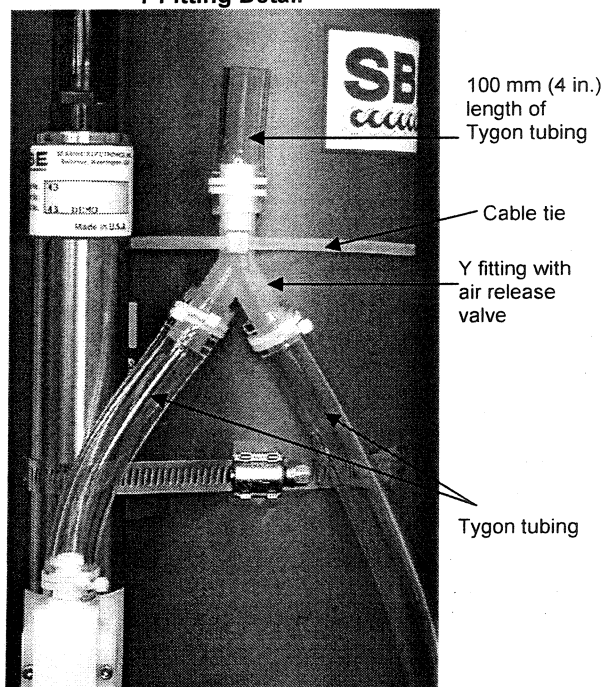
Overall View



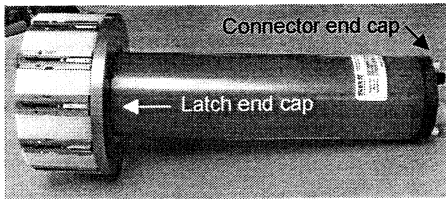
Temperature/Conductivity to DO Sensor Detail



Y Fitting Detail

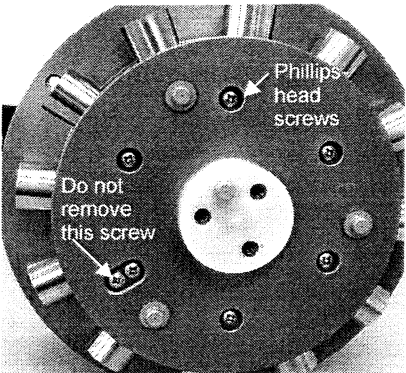
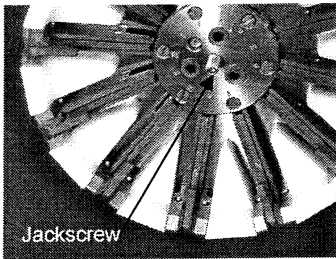
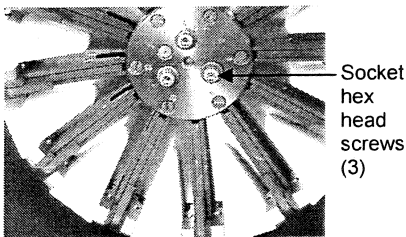


Appendix III: Electronics Disassembly/Reassembly



The standard Carousel electronics are accessed through the latch end cap. The *additional* electronics related to the optional serial interface (for a Carousel with three bulkhead connectors on the connector end cap) are accessed through the connector end cap.

At Latch End Cap (standard Carousel electronics)



Disassembly

1. Remove the pylon from the pylon / hub assembly, as described in *Removing Center Pylon in Section 5: Routine Maintenance*.
2. Remove the three socket hex head screws, lock washers, and flat washers from the top of the latch assembly.
3. (Carousels built 2006 and later) Insert a jackscrew in the center hole (see photo of jackscrew kit on next page). As you turn the jackscrew, the latch assembly will push away from the pylon. Lift the latch assembly off the pylon.
4. Wipe the outside of the end cap and housing dry, being careful to remove any water at the seam between them.
5. Remove the end cap and electronics:
 - A. Remove the Phillips-head screws and insulators from the end cap (the number of screws varies, depending on the pylon size). Do not remove the ground strap screw.
 - B. Pull the end cap and 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-ring from damage or contamination.
 - D. Disconnect the Molex connector connecting the PCB assembly to the Carousel.

Reassembly

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 Phillips-head screws and washers to secure the end cap to the housing.
5. Reinstall the latch assembly on the end cap, using the three socket head screws, lock washers, and flat washers.
6. Reinstall the pylon in the hub, and reinstall the lifting bail.

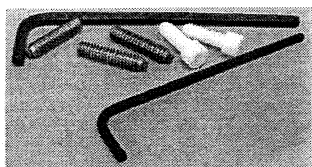
Note:

Before delivery, a desiccant package is inserted in the housing and the electronics chamber is filled with dry Argon gas to 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.

At Connector End Cap (additional electronics for optional serial interface)

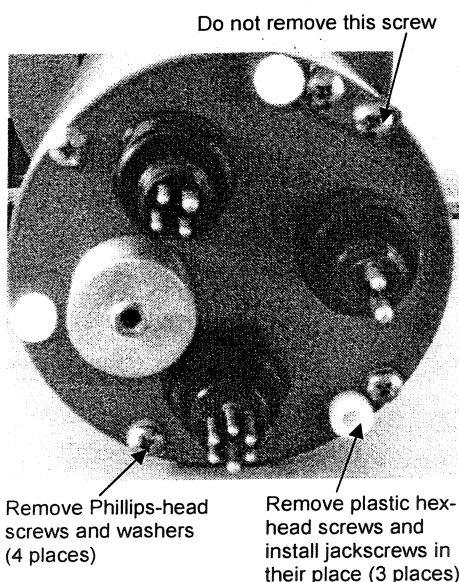
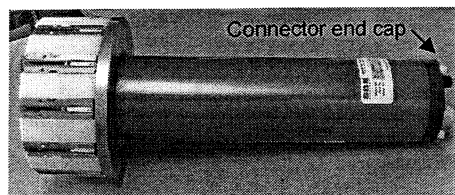
Jackscrew
kit



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

- two Allen wrenches
- three jackscrews
- two spare plastic socket hex-head screws

Disassembly



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 insulators 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 connectors 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 connectors to the PCB assembly. Verify the connectors hold 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-us.com/TDS/TDSFiles/NSBlueMoly.pdf>) for the most up-to-date specifications.



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 powder 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 (1316°C), use Never-Seez® Pure Nickel Special.

Other Anti-Seize Lubricants

- 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®

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Technical Specifications

Color	Blue	
Temperature Range, °F (°C)	-150°F to 1500°F (-101°C to 815°C)	
Solvent Resistance	Excellent in fresh or salt water	
Particle Size, mil (microns)	2 maximum (50 µ)	
Density (g/cm³)	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 (°C)	>482°F (>250°C)	D-92
Dropping Point, °F (°C)	360°F (182°C)	D-566
Copper Corrosion Test @ 212°F (100°C), 24 hours	No Corrosion	D-130-83
Torque Coefficient, k factor	0.150	
Coefficient of Friction (4 ball), 167°F (75°C)	0.0824	D-2266

Appendix IV: Never-Seez Blue Moly Data Sheet

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

Shelf Life: Never-Seez® Blue Moly does not deteriorate with age when stored unopened at temperatures below 120°F (49°C).

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
NBBT-8	Brush Top	8 oz.
NBBT-16	Brush Top	1 lb.
NB-160	Flat Top	1 lb.
NB-42B	Pail	42 lb.
NB-425B	Drum	425lbs.

Bostik Findley, Inc.
 211 Boston Street
 Middleton, MA 01449-2128 USA
 Technical Service: 888-603-8568
 FAX: 878-750-7283
<http://www.bostikfindley-us.com>

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N2-04/04/02

Appendix V: Replacement Parts

Part Number	Part	Application Description	Quantity in Carousel
17198*	6-pin AG-206 to 6-pin AG-206, 2.0 m (6.6 ft)	From Carousel to 9plus, 17plus, or AFM	-
80591*	2-pin RMG-2FS to 2-pin MS3106A-12S-3P, 2.4 m (8 ft)	From Carousel to SBE 33 (test cable)	-
17292*	4-pin RMG-4FS to 4-pin RMG-4FS, 2.0 m (6.6 ft)	From Carousel to 19, 19plus, or 25	
171220*	6-pin AG-206 to 6-pin AG-206 to 6-pin AG-206 Y-cable	From SBE 35 or 35RT to: • 9plus (with 11plus) and Carousel, • 17plus and Carousel, or • AFM and Carousel	
171221*	6-pin AG-206 to 6-pin AG-206, 2.4 m (8 ft)	From SBE 35 or 35RT to Carousel (for use with 19, 19plus, or 25 and SBE 33 Carousel Deck Unit)	
171741	6-pin MCIL-6FS to 6-pin MCIL-6FS (wet-pluggable), 2.0 m (6.6 ft)	From Carousel to 9plus, 17plus, or AFM (wet-pluggable connectors)	-
801363	2-pin MCIL-2FS to 2-pin MS3106A-12S-3P (wet-pluggable), 2.4 m (8 ft)	From Carousel (wet-pluggable connectors) to SBE 33 (test cable)	-
171912	4-pin MCIL-4FS to 4-pin MCIL-4FS (wet-pluggable), 2.0 m (6.6 ft)	From Carousel to SBE 19, 19plus, or 25 (wet-pluggable connectors)	
171995	6-pin MCIL-6FS to 6-pin MCIL-6FS to 6-pin MCIL-6FS (wet-pluggable) Y-cable	From SBE 35 or 35RT to: • 9plus (with 11plus) and Carousel, • 17plus and Carousel, or • AFM and Carousel	
171996	6-pin MCIL-6FS to 6-pin MCIL-6FS (wet-pluggable), 2.4 m (8 ft)	From SBE 35 or 35RT to Carousel (for use with SBE 19, 19plus, or 25 and SBE 33 Carousel Deck Unit)	
17043*	Locking sleeve	Locks cable or dummy plug in place	4
17044.1*	2-pin RMG-2FSD-LP dummy plug and locking sleeve	For when 2-pin connector not used	1
17046.1*	4-pin RMG-4FSD-LP dummy plug and locking sleeve	For when 4-pin connector not used	1
17047.1*	6-pin AG-206FSD-LP dummy plug and locking sleeve	For when 6-pin connector not used	1
171192	Locking sleeve	Locks cable or dummy plug in place (for wet-pluggable connector)	4
171497.1	2-pin MCDC-2-F dummy plug and locking sleeve	For when 2-pin connector not used (wet-pluggable connector)	1
171398.1	4-pin MCDC-4-F dummy plug and locking sleeve	For when 4-pin connector not used (wet-pluggable connector)	1
171498.1	6-pin MCDC-6-F dummy plug and locking sleeve	For when 6-pin connector not used (wet-pluggable connector)	1
50092	SBE 16/19 Jackscrew Kit	For removing connector end cap	1

* For standard Impulse glass-reinforced epoxy bulkhead connectors

Continued on next page

Appendix V: Replacement Parts

Continued from previous page

Part Number	Part	Application Description	Quantity in Carousel
50151	Spare o-ring kit	Spare o-rings, including: <ul style="list-style-type: none"> • 30097 Parker 2-111N674-70 (actuator o-ring) • 30618 Parker 2-106E962-90 (latch spacer o-ring) • 30815 Parker 2-233E603-70 (end cap o-ring) 	-
50133	Pylon spares kit	Spare o-rings and hardware for pylon, including: <ul style="list-style-type: none"> • 30097 Parker 2-111N674-70 (actuator o-ring) • 30618 Parker 2-106E962-90 (latch spacer o-ring) • 30815 Parker 2-233E603-70 (pylon end cap o-ring) • 23684 Ground strap (end cap) • 30044 Anode (for pylon, hub, cage) • 30116 Machine screw 2-56 x 3/8 PH SS (latch end cap: coil terminate PCB to end cap) • 30137 Machine screw 6-32 x 1/4 PH SS (for 23684, 3400 m) • 30154 Machine screw 8-32 x 3/8 (for 23684, 6800 m) • 30164 Machine screw 8-32 x 1 1/8 PH SS (end cap to housing, 3400 m) • 30235 Washer, #2 nylon (for 30116) • 30238 Washer, #4 flat (for 30586) • 30241 Washer, #6 nylon (for 30137) • 30249 Washer, #10 flat (for 30587) • 30250 Washer, # 10 split ring lock (for 30587) • 30254 Washer, 1/4 split ring lock (for 30602, 30570, 30294) • 30267 Screw insulator, #8 x 1/2 (for 30164) • 30271 Spacer, #2 x 1/8, nylon (for 30116) • 30294 Screw insulator, 1/4 x 1/4 (latch end cap to hub) • 30526 Machine screw 1/4-20 x 3/4, plastic (plug jackscrew holes) • 30570 Washer, 1/4 flat, SS (pylon hub to bale) • 30586 Screw, 4-40 x 1-1/2 socket head (latch end cap: actuator to recesses in end cap) • 30587 10-32 x 3/4 socket head (trigger mount disk to latch end cap / coil) • 30588 Screw, 6-32 x 2" PH, SS (latch assembly to latch end cap) • 30602 Screw, 1/4-20 x 2-1/4 S SH SS (hub to latch end cap) • 30604 Screw insulator, #10 x 1/4 (for 30587) • 30606 Screw insulator, #4 x 1/2 (for 30586) • 30657 Machine screw 2-56 x 3/8 FH (trigger: cover plate and slider to side plate) • 30658 Machine screw 6-32 x 11/16 FH (latch assembly retainer disk to mount disk) • 30659 Machine screw 4-40 x 13/16 FH (support bars to latch assembly) • 30663 Latch spring (recoil motion in slider) • 31394 Machine screw 10-24 x 1/2 FH (trigger dummies to mount disk) 	-

Continued on next page

Continued from previous page

Part Number	Part	Application Description	Quantity in Carousel
50340	SBE 32 small (1" diameter frame parts) frame complete spare hardware kit	Complete hardware set (bolts, nuts, insulators, etc.) for frame and lifting bail (does not include frame pieces or lifting bail) for full size SBE 32: - 12-position, 12 liters or smaller - 24-position, 2.5 liters or smaller	-
50341	SBE 32 large (1.375" diameter frame parts) frame complete spare hardware kit	Complete hardware set (bolts, nuts, insulators, etc.) for frame and lifting bail (does not include frame pieces or lifting bail) for full size SBE 32: - 12-position, 20 liters or larger - 24-position, 5.0 liters or larger	-
50342	SBE 32C / 32SC complete spare hardware kit	Complete hardware set (bolts, nuts, insulators, etc.) for frame and lifting bail (does not include frame pieces or lifting bail) for SBE 32C or 32SC	-
50299	Spare titanium latch kit	Latch parts, hardware, and o-rings to replace 1 latch	-
50123	Carousel tool kit	Tools useful for using/servicing Carousel, including: <ul style="list-style-type: none"> • 30434 Disposable syringe (for applying lubricants) • 30664 Nicopress oval sleeve, 18-1-C (crimps for lanyards) • 30665 Monofilament line, 0.080 inch OD (Weedeater line for lanyards) • 30666 Bostik Blue Moly, 8 oz. can (anti-seizing lubricant for hardware) • 65001 Crimp tool, Klein, 1006 9-3/4 (crimp tool for Nicopress oval sleeves) • 65002 Fresh cut pliers (for cutting lanyard material) • 65003 3/8" Hex Allen ball wrench (for all large bolts) • 65004 3/16" Hex Allen ball wrench (for 1/4-20 socket head bolts) • 65005 5/32" Hex Allen ball wrench (for 12-place frame to side bar bolts) • 65006 Screwdriver, #2 (general use as needed) • 65007 Screwdriver, #12 (general use as needed) • 65008 3/4" Open end box wrench (all nuts to large bolts) • 65009 3/8" Hex Allen socket (attach to ratchet for use on large bolts) • 65010 3/8" Ratchet (alternative tool for large bolts) • 65012 7/32" Hex Allen ball wrench (for 24-place frame to side bar bolts) 	-

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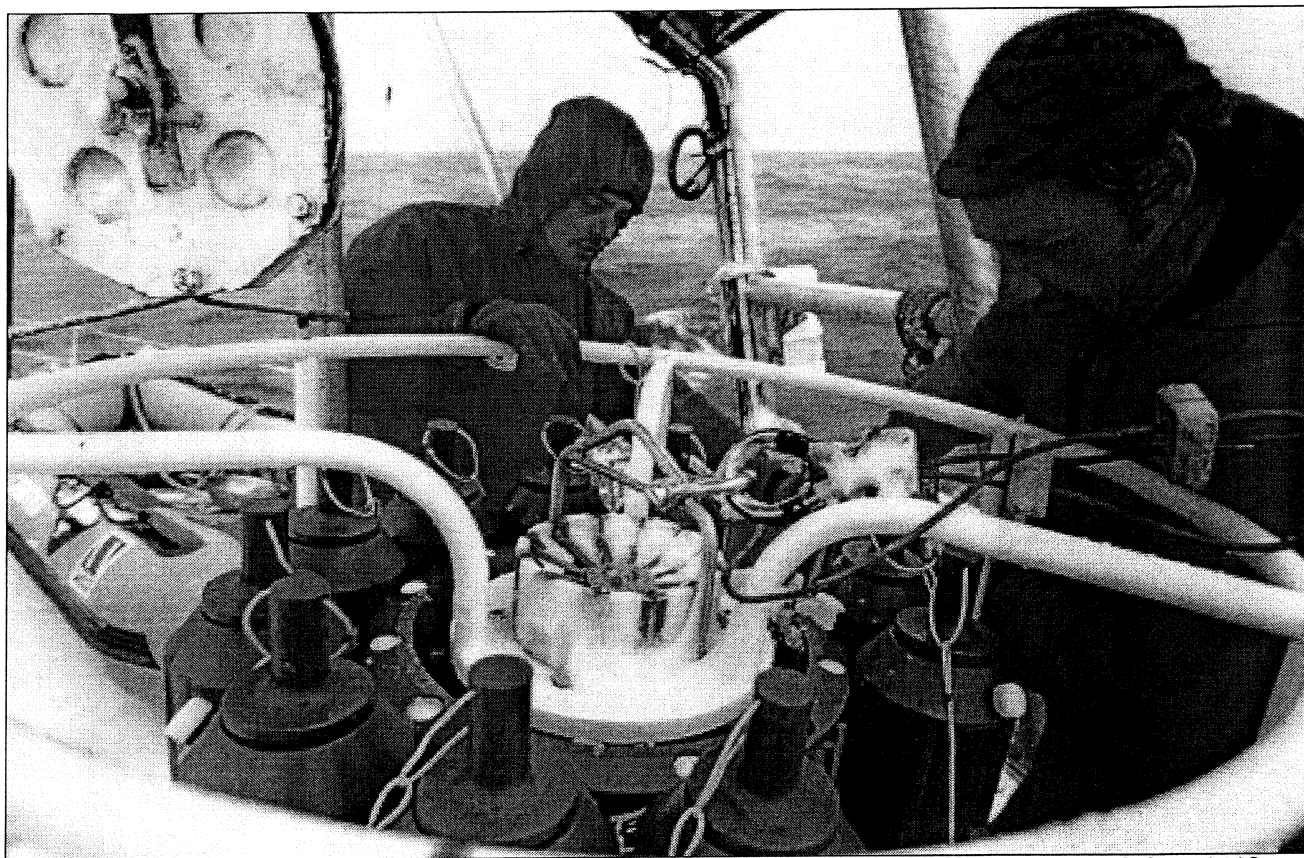


Photo by S. Compaint / Sygma

SBE 32 Carousel Water Sampler - An innovative design free of the reliability problems associated with motor-driven types. The Carousel has no moving-shaft seals that can bind up at low temperatures or under pressure because each bottle position has its own magnetically-activated lanyard release latch. Only the magnetic field - not a moving part - links the Carousel's lanyard release mechanism with the pylon control electronics.

Sea-Bird's Carousel has been extensively deployed throughout the world's oceans, where it has built a reputation for reliability and ease of use. The Carousel has rapidly become *the* standard for oceanographic water sampling.

- Reliable - no motors or oil-filled seals
- Drop-in replacement for existing pylons
- Variety of sizes and configurations
- Compatible with most CTDs
- No interruption of CTD data or power
- Easy one-handed lanyard attachment
- Fire bottles in any order
- Programmable autonomous operation

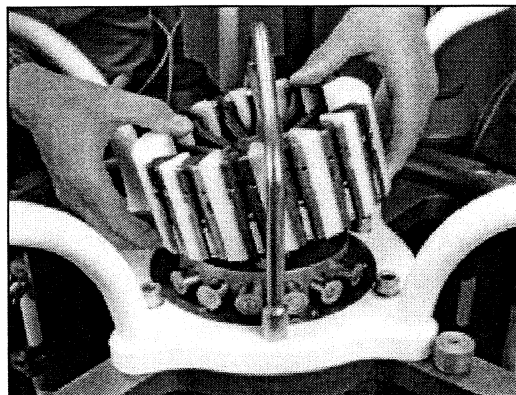
SYSTEM ENGINEERED - PERFORMANCE PROVEN - TIME TESTED



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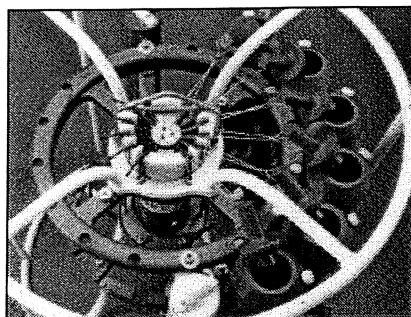
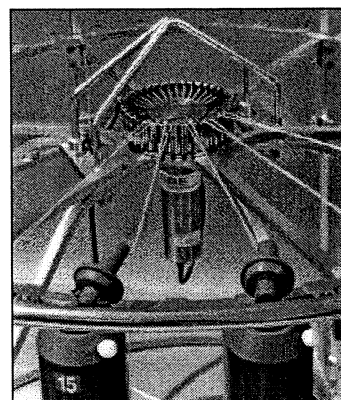
The heart of every Carousel is the magnetically-actuated lanyard release (at right). A pressure-proof electromagnet at each bottle position is energized on command to release the latch holding the bottle lanyard. Titanium, acetal plastic, and other corrosion-resistant materials are used in the latch and magnet assembly. The latch array's modular construction makes servicing easy.



SBE 32 (FULL SIZE) CAROUSEL

The Carousel's electronics/release assembly and mounting hub are standard components of all 12- and 24-position systems, and are available separately. When the electronics/release assembly is bolted into the mounting hub, a drop-in replacement is created for the *pylon* assembly commonly found in many existing water samplers, allowing reuse of existing bottle mount stands and adapter plates when upgrading to the more reliable and convenient Carousel design.

36-position Carousels typically require a custom design suited to the intended bottle size, and are built to meet specific application requirements for size, weight, and materials. One example of a 36-position electronics/release assembly is shown at right, installed in a custom 36-position stainless steel frame for 12-liter bottles.

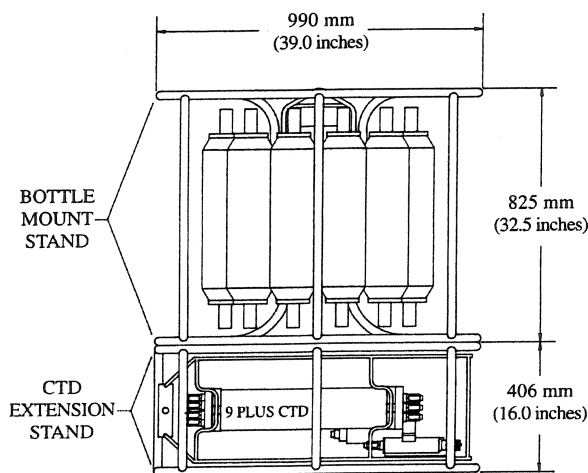


SBE 32C COMPACT CAROUSEL

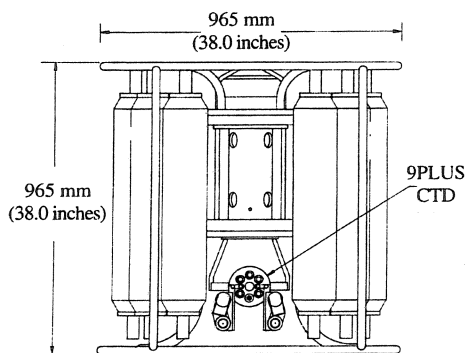
For use with limited vertical clearance, the SBE 32C is a 12-position sampler without CTD extension stand. It supports bottles up to 8 liters, and accommodates a 9*plus* CTD mounted horizontally inside the bottle circle. Bottle positions are closely spaced into 2 arcs, leaving spaces between the arc ends to provide unobstructed flow to the 9*plus* or to allow mounting an SBE 19, 19*plus*, or 25 CTD (or SBE 49 CTD for real-time operation only) and/or other instruments vertically, using an accessory mounting fixture.

SBE 32SC SUB-COMPACT CAROUSEL

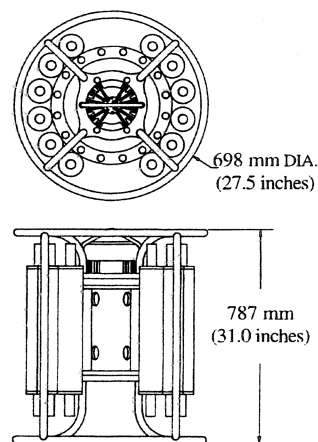
The 12-position SBE 32SC is sized for 1.7 or 2.5 liter bottles. When used with an SBE 19, 19*plus*, or 25 CTD (or SBE 49 CTD for real-time operation only), it offers a small yet full-featured system, well suited to operation from small boats.



Full Size Carousel (12-bottle, 5-liter shown)



Compact Carousel with 9plus



Subcompact Carousel, 12 1.7-liter bottles

CAROUSEL CONTROL

The Carousel can be controlled in several ways:

- Real-time data acquisition and control -
 - SBE 11*plus* Deck Unit for SBE 9*plus* CTD
 - SBE 33 Carousel Deck Unit for SBE 19, 19*plus*, 25, or 49 CTD; no CTD; or Neil Brown Mk III CTD
- Autonomous data acquisition and control (no conducting wire required)
 - SBE 17*plus* V2 SEARAM for SBE 9*plus* CTD
 - Auto Fire Module (AFM) for SBE 19, 19*plus*, or 25 CTD or no CTD

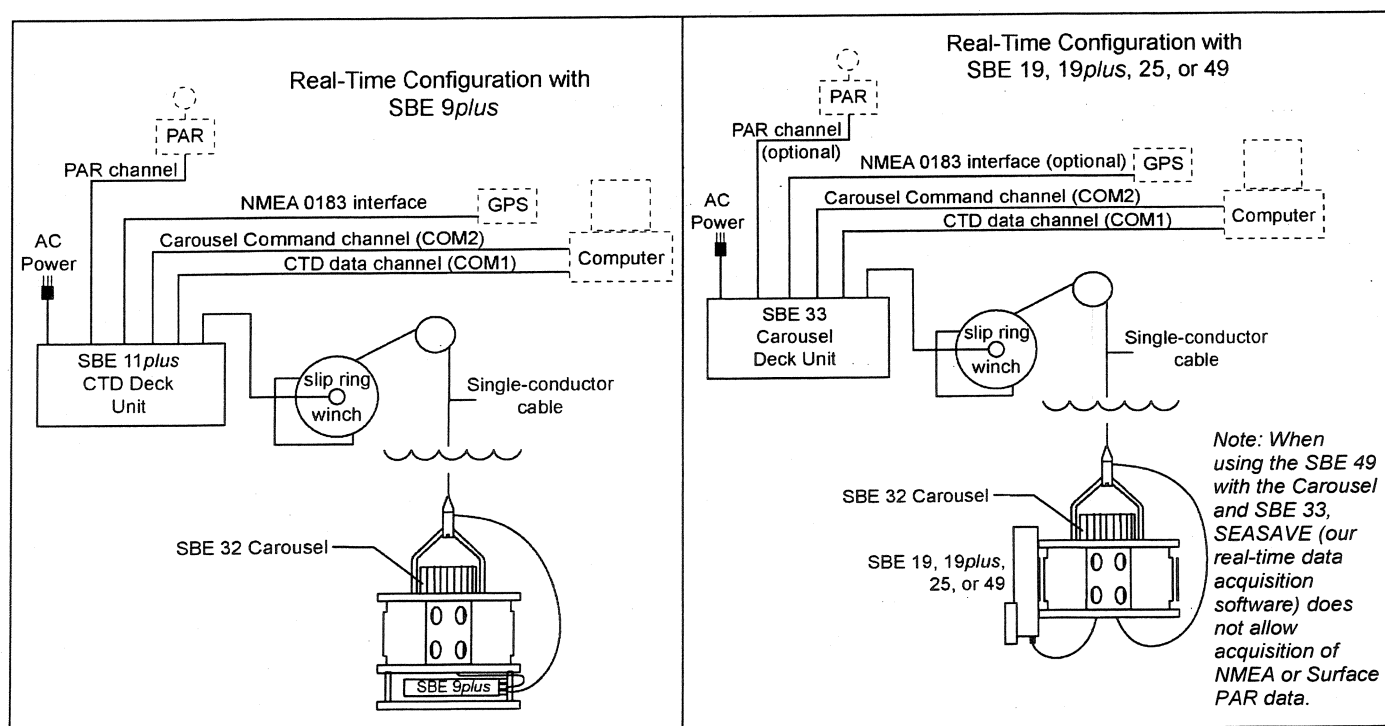
Each of these is described briefly below; see the applicable specification sheet for more details.

SBE 11plus Deck Unit

The Carousel is designed to be connected to the SBE 9*plus* CTD and SBE 11*plus* Deck Unit, and controlled via the SBE 911*plus* modem channel.

SBE 33 Carousel Deck Unit

For stand-alone Carousel use (without a CTD), the SBE 33 provides power and real-time control to the water sampler. When used with an SBE 19, 19*plus*, 25, or 49 CTD, it also provides a real-time data telemetry link and power for the CTD and auxiliary instruments. Optional interfaces for the SBE 33 include a NMEA 0183 interface to allow GPS position data to be appended to Sea-Bird CTD data, and an auxiliary A/D channel to interface a surface PAR sensor.



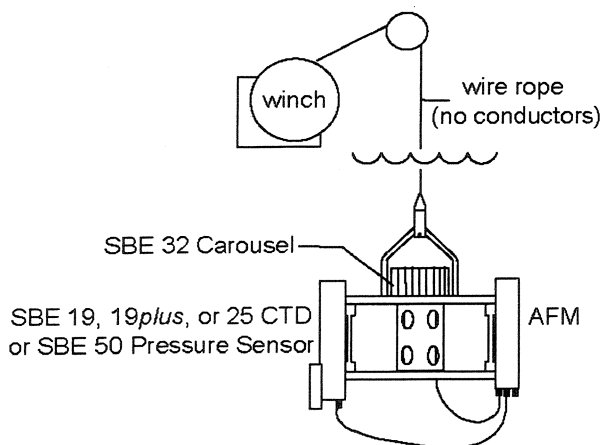
SBE 17plus V2 SEARAM Recorder & Auto Fire Module

The SEARAM allows Carousel operation with an SBE 9*plus* CTD without a conducting seacable. Power is supplied to both CTD and Carousel by the SEARAM's internal battery. Using pressure data received from the SBE 9*plus* and a programmable table of bottle closure pressures, the SEARAM commands the Carousel to close bottles on upcast. Setup, checkout, and data uploading are performed through the provided software.

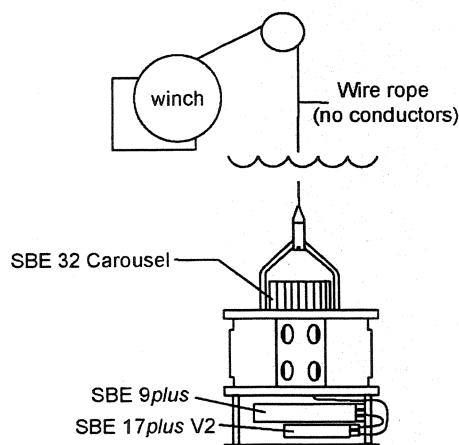
Auto Fire Module (AFM)

The AFM allows Carousel operation without a conducting sea cable by firing bottles at user-programmed time intervals. Or, when used with SBE 19, 19*plus*, or 25 CTD or SBE 50 Pressure Sensor, the AFM monitors the instrument pressure data and fires bottles at user-programmed depths. The AFM also records bottle number, firing confirmation, and 5 scans of CTD data for each bottle fired. At the end of a cast, data from the CTD and the bottle summary file from the AFM are both uploaded using the provided software. Setup and checkout are also performed (without opening the housing) through the software. The AFM, supplied with 9 alkaline D-size cells, provides Carousel power and AFM operation of at least 40 hours.

Auto Fire Module and SBE 19, 19plus, 25, or 50



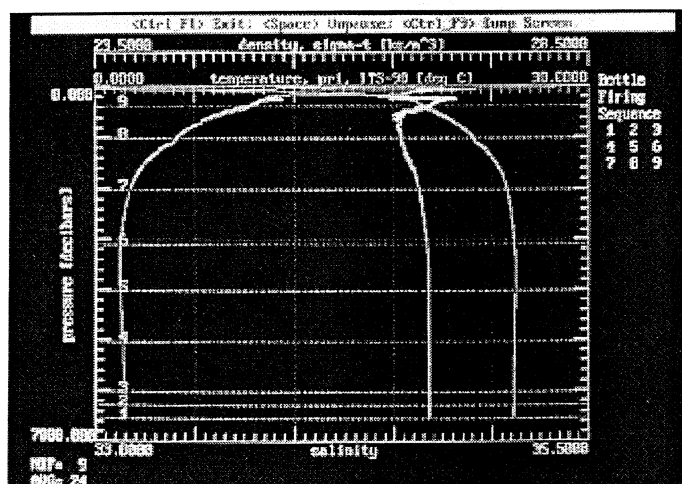
SBE 17plus with SBE 32 and SBE 9plus



SEA-BIRD SOFTWARE

SEASOFT[®]-Win32, our complete Windows 95/98/NT/2000/XP software package, is included at no extra charge. SEASOFT's modular programs include:

- SEATERM and SeaterMAF – terminal programs for setup and data uploading.
- SEASAVE - real-time data acquisition and simultaneous keyboard control of bottle firing. A typical real-time CTD data plot (at right) shows how the software automatically marks the display with bottle numbers, keeps track of which bottles have been fired, and creates a *bottle data* file during real-time data collection.
- SBE Data Processing – filtering, aligning, averaging, and display of CTD and auxiliary sensor data and derived variables.



DIMENSIONS

Full Size Carousel	Diameter mm [in.]	Overall Height mm [in.] ¹	Dry Weight (no CTD or bottles) kg [lbs]	Full Size Carousel	Diameter mm [in.]	Overall Height mm [in.] ¹	Dry weight (no CTD or bottles) kg [lbs]
12 bottle 1.2 liter ²	See 2.5 liter	See 2.5 liter	See 2.5 liter	24 bottle 1.2 liter ²	See 2.5 liter	See 2.5 liter	See 2.5 liter
12 bottle 1.7 liter ²	991 [39]	1201 [47.3]	68 [150]	24 bottle 1.7 liter ²	1143 [45]	1214 [47.8]	95 [210]
12 bottle 2.5 liter ²	991 [39]	1438 [56.6]	79 [174]	24 bottle 2.5 liter ²	1143 [45]	1417 [55.8]	106 [235]
12 bottle 5 liter ²	991 [39]	1234 [48.6]	78 [172]	24 bottle 5 liter ³	1550 [61]	1300 [51.3]	179 [397]
12 bottle 8 liter ²	991 [39]	1438 [56.6]	79 [174]	24 bottle 8 liter ³	1550 [61]	1506 [59.3]	185 [410]
12 bottle 10 liter ²	991 [39]	1603 [63.1]	82 [182]	24 bottle 10 liter ³	1550 [61]	1659 [65.3]	194 [430]
12 bottle 12 liter ²	991 [39]	1730 [68.1]	83 [184]	24 bottle 12 liter ³	1550 [61]	1786 [70.3]	199 [440]
12 bottle 20 liter ³	1550 [61]	1765 [69.5]	164 [363]				
12 bottle 30 liter ³	1550 [61]	1765 [69.5]	171 [378]				
Compact Carousel				Sub-Compact Carousel			
12 bottle 1.2-8 liter ²	966 [38]	973 [38.3]	68 [150]	12 bottle 1.7 liter ²	699 [27.5]	800 [31.5]	50 [111]
				12 bottle 2.5 liter ²	699 [27.5]	1003 [39.5]	52 [114]

¹ Overall height = bottle mount stand + CTD extension stand (if applicable) + height of lifting bail above bottle mount stand.

² Frame parts: 25.4 mm (1 in.) diameter for full size SBE 32 12-bottle through 12-liter bottle size & 24-bottle through 2.5-liter bottle size, & all compact SBE 32C & sub-compact SBE 32SC.

³ Frame parts: 34.9 mm (1.375 in.) diameter for full size SBE 32 12-bottle larger than 12-liter bottle size & 24-bottle larger than 2.5-liter bottle size.

SPECIFICATIONS

Depth Rating	6800 meters (7000 and 10,000 meters optional)
Sea Cable Compatibility	Single or multi-core armored cable up to 10,000 meters long with inner core resistance of 0-350 ohms
Carousel Materials	Anodized aluminum, stainless steel, titanium, Delrin, PVC

05/06

O.T.E. Model 110 Sample Bottle



Description

O.T.E. non-metallic free-flushing water sampling bottles with improved Sea-Bird mounting hardware are available in 5, 8, 10, or 12 liter sizes. These bottles substitute a rugged titanium base and Delrin mount blocks for the glued-PVC components used on other types. The base is securely attached – not glued – to the bottle using stainless steel clamps. The clamps are electrically isolated from the titanium base to prevent galvanic attack.

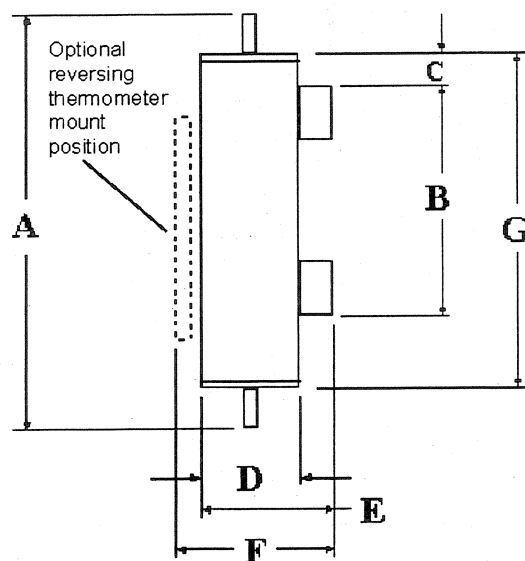
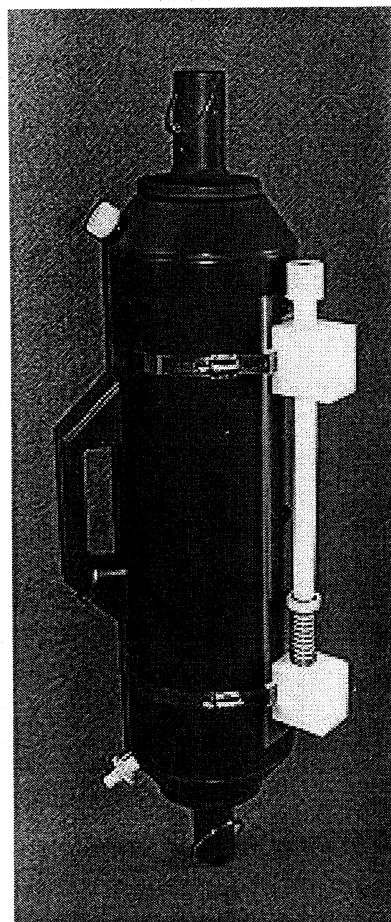
These improved bottles fit existing bottle frame adapter plates, or, for activation by a messenger, can optionally be supplied for individual or serial attachment to a hydrowire. The improved bottles are strongly recommended for operation in cold regions, where PVC mounts become brittle and prone to breakage.

Standard and Optional Features

Standard order includes gray PVC sampler body, latex tubing spring closure, mounting blocks to attach to bottle stand adapter plates, release lanyards, Delrin drain valve, and Buna O-rings. External stainless steel springs, reversing thermometer mounts, and cable mounts for hydrowire deployment (via messengers) are optional.

Dimensions and Weights

	Sampler Capacity (liters)			
	5	8	10	12
A, mm (in.)	692.0 (27.2)	889.0 (35.0)	1041.0 (41.0)	1168.0 (46.0)
B, mm (in.)	330.0 (13.0)			
C, mm (in.)	63.0 (4.0)			
D, mm (in.)	142.0 (5.6)			
E, mm (in.)	192.0 (7.6)			
F, mm (in.)	257.0 (10.1)			
G, mm (in.)	508.0 (20.0)	711.0 (28.0)	863.0 (34.0)	990.0 (39.0)
Empty Weight, kg (lb)	3.6 (8.0)	4.5 (10.0)	5.7 (12.5)	6.1 (13.5)
Full Weight, kg (lb)	8.6 (19.0)	12.5 (27.6)	15.7 (34.5)	18.1 (39.9)
End Opening, mm (in.)	74.0 (2.9)			127.0 (5.0)





Sea-Bird Electronics, Inc.

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Website: <http://www.seabird.com>

Phone: (425) 643-9866

FAX: (425) 643-9954

Email: seabird@seabird.com

SBE Pressure Test Certificate

Test Date: 10/8/2007

Description SBE-32 Carousel

Job Number: 49707

Customer Name TDI-BROOKS

SBE Sensor Information:

Model Number: 32

Serial Number: 0645

Pressure Sensor Information:

Sensor Type: None

Sensor Serial Number: None

Sensor Rating: 0

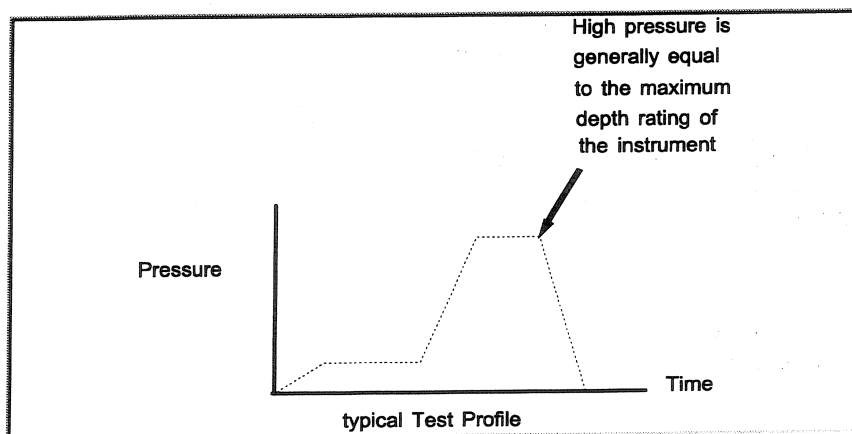
Pressure Test Protocol:

Low Pressure Test: 40 PSI Held For 15 Minutes

High Pressure Test: 40 PSI Held For 30 Minutes

Passed Test: ☒

Tested By: jbs





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APPLICATION NOTE NO.45

Revised **May 2007**

Guide to SBE 32 Carousel Water Sampler Configuration Options

The SBE 32 Carousel Water Sampler is defined by the intended application(s) and control methods, as well as the Carousel model, number of and size of bottles, maximum depth rating, and connector type. Many of these configuration options interact; for example, the number of bottle positions and maximum bottle size is dependent on the Carousel model. Consider the physical requirements of the intended application(s), the interface issues, and make the following choices:

- **CTD/Instrument to be used with the Carousel –**
 - SBE *9plus* CTD
 - SBE 19, *19plus*, or 25 CTD
 - SBE 49 CTD
 - SBE 50 Pressure Sensor
 - No CTD
- **Bottle closure control method –**
 - Real-time (bottles are closed by command from the ship, typically while monitoring real-time CTD data)
 - Autonomous (bottles are closed at pre-programmed pressures or times; no conducting wire is required)
- **Number of bottle positions * -**
 - 12
 - 24
 - 36
- **Maximum bottle size (volume) * -**
 - Accommodates bottles from 1.2 to 30 liters, depending on Carousel model and number of bottle positions
- **Maximum depth rating * -**
 - 6800 meters (22,300 ft)
 - 7000 meters (22,900 ft)
 - 10,500 meters (34,400 ft)
- **Bulkhead and cable connectors –**
 - Standard glass-reinforced epoxy
 - Wet-pluggable (MCBH)
- **Carousel model –**
 - Standard (SBE 32)
 - Compact (SBE 32C)
 - Sub-Compact (SBE 32SC)
- **Amount of flexibility –**
 - Design a system for one application
 - Design a system that can easily be reconfigured in the field to work with a variety of CTDs and bottle closure control methods

Each of these options is described in detail below.

* **Note:** Sea-Bird introduced a small, lightweight, and economical water sampler, the **SBE 55 ECO Water Sampler**, in 2007. The ECO, available in a **3- or 6-bottle** configuration with **4-liter** bottles, is rated for **600 meters**. The ECO can be used with the SBE 19, *19plus*, 25, or 49, and provides autonomous or real-time operation. See the ECO datasheet on our website for details.

CTD and Bottle Closure Control Method

Bottle Closure Control Method	Control	CTD / Instrument
Real-Time (bottles closed by command from the ship)	SBE 11 <i>plus</i> Deck Unit	SBE 9 <i>plus</i> CTD
	SBE 33 Deck Unit	SBE 19 / 19 <i>plus</i> / 25 CTD
		SBE 49 CTD (with limitations; see description below)
		None
Autonomous (no conducting wire required; bottles closed automatically based on pre-programmed pressures or times)	SBE 17 <i>plus</i> V2 SEARAM Recorder and Auto Fire Module	SBE 9 <i>plus</i> CTD
	Carousel Auto Fire Module (AFM)	SBE 19 / 19 <i>plus</i> / 25 CTD
		SBE 50 Pressure Sensor
		None

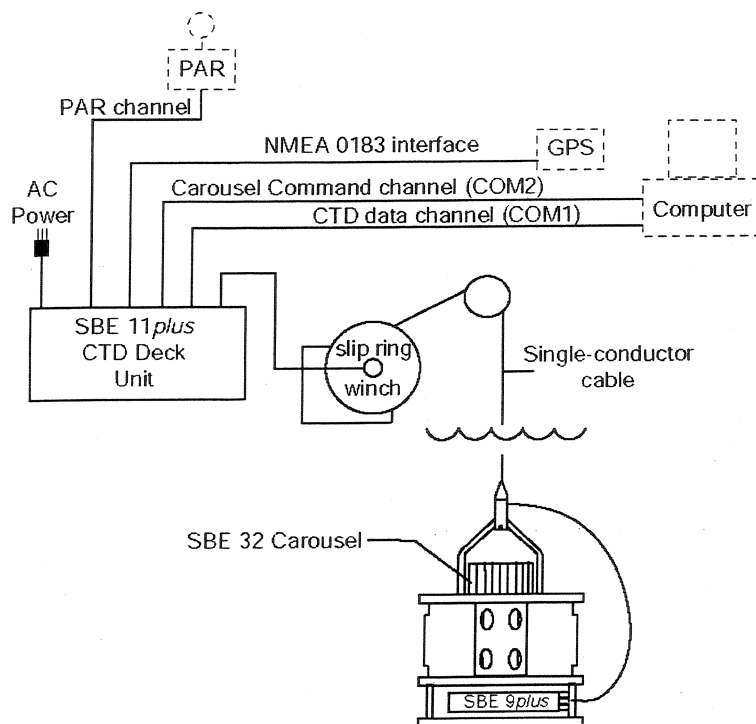
Each of these combinations is described below:

Real-Time Data Acquisition and Control (bottles closed by command from the ship)

- SBE 11*plus* Deck Unit -**

The Carousel is designed to be connected directly 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 (Sea-Bird real-time data acquisition software). The SBE 11*plus* includes a standard NMEA Interface to support NMEA 0183 protocol, and a standard interface for a Surface PAR sensor.

Note: The modem (Carousel command) channel is standard on the current production version of both the SBE 9*plus* and the SBE 11*plus* V2. It was optional on all 9*plus* CTDs with serial number 785 and lower, and on all 11*plus* Deck Units (V1 and V2) with serial number 700 and lower.



Real-Time Data Acquisition and Control (*continued*)

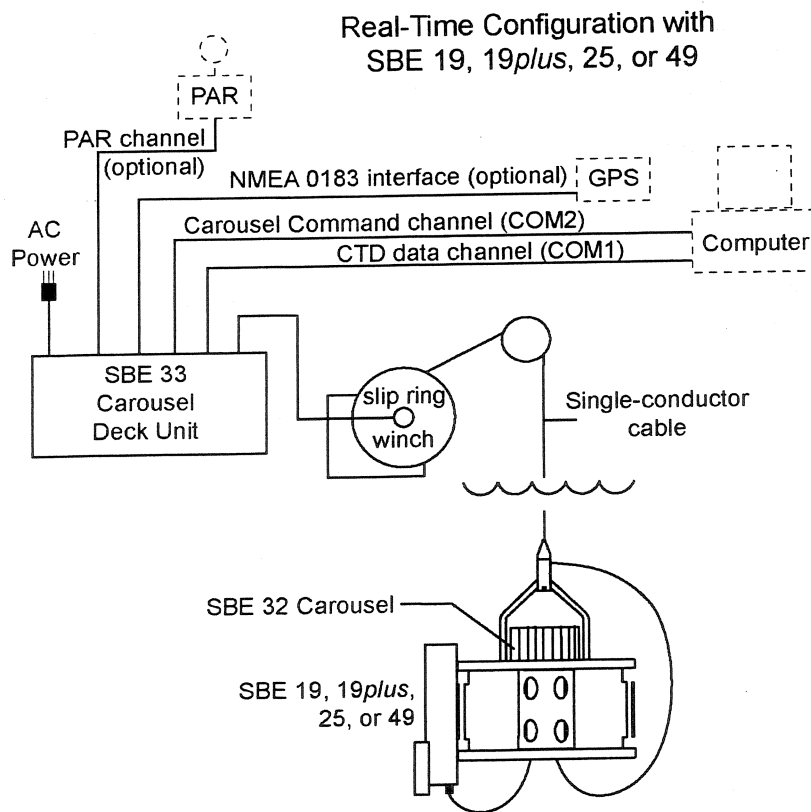
- **SBE 33 Carousel Deck Unit –**

With an optional interface, the Carousel can also be powered and controlled using the SBE 33, and can be used with or without a CTD (SBE 19 / 19*plus*, 25, or 49 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 front panel controls 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.

Note: When using the SBE 49 CTD with the SBE 33, SEASAVE (our real-time data acquisition software) does not allow acquisition of NMEA or Surface PAR data.



**Autonomous Data Acquisition and Control (no conducting wire required;
bottles closed automatically based on pre-programmed pressures or times)**

Autonomous sampling does not provide water sample quality equal to real-time sampling; it is a compromise intended to serve users who do not have real-time capability on their vessel. See *Note on Water Sample Quality from Autonomous Samples* below.

- **SBE 17plus V2 SEARAM Recorder and Auto Fire Module -**

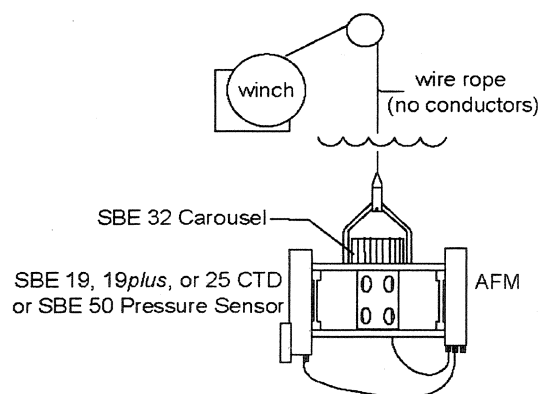
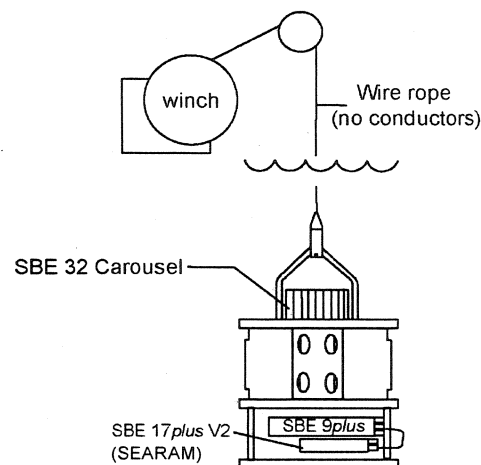
The SBE 17plus V2, mounted with the SBE 9plus CTD, allows the Carousel to operate autonomously on non-conducting cables. Using CTD pressure data from the 9plus and a programmable table of bottle closure pressures, the 17plus signals the Carousel to close bottles on upcast. Built-in logic and user-input parameters provide control in determining when the upcast begins, preventing accidental bottle closure caused by temporary upward movements during downcast. Power is supplied to the 9plus and Carousel by the 17plus' batteries, and data from the 9plus is stored in the 17plus memory.

- **Carousel Auto Fire Module (AFM) -**

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, 19plus, or 25 CTD or SBE 50 Pressure Sensor, the AFM monitors real-time pressure data transmitted by the CTD / SBE 50, and fires bottles at pre-defined pressures (depths) on upcast or downcast, or whenever the CTD / SBE 50 is stationary for a specified period of time. Power is supplied to the Carousel by the AFM's batteries; bottle number, firing confirmation, and five scans of CTD / SBE 50 data are recorded in the AFM memory for each bottle fired.



Note on Water Sample Quality from Autonomous Samples

The 17plus and AFM auto fire feature enables a ship without a slip ring and electro-mechanical cable to gather CTD data and collect water samples without the need for real-time CTD data. However, dynamic conditions affect the quality (validity) of water samples in several ways:

1. Oceanographic conditions (for example, internal waves and currents) cause density surfaces to move continuously, causing water of a given salinity to move up and down. Scientists generally prefer to view real-time CTD data on the downcast, to see the temperature/salinity/density structure. Then, on the upcast, they can stop the water sampler at depths where gradients are small, before closing each bottle; higher quality water samples are obtained, because dynamic errors are smaller.
2. If the CTD/water sampler package does not stop to fire a bottle, the water in the bottle is a mixture of water from many meters below the firing point (assuming you are taking water samples on upcast). If moving at 1 m/sec, a bottle's *flushing constant* is typically five to eight volumes, with water flushing slowly at the bottle inside wall and faster toward the bottle center. For a 5-liter bottle, the trapped sample contains a mix of water from a cylinder in the water column with diameter equal to the bottle inner diameter and volume of 25 - 40 liters (i.e., height of the cylinder is five to eight times the bottle height). Scientists prefer to stop the package to allow bottles to flush freely for several minutes before closing to obtain highest quality water samples.

The AFM (but not the 17plus) can be programmed to sample when stationary, eliminating the flushing problem (2). However, the lack of real-time data can still result in samples being taken in areas with large gradients (1), because the user can only estimate the depth of the gradients, and can only estimate the actual package depth from the cable payout.

While autonomous sampling can be a convenient alternative to real-time water sampler control, the quality of the samples is generally lower than for samples collected with a real-time system.

Number of Bottle Positions

Carousels are available for 12, 24, or 36 bottles, defining the number of lanyard release latches on the pylon, number of bottle mounts, and bottle mounting stand diameter. The 36-bottle Carousel is custom; consult Sea-Bird.

Maximum Bottle Size

The size (volume) of bottles to be used affects the bottle stand size. **Typically, a Carousel built for bottles of one size accommodates bottles of all smaller sizes (Exceptions: SBE 32 Standard Carousel built for 5-liter bottles does not accommodate 2.5-liter bottles; SBE 32 Standard Carousel and 32SC Sub-Compact Carousel built for 1.7-liter bottles does not accommodate 1.2-liter bottles).** Consider shipboard storage and handling space limitations, and try to anticipate the maximum bottle size that you will want. For example, if the immediate need is for twelve 5-liter bottles, but 10-liter bottles may be desired in the future, specify a twelve-position, 10-liter Carousel.

Housing Depth Rating and Connectors

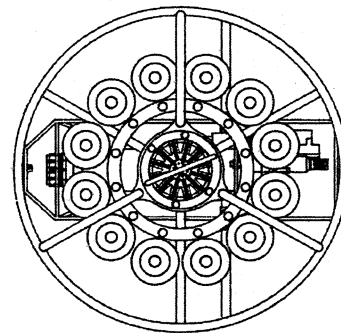
The Carousel pressure housing is anodized aluminum, and has a depth rating of 6,800 meters (22,300 ft). Optional titanium pressure housings have depth ratings to 7000 or 10,500 meters (22,900 or 34,400 ft).

The Carousel is available with standard glass-reinforced epoxy or optional wet-pluggable (MCBH) connectors. Order the Carousel with connectors to match the type on the equipment (CTD, 17*plus* V2, AFM as applicable) you will be connecting to it – interface cables have the same connector type on both ends.

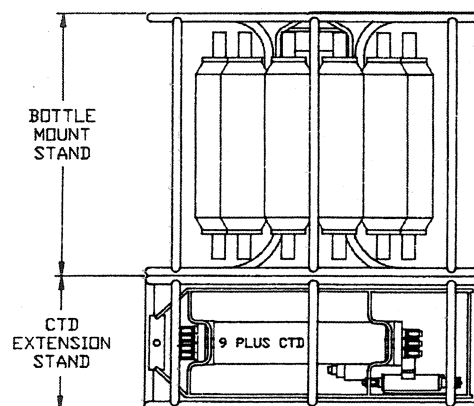
All housing depth and connector options are available for all Carousel models (SBE 32, 32C, and 32SC).

Carousel Model

- **Standard Carousel (SBE 32)** – a 12-, 24-, or 36-position sampler (12-bottle Carousels for all bottle sizes through 30 liters; 24- and 36-bottle Carousels for bottles of 12-liter capacity and less). The SBE 32 includes a CTD extension stand for mounting an SBE 9*plus*, 19, 19*plus*, 25, or 49 CTD with auxiliary sensors and equipment (SBE 17*plus* V2, transmissometer, fluorometer, etc.) in a horizontal position below the bottle stand.

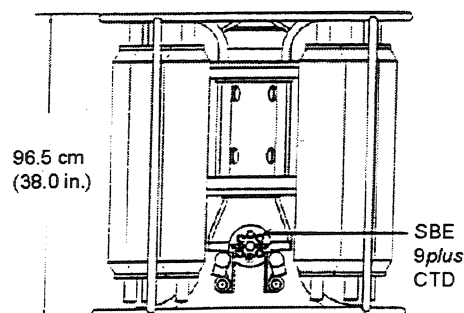
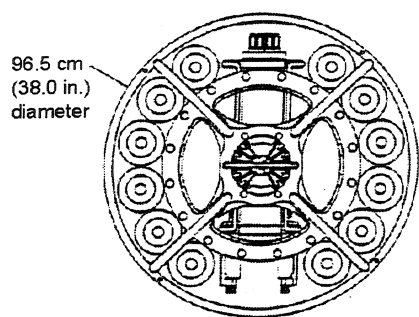


Note: Bottle mount stand height and diameter and CTD extension stand height varies, depending on number and size of bottles. See the SBE 32 specification sheet or manual for details.

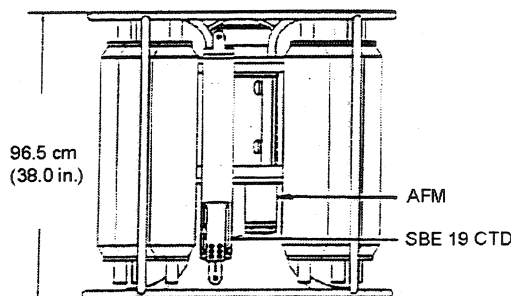
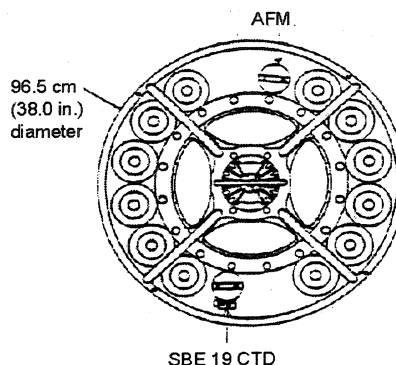


SBE 32 Standard Carousel (shown with SBE 9*plus* CTD)

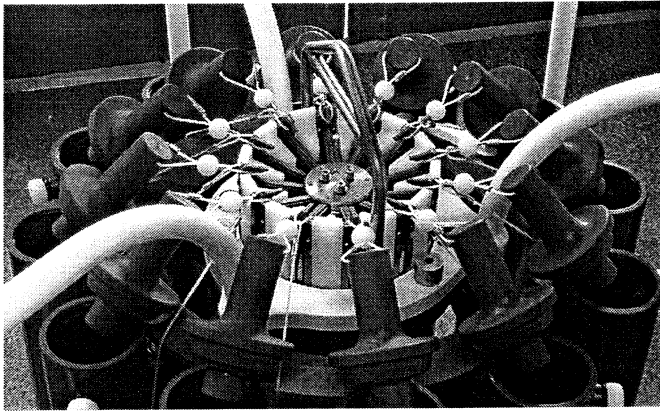
- Compact Carousel (SBE 32C)** - a 12-position sampler for 8-liter bottles. The bottle mount stand diameter is 2.5 cm (1 inch) smaller than for the comparable Standard Carousel, and the height is designed to fit through a 1 m x 1 m door. The 32C does not have an extension stand for mounting a CTD. To provide room for mounting a CTD and accessories (AFM, fluorometer, transmissometer, etc.), the bottle positions are closely spaced into two arcs, the centers of which are 180 degrees apart. This leaves four auxiliary mounting positions between the ends of the arcs for mounting a CTD and accessories. Because of the tight bottle spacing and smaller stand diameter, reversing thermometers would extend outside the bottle stand, and their use is not recommended.
 - An SBE 19, 19*plus*, or 49 CTD mounts vertically in one of the auxiliary mounting positions, using an accessory mounting fixture.
 - Similarly, the SBE 25 CTD main housing mounts vertically in one of the auxiliary mounting positions. The SBE 25's standard modular sensors (SBE 3 Temperature Sensor, SBE 4 Conductivity Sensor, SBE 5 Pump, and SBE 29 Pressure Sensor) together mount vertically in a second auxiliary mounting position.
 - Auxiliary sensors and equipment (AFM, fluorometer, etc.) mount to any available auxiliary mounting positions.
 - A horizontal-mounting bracket for the SBE 9*plus* CTD (with or without the SBE 17*plus* V2) allows it to be mounted underneath and inside the bottle stand.
- Sub-Compact Carousel (SBE 32SC)** - a 12-position sampler for 1.7- or 2.5-liter bottles. The bottle mount stand diameter is 29 cm (11.5 inch) smaller than for the comparable Standard Carousel, and the height is designed to fit through a 1 m x 1 m door. The 32SC does not have an extension stand for mounting a CTD. The SBE 32SC is designed for use with a SBE 19, 19*plus*, or 25 CTD; it is not compatible with the SBE 9*plus* CTD. To provide room for mounting a CTD and accessories (AFM, fluorometer, transmissometer, etc.), the bottle positions are closely spaced into two arcs, the centers of which are 180 degrees apart. This leaves four auxiliary mounting positions between the ends of the arcs for mounting a CTD and accessories. Because of the tight bottle spacing and smaller stand diameter, reversing thermometers would extend outside the bottle stand, and their use is not recommended.
 - An SBE 19, 19*plus*, or 49 CTD mounts vertically in one of the auxiliary mounting positions, using an accessory mounting fixture.
 - Similarly, the SBE 25 CTD main housing mounts vertically in one of the auxiliary mounting positions. The SBE 25's standard modular sensors (SBE 3 Temperature Sensor, SBE 4 Conductivity Sensor, SBE 5 Pump, and SBE 29 Pressure Sensor) together mount vertically in a second auxiliary mounting position.
 - Auxiliary sensors and equipment (AFM, fluorometer, etc.) mount to any available auxiliary mounting positions.



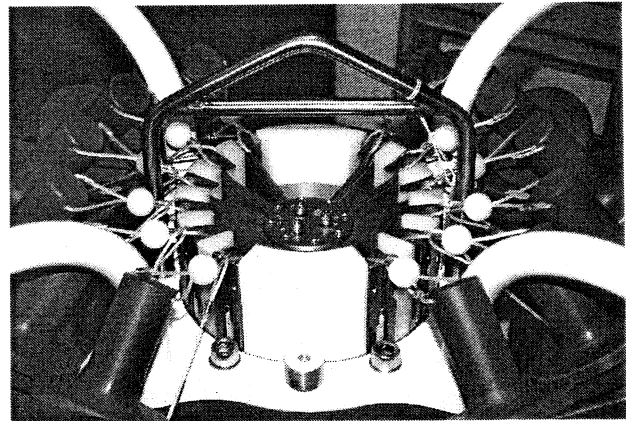
SBE 32C Compact Carousel (shown with SBE 9*plus* CTD)



SBE 32C Compact Carousel (shown with SBE 19 CTD);
SBE 32SC Sub-Compact Carousel similar
[diameter= 70 cm (27.5 in.), height = 79 or 99 cm (31 or 39 in.)]



Standard Pylon Detail



Compact or Sub-Compact Pylon Detail

Note: As shown above, the latch spacing in the Standard Carousel pylon is different from the spacing in the Compact or Sub-Compact Carousel. This difference prevents substitution of the Standard Carousel pylon in the Compact or Sub-Compact Carousel, or vice versa, because the angle of the lanyards (which connect the latches to the bottles) will prevent proper functioning of the system.

Designing a Flexible System

Looking at the chart on the following page, there are six application types:

1. Real-time with SBE 9*plus* CTD and SBE 11*plus* Deck Unit
2. Real-time with SBE 19, 19*plus*, 25, or 49 CTD and SBE 33 Deck Unit
3. Real-time with no CTD and SBE 33 Deck Unit
4. Autonomous with SBE 9*plus* CTD and SBE 17*plus* V2 SEARAM
5. Autonomous with SBE 19, 19*plus*, or 25 CTD, or SBE 50 Pressure Sensor, and AFM
6. Autonomous with AFM and no CTD

All application types can be accommodated by ordering an SBE 32 (Standard model) with operating mode option 32-3b (standard connectors) or 32-3e (wet-pluggable connectors) or an SBE 32C (Compact model) with operating mode option 32C-3b (standard connectors) or 32C-3d (wet-pluggable connectors). These provide a system with the most flexibility, allowing you to easily swap equipment at sea as needed for the application.

Application types 2, 3, 5, and 6 can be accommodated by ordering an SBE 32SC (Sub-Compact model) with operating mode option 32SC-3a (standard connectors) or 32SC-3c (wet-pluggable connectors).

Chart for Determining Appropriate Model & Optional Operating Mode Configuration

Operation	CTD/ Instrument	Control	Carousel Model	Bottle Positions	Bottle Size (liters)	Carousel Operating Mode Option ¹
Real-Time (bottles closed by command from ship)	SBE <i>9plus</i> ²	SBE <i>11plus</i> Deck Unit	32	12	1.7, 2.5, 5, 8, 10, 12, 20, or 30	None required (also works with 32-3b or 32-3e)
				24	1.7, 2.5, 5, 8, 10, or 12	
				36	(consult Sea-Bird)	
			32C	12	8	None required (also works with 32C-3b or 32C-3d)
	SBE 19, <i>19plus</i> , 25, or 49	SBE 33 Deck Unit	32	12	1.7, 2.5, 5, 8, 10, 12, 20, or 30	32-3b or 32-3e
				24	1.7, 2.5, 5, 8, 10, or 12	
				36	(consult Sea-Bird)	
			32C	12	8	32C-3b or 32C-3d
			32SC ³	12	1.7 or 2.5	32SC-3a or 32SC-3c
	None	SBE 33 Deck Unit	32	12	1.7, 2.5, 5, 8, 10, 12, 20, or 30	32-3b or 32-3e
				24	1.7, 2.5, 5, 8, 10, or 12	
				36	(consult Sea-Bird)	
			32C	12	8	32C-3b or 32C-3d
			32SC ³	12	1.7 or 2.5	32SC-3a or 32SC-3c
Autonomous (no conducting wire required; bottles closed automatically based on pre- programmed pressures or times)	SBE <i>9plus</i> ²	SBE <i>17plus</i> V2 SEARAM	32	12	1.7, 2.5, 5, 8, 10, 12, 20, or 30	None required (also works with 32-3b or 32-3e)
				24	1.7, 2.5, 5, 8, 10, or 12	
				36	(consult Sea-Bird)	
			32C	12	8	None required (also works with 32C-3b or 32C-3d)
	SBE 19, <i>19plus</i> , or 25, or SBE 50 Pressure Sensor	Carousel Auto Fire Module (AFM)	32	12	1.7, 2.5, 5, 8, 10, 12, 20, or 30	None required (also works with 32-3b or 32-3e)
				24	1.7, 2.5, 5, 8, 10, or 12	
				36	(consult Sea-Bird)	
			32C	12	8	None required (also works with 32C-3b or 32C-3d)
			32SC ³	12	1.7 or 2.5	None required (also works with 32SC-3a or 32SC-3c)
	None	Carousel Auto Fire Module (AFM)	32	12	1.7, 2.5, 5, 8, 10, 12, 20, or 30	None required (also works with 32-3b or 32-3e)
				24	1.7, 2.5, 5, 8, 10, or 12	
				36	(consult Sea-Bird)	
			32C	12	8	None required (also works with 32C-3b or 32C-3d)
			32SC ³	12	1.7 or 2.5	None required (also works with 32SC-3a or 32SC-3c)

Notes:

¹ Listed operating mode options are for the Carousel electronics only. CTDs/Instruments (SBE 19, *19plus*, 25, 49 CTD; SBE 50 Pressure Sensor) and controllers (SBE *11plus*, SBE 33, SBE *17plus* V2, AFM) are not included; order separately.

² The SBE 32SC's (Sub-Compact) standard telemetry is compatible with the SBE *9plus*, but the SBE *9plus* is too large to allow a practical mounting in the SBE 32SC frame.

³ The **SBE 55 ECO Water Sampler** provides a small, lightweight, economical alternative to the SBE 32SC. The ECO, available in a 3- or 6-bottle configuration with 4-liter bottles, is rated for 600 meters. The ECO can be used with the SBE 19, *19plus*, 25, or 49, and provides autonomous or real-time operation. See the ECO datasheet on our website for details.



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APPLICATION NOTE NO. 66

October 2007

Routine Maintenance for the SBE 32 Carousel Water Sampler

This Application Note reviews corrosion precautions and routine maintenance for the SBE 32 Carousel Water Sampler. The reliability of the Carousel is sustained by establishing proper handling practices.

Corrosion Precautions/Cleaning

Rinsing and Cleaning

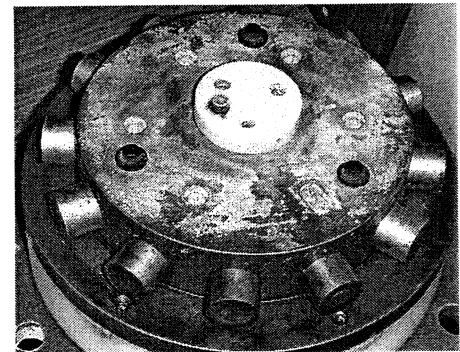
After Every Cast

- Rinse the **entire** Carousel, including the frame, with **fresh** water after each cast.
- The Carousel's trigger mechanism is made of 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 (such as WD-40).** Rinse the trigger mechanism thoroughly with **fresh** water after each cast.

If it will be More than 24 Hours Until the Next Cast

To prevent salt buildup on the latches (which can cause *sticky* latches), Sea-Bird recommends the following:

1. Remove the 3 socket hex head screws holding the latch assembly to the pylon [Photo 1 in *Removing / Replacing Latch Assembly*]. Soak the whole latch assembly in a bucket of **fresh** water until the next cast.
2. With the latch assembly removed, thoroughly rinse the top of the pylon, including the magnets, with **fresh** water [Photo 5 in *Removing / Replacing Latch Assembly*]. The photo at right illustrates the salt deposits and corrosion that result from **not** rinsing these surfaces with **fresh** water!



Periodically, and if experiencing *Sticky* Latches

1. Remove the 3 socket hex head screws holding the latch assembly to the pylon [Photo 1 in *Removing / Replacing Latch Assembly*]. Soak the whole latch assembly in a bucket of warm, soapy, **fresh** water; rinse with **fresh** water after soaking.
2. If latches stick after this cleaning:
 - A. Open (unlock) all of the latches.
 - B. Place the latch assembly *upside down* on the top rack of a residential or commercial dishwasher. Run the dishwasher with regular dishwasher soap, and a **no-heat dry cycle** (air dry only!).

Anodes

Large zinc anodes provide corrosion protection:

- SBE 32C and 32SC - 2 each in lower adapter plate, lower guard ring, upper adapter plate, upper guard ring; 1 on pylon/hub assembly
- SBE 32 (standard)
 - 12-bottle size - 3 each on lower guard ring and upper guard ring; 2 on lower adapter plate; 1 on pylon/hub assembly
 - 24-bottle size - 3 each in lower adapter plate, lower guard ring, upper adapter plate, upper guard ring; 1 on pylon/hub assembly
- CTD extension stand (if used) - 2

Check the anodes occasionally to verify that they are securely fastened and have not eroded.

Screws

All screws exposed to seawater have been generously lubricated with Bostik's Never-Seez Blue Moly anti-seize compound, (available from marine hardware stores). When disassembling/reassembling the Carousel, re-lubricate these screws with Blue Moly or equivalent. Blue Moly is electrically conductive, so be careful not to get it on circuit boards.

Note: Blue Moly is molybdenum disulfide and pure nickel flake in pressure-resistant premium grade grease, formulated *without* graphite, lead, or copper. See Bostik's website (www.bostik-us.com/TDS/TDSFiles/NSBlueMoly.pdf) for the most up-to-date specification; a copy of their current data sheet is included in this Application Note for your convenience.

Storage

If the Carousel is stored on deck, we recommend covering it to keep off salt spray and protect the plastic parts from UV rays. At a minimum, a cover for the latch assembly is a good investment.

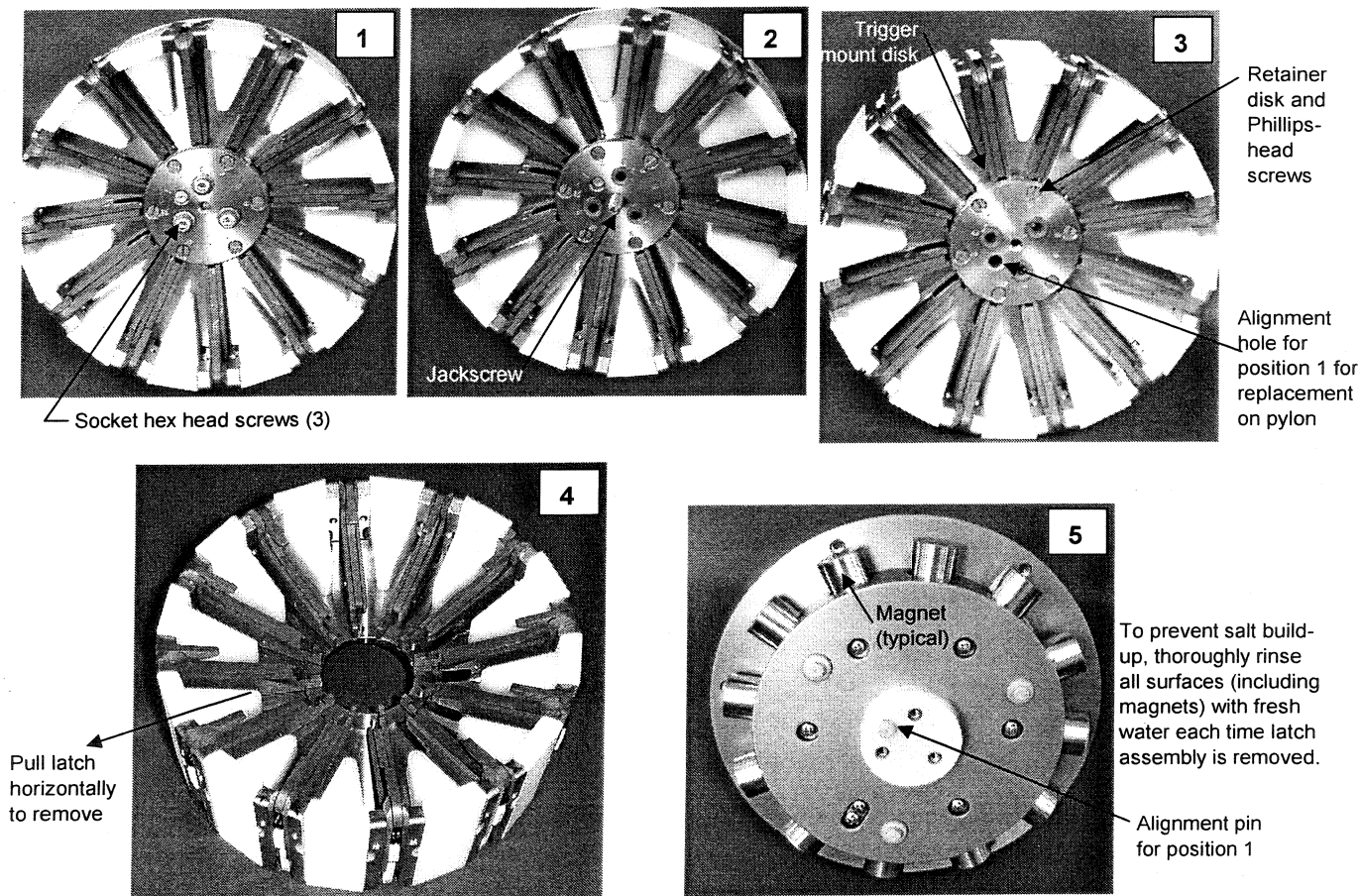
Removing/Replacing Latch Assembly

Removing Latch Assembly

1. Remove the three socket hex head screws, lock washers, and flat washers from the top of the latch assembly. [Photo 1]
2. (For Carousels built in 2006 and later) Insert a jackscrew (jackscrew kit is provided with the Carousel) in the center hole. As you turn the jackscrew, the latch assembly will push away from the pylon. [Photo 2]
3. Lift the latch assembly off the pylon.
4. Remove individual latches if desired:
 - A. Mark the location of latch 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. [Photo 3]
 - C. Pull the desired latch(es) horizontally from the trigger mount disk. Mark the latch(es) to aid in reassembly. [Photo 4]

Replacing Latch Assembly

1. Replace the latches on the trigger mount disk.
2. Place the retainer disk on the latches, aligning the mark you made for latch 1 on the trigger mount disk with latch 1 on the retainer disk. Verify that the latches 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. [Photos 3 and 5] Seat the latch assembly on the pylon. Reinstall the three socket hex head screws, lock washers, and flat washers.



Removing Center Pylon

CAUTION: Disconnect cables from the connector end cap before removing center pylon, to avoid damaging instruments.

1. Remove the lifting bail.
 - A. Remove the hardware from underneath the lower guard ring.
 - B. Begin to pull the lifting bail up, until it is above the lower guard ring/adaptor 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.

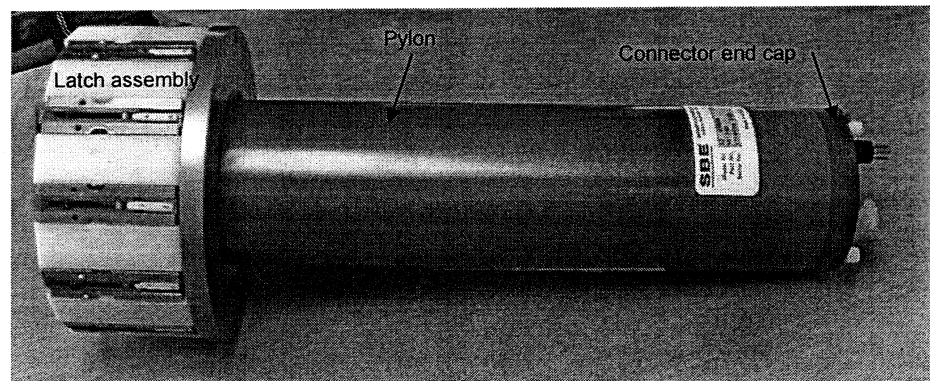
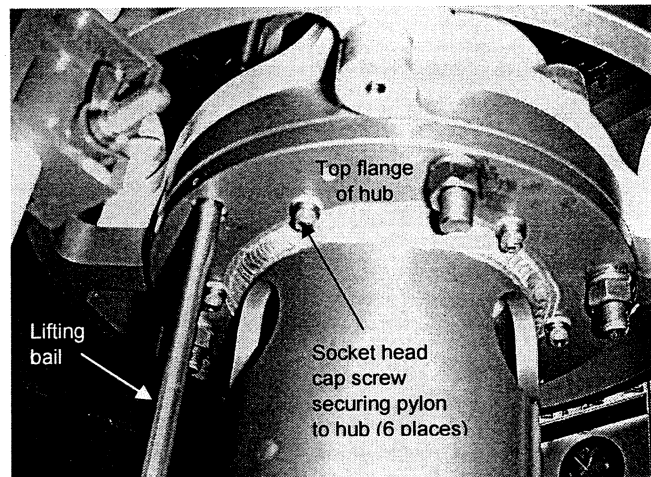
NOTE:

There are plastic insulators on the underside of the following connections:

- Lower guard ring/adaptor 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.

2. Remove the 6 socket hex head cap screws and 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.



Never-Seez Blue Moly Data Sheet



TECHNICAL DATA SHEET

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 powder 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 (1316°C), use Never-Seez® Pure Nickel Special.

Other Anti-Seize Lubricants

- 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®
- Heavy Metal Free



Technical Specifications

Color	Blue	
Temperature Range, °F (°C)	-22°F to 1500°F (-30°C to 815°C)	
Thickener Type	Lithium Soap	
Particle Size, mil (microns)	2.0 maximum (50 µ)	
Density (g/cm³)	1.17 to 1.23	
		ASTM Test Method
Flash Point, °F (°C)	475°F (246°C)	D-92
Copper Corrosion Test @ 212°F (100°C), 24 hrs.	No Corrosion	D-130
Worked Penetration, 60 Strokes @ 77°F (25°C)	260-310	D-217
NLGI Grade	1/2	D-217
Dropping Point, °F (°C)	360°F (182°C)	D-566
Water Washout, % loss @ 100°F @ 175°F	<2 <5	D-1264
Coefficient of Friction @ 167°F (75°C), Four Ball	0.0824	D-2266
Torque Coefficient, k factor	0.15	
Four Ball EP		D-2596
Load Wear Index	53.2	
Last Non-seizure Load (scar)	63 kgf (0.38 mm)	
Last Seizure Load (scar)	250 kgf (2.10 mm)	
Weld Load	315 kgf	
Fretting Wear @ 73°F (23°C), 22 hrs.	6.2	D-4170

® Teflon is a Registered Trademark of Dupont.

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

Shelf Life: Never-Seez® Blue Moly does not deteriorate with age when stored unopened at temperatures below 120°F (49°C).
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:

NEVER-SEEZ® BLUE MOLY

STOCK NUMBER	DESCRIPTION	SIZE
NBBT-8	Brush Top	8 oz.
NBBT-16	Brush Top	1 lb.
NB-160	Flat Top	1 lb.
NB-42B	Pail	42 lb.
NB-425B	Drum	425lbs.

IMPORTANT NOTICE

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<http://www.bostik-us.com>

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N2-09/12/07



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APPLICATION NOTE NO. 71

Revised July 2005

Desiccant Use and Regeneration (drying)

This application note applies to all Sea-Bird instruments intended for underwater use. The application note covers:

- When to replace desiccant
- Storage and handling of desiccant
- Regeneration (drying) of desiccant
- Material Safety Data Sheet (MSDS) for desiccant

When to Replace Desiccant Bags

Before delivery of the instrument, a desiccant package is placed in the housing, and the electronics chamber is filled with dry Argon. These measures help prevent condensation. To ensure proper functioning:

1. Install a new desiccant bag each time you open the housing and expose the electronics.
2. If possible, dry gas backfill each time you open the housing and expose the electronics. If you cannot, wait at least 24 hours before redeploying, to allow the desiccant to remove any moisture from the chamber.

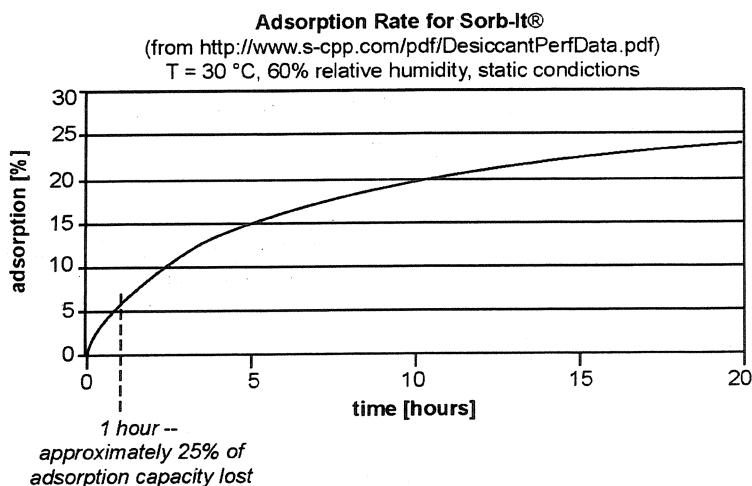
What do we mean by *expose the electronics*?

- For most battery-powered Sea-Bird instruments (such as SBE 16, 16*plus*, 16*plus*-IM, 17*plus*, 19, 19*plus*, 25, 26, 26*plus*, 37-SM, 37-SMP, 37-IM, 37-IMP, 44, 53; Auto Fire Module [AFM]), there is a bulkhead between the battery and electronics compartments. Battery replacement does not affect desiccation of the electronics, as the batteries are removed without removing the electronics and no significant gas exchange is possible through the bulkhead. Therefore, opening the battery compartment to replace the batteries does not expose the electronics; you do not need to install a new desiccant bag in the electronics compartment each time you open the battery compartment. For these instruments, install a new desiccant bag if you open the electronics compartment to access the printed circuit boards.
- For the SBE 39, 39-IM, and 48, the electronics must be removed or exposed to access the battery. Therefore, install a new desiccant bag each time you open the housing to replace a battery.

Storage and Handling

Testing by Süd-Chemie (desiccant's manufacturer) at 60% relative humidity and 30 °C shows that approximately 25% of the desiccant's adsorbing capacity is used up after only 1 hour of exposure to a constantly replenished supply of moisture in the air. In other words, if you take a bag out of a container and leave it out on a workbench for 1 hour, one-fourth of its capacity is gone before you ever install it in the instrument. Therefore:

- Keep desiccant bags in a tightly sealed, impermeable container until you are ready to use them. Open the container, remove a bag, and quickly close the container again.
- Once you remove the bag(s) from the sealed container, rapidly install the bag(s) in the instrument housing and close the housing.
Do not use the desiccant bag(s) if exposed to air for more than a total of 30 minutes.



Regeneration (drying) of Desiccant

Replacement desiccant bags are available from Sea-Bird:

- PN 60039 is a metal can containing 25 1-gram desiccant bags and 1 humidity indicator card. The 1-gram bags are used in our smaller diameter housings, such as the SBE 3 (*plus*, F, and S), 4 (M and C), 5T, 37 (-SI, -SIP, -SM, -SMP, -IM, and -IMP), 38, 39, 39-IM, 43, 44, 45, 48, 49, and 50.
- PN 31180 is a 1/3-ounce desiccant bag, used in our SBE 16*plus*, 16*plus*-IM, 19*plus*, 21, and 52-MP.
- PN 30051 is a 1-ounce desiccant bag. The 1-ounce bags are used in our larger diameter housings, such as the SBE 9*plus*, 16, 17*plus*, 19, 25, 26, 26*plus*, 32, 53 BPR, AFM, and PDIM.

However, if you run out of bags, you can regenerate your existing bags using the following procedure provided by the manufacturer (Süd-Chemie Performance Packaging, a Division of United Catalysts, Inc.):

MIL-D-3464 Desiccant Regeneration Procedure

Regeneration of the United Desiccants' Tyvek Desi Pak® or Sorb-It® bags or United Desiccants' X-Crepe Desi Pak® or Sorb-It® bags can be accomplished by the following method:

1. Arrange the bags on a wire tray in a single layer to allow for adequate air flow around the bags during the drying process. The oven's inside temperature should be room or ambient temperature (25 – 29.4 °C [77 – 85 °F]). **A convection, circulating, forced-air type oven is recommended for this regeneration process. Seal failures may occur if any other type of heating unit or appliance is used.**
2. When placed in forced air, circulating air, or convection oven, allow a minimum of 3.8 to 5.1 cm (1.5 to 2.0 inches) of air space between the top of the bags and the next metal tray above the bags. If placed in a radiating exposed infrared-element type oven, shield the bags from direct exposure to the heating element, giving the closest bags a minimum of 40.6 cm (16 inches) clearance from the heat shield. Excessive surface film temperature due to infrared radiation will cause the Tyvek material to melt and/or the seals to fail. Seal failure may also occur if the temperature is allowed to increase rapidly. This is due to the fact that the water vapor is not given sufficient time to diffuse through the Tyvek material, thus creating internal pressure within the bag, resulting in a seal rupture. Temperature should not increase faster than 0.14 to 0.28 °C (0.25 to 0.50 °F) per minute.
3. Set the temperature of the oven to 118.3 °C (245 °F), and allow the bags of desiccant to reach equilibrium temperature. **WARNING:** Tyvek has a melt temperature of 121.1 – 126.7 °C (250 – 260 °F) (Non MIL-D-3464E activation or reactivation of both silica gel and Bentonite clay can be achieved at temperatures of 104.4 °C [220 °F]).
4. Desiccant bags should be allowed to remain in the oven at the assigned temperature for 24 hours. At the end of the time period, the bags should be immediately removed and placed in a desiccator jar or dry (0% relative humidity) airtight container for cooling. If this procedure is not followed precisely, any water vapor driven off during reactivation may be re-adsorbed during cooling and/or handling.
5. After the bags of desiccant have been allowed to cool in an airtight desiccator, they may be removed and placed in either an appropriate type polyliner tightly sealed to prevent moisture adsorption, or a container that prevents moisture from coming into contact with the regenerated desiccant.

NOTE: Use only a metal or glass container with a tight fitting metal or glass lid to store the regenerated desiccant. Keep the container lid **closed tightly** to preserve adsorption properties of the desiccant.

MATERIAL SAFETY DATA SHEET – August 13, 2002

SORB-IT®

Packaged Desiccant

SECTION I -- PRODUCT IDENTIFICATION

Trade Name and Synonyms:	Silica Gel, Synthetic Amorphous Silica, Silicon, Dioxide
Chemical Family:	Synthetic Amorphous Silica
Formula:	SiO ₂ .x H ₂ O

SECTION II -- HAZARDOUS INGREDIENTS

Components in the Solid Mixture

COMPONENT	CAS No	%	ACGIH/TLV (PPM)	OSHA-(PEL)
Amorphous Silica	63231-67-4	>99	PEL - 20 (RESPIRABLE), TLV - 5	LIMIT - NONE, HAZARD - IRRITANT

Synthetic amorphous silica is not to be confused with crystalline silica such as quartz, cristobalite or tridymite or with diatomaceous earth or other naturally occurring forms of amorphous silica that frequently contain crystalline forms.

This product is in granular form and packed in bags for use as a desiccant. Therefore, no exposure to the product is anticipated under normal use of this product. Avoid inhaling desiccant dust.

SECTION III -- PHYSICAL DATA

Appearance and Odor:	White granules; odorless.
Melting Point:	>1600 Deg C; >2900 Deg F
Solubility in Water:	Insoluble.
Bulk Density:	>40 lbs./cu. ft.
Percent Volatile by Weight @ 1750 Deg F:	<10%.

MATERIAL SAFETY DATA SHEET – August 13, 2002

SORB-IT®

Packaged Desiccant

SECTION IV -- FIRE EXPLOSION DATA

Fire and Explosion Hazard - Negligible fire and explosion hazard when exposed to heat or flame by reaction with incompatible substances.

Flash Point - Nonflammable.

Firefighting Media - Dry chemical, water spray, or foam. For larger fires, use water spray fog or foam.

Firefighting - Nonflammable solids, liquids, or gases: Cool containers that are exposed to flames with water from the side until well after fire is out. For massive fire in enclosed area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of the tank due to fire.

SECTION V -- HEALTH HAZARD DATA

Health hazards may arise from inhalation, ingestion, and/or contact with the skin and/or eyes. Ingestion may result in damage to throat and esophagus and/or gastrointestinal disorders. Inhalation may cause burning to the upper respiratory tract and/or temporary or permanent lung damage. Prolonged or repeated contact with the skin, in absence of proper hygiene, may cause dryness, irritation, and/or dermatitis. Contact with eye tissue may result in irritation, burns, or conjunctivitis.

First Aid (Inhalation) - Remove to fresh air immediately. If breathing has stopped, give artificial respiration. Keep affected person warm and at rest. Get medical attention immediately.

First Aid (Ingestion) - If large amounts have been ingested, give emetics to cause vomiting. Stomach siphon may be applied as well. Milk and fatty acids should be avoided. Get medical attention immediately.

First Aid (Eyes) - Wash eyes immediately and carefully for 30 minutes with running water, lifting upper and lower eyelids occasionally. Get prompt medical attention.

First Aid (Skin) - Wash with soap and water.

MATERIAL SAFETY DATA SHEET – August 13, 2002

SORB-IT®

Packaged Desiccant

NOTE TO PHYSICIAN: This product is a desiccant and generates heat as it adsorbs water. The used product can contain material of hazardous nature. Identify that material and treat accordingly.

SECTION VI -- REACTIVITY DATA

Reactivity - Silica gel is stable under normal temperatures and pressures in sealed containers. Moisture can cause a rise in temperature which may result in a burn.

SECTION VII --SPILL OR LEAK PROCEDURES

Notify safety personnel of spills or leaks. Clean-up personnel need protection against inhalation of dusts or fumes. Eye protection is required. Vacuuming and/or wet methods of cleanup are preferred. Place in appropriate containers for disposal, keeping airborne particulates at a minimum.

SECTION VIII -- SPECIAL PROTECTION INFORMATION

Respiratory Protection - Provide a NIOSH/MSHA jointly approved respirator in the absence of proper environmental control. Contact your safety equipment supplier for proper mask type.

Ventilation - Provide general and/or local exhaust ventilation to keep exposures below the TLV. Ventilation used must be designed to prevent spots of dust accumulation or recycling of dusts.

Protective Clothing - Wear protective clothing, including long sleeves and gloves, to prevent repeated or prolonged skin contact.

Eye Protection - Chemical splash goggles designed in compliance with OSHA regulations are recommended. Consult your safety equipment supplier.

SECTION IX -- SPECIAL PRECAUTIONS

Avoid breathing dust and prolonged contact with skin. Silica gel dust causes eye irritation and breathing dust may be harmful.



MATERIAL SAFETY DATA SHEET – August 13, 2002

SORB-IT®

Packaged Desiccant

* No Information Available

HMIS (Hazardous Materials Identification System) for this product is as follows:

Health Hazard	0
Flammability	0
Reactivity	0
Personal Protection	HMIS assigns choice of personal protective equipment to the customer, as the raw material supplier is unfamiliar with the condition of use.

The information contained herein is based upon data considered true and accurate. However, United Desiccants makes no warranties expressed or implied, as to the accuracy or adequacy of the information contained herein or the results to be obtained from the use thereof. This information is offered solely for the user's consideration, investigation and verification. Since the use and conditions of use of this information and the material described herein are not within the control of United Desiccants, United Desiccants assumes no responsibility for injury to the user or third persons. The material described herein is sold only pursuant to United Desiccants' Terms and Conditions of Sale, including those limiting warranties and remedies contained therein. It is the responsibility of the user to determine whether any use of the data and information is in accordance with applicable federal, state or local laws and regulations.

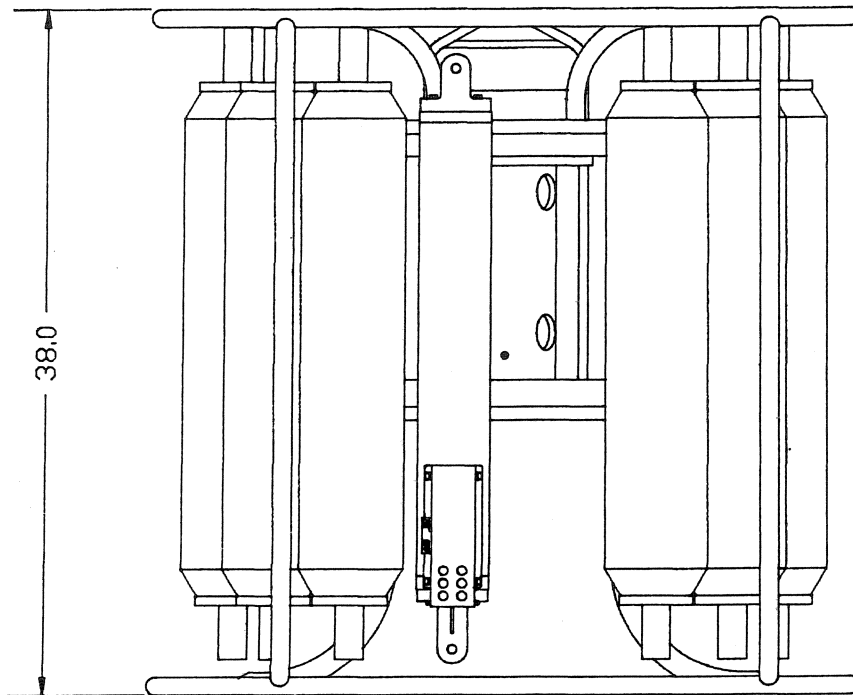
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30568 Cable, AG-206 to AG-206, 9plus to SBE 32 I/F, 79", PN 17198.....	10
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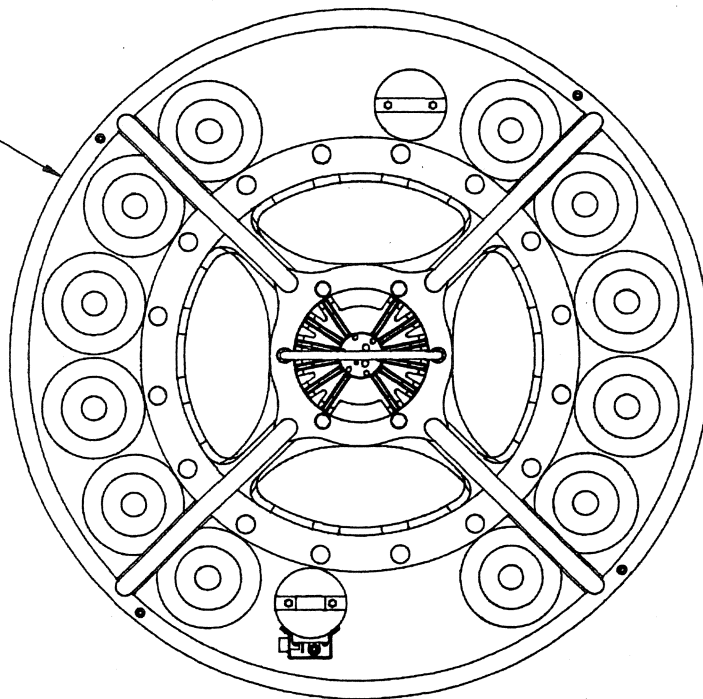
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DATE	SYM	REASON	RECORD	AUTH.	DR.	CK.

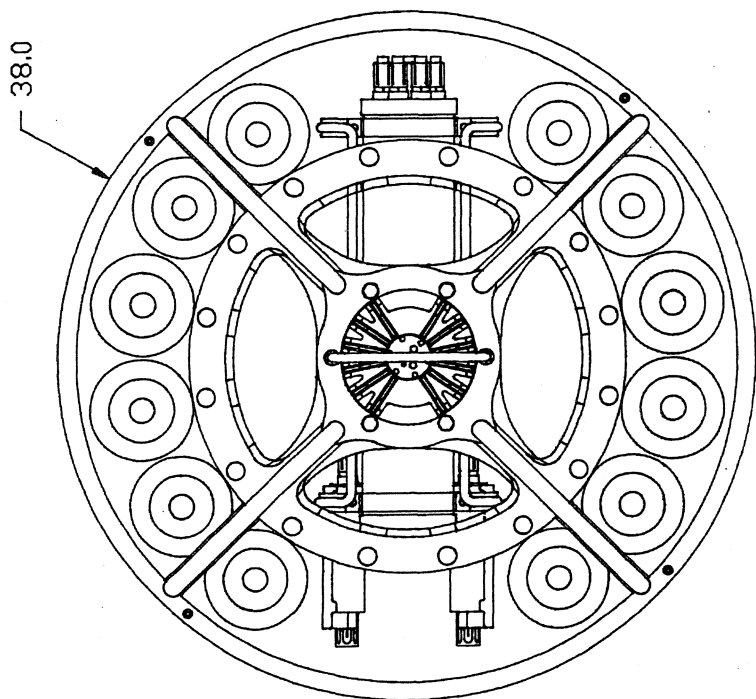
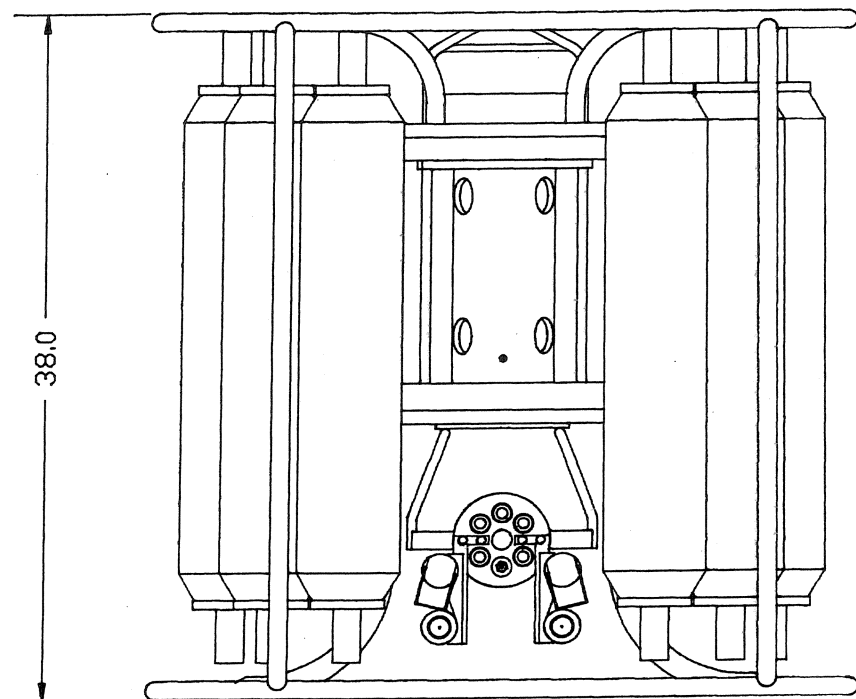


38.0 DIA



TOLERANCES	SEA-BIRD ELECTRONICS, INC				
FRACTIONAL	P/N	SCALE	DRAWN BY	APPROVED BY	
DECIMAL					
ANGULAR					
TITLE					REV
SBE-32 COMPACT CAROUSEL					
DATE					DRAWING NUMBER
10/24/94					20894

DATE	SYM	REVISION RECORD	AUTH	DR	CK



TOLERANCES	SEA-BIRD ELECTRONICS, INC			
FRACTIONAL	P/N	SCALE	DRAWN BY	
DECIMAL	TITLE	APPROVED BY		
ANGULAR	DATE	SBE-32 COMPACT CAROSEL		
	1-17-94	DRAWING NUMBER 20894.1		REV

HUB IS NOT INCLUDED: HUB PART NUMBERS

HUB IS INCLUDED:

6800M	7000M	10,500M	6800M	7000M	10,500M
90411, 12/16-Position	90415, 12/16-Position	90418, 12/16-Position	90422, 12/16-Position		
90412, 16-Position			90423, 16-Position		
Subconn					
90478, 12/16-Position	90481, 12/16-Position				
90485, 16-Position					



ADAPTER PLATES

BOTTLE MOUNT STAND DESCRIPTION	PRICE LIST P/N	GUARD		GUARD SIDE BAR	CTD MOUNT FRAME		FRAME ASSEMBLY	SBE P/N		PRICE LIST P/N	LIFTING BAIL
		UPPER	LOWER		SBE P/N	PRICE LIST P/N		TOP	BOTTOM		
12 BOTTLE											
1.2 - 8 LITER		23795C	23792C	23790C	23844C		50130.1	23794C	23793C		23678
12 LITER		23795C	231423C	231422C	23844C		50130.1	23794C	23793C		23678
16 BOTTLE											
1.2 - 8 LITER		23795C	23792C	23790C	23844C		50130.1	23794C	23793C		23678
SUB-COMPACT											
12 BOTTLE / 1.7-L		231038C	231068C				50130	231035C	231036C		23678
12 BOTTLE / 2.5-L		231038C	231037C				50130	231035C	231036C		23678

NOTES:

1. REFER TO FRAME ASSEMBLY DRAWING 40723 FOR PART LOCATIONS.
2. PYLON ASSEMBLY: PART NUMBERS SHOWN ON CHART ARE FOR SINGLE CONNECTOR END CAP.
ADD .1 TO P/N FOR 3 CONNECTOR END CAP (IE 90411 BECOMES 90411.1)

TOLERANCES	SEA-BIRD ELECTRONICS, INC									
FRACTIONAL	P/N	SEE TABLE	SCALE	DRAWN BY	DC					
DECIMAL	TITLE	SBE 32-16 CAROUSEL FRAME COMPONENTS			APPROVED BY					
ANGULAR	DATE	7/26/94	DWG NO.	40724	DATE	1 OF 2	REV	D		

CAROUSEL ASSEMBLY PART ROUND STOCK DIMENSIONS

GUARD		
PN	TYPE	DIAMETER
231037C	LOWER	1 in.
231068C	LOWER	1 in.
231423C	LOWER	1.25 in.
23792C	LOWER	1.25 in.
231038C	UPPER	1 in.
23795C	UPPER	1 in.

GUARD SIDE BAR	
Side Bar	Diameter
23790C	1 in.
231422C	1 in.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
12.01.00	B	ADD SC, UPDATE 12-P	MJ	CB	CB
12.01.03	B	ADDED HUB PN'S	CB	KLP	CB
5.01.04	C	ADD FRAME ASSY KIT	CB	CB	
10.26.04	D	Added Guard Dia. Table	MJ	KHH	

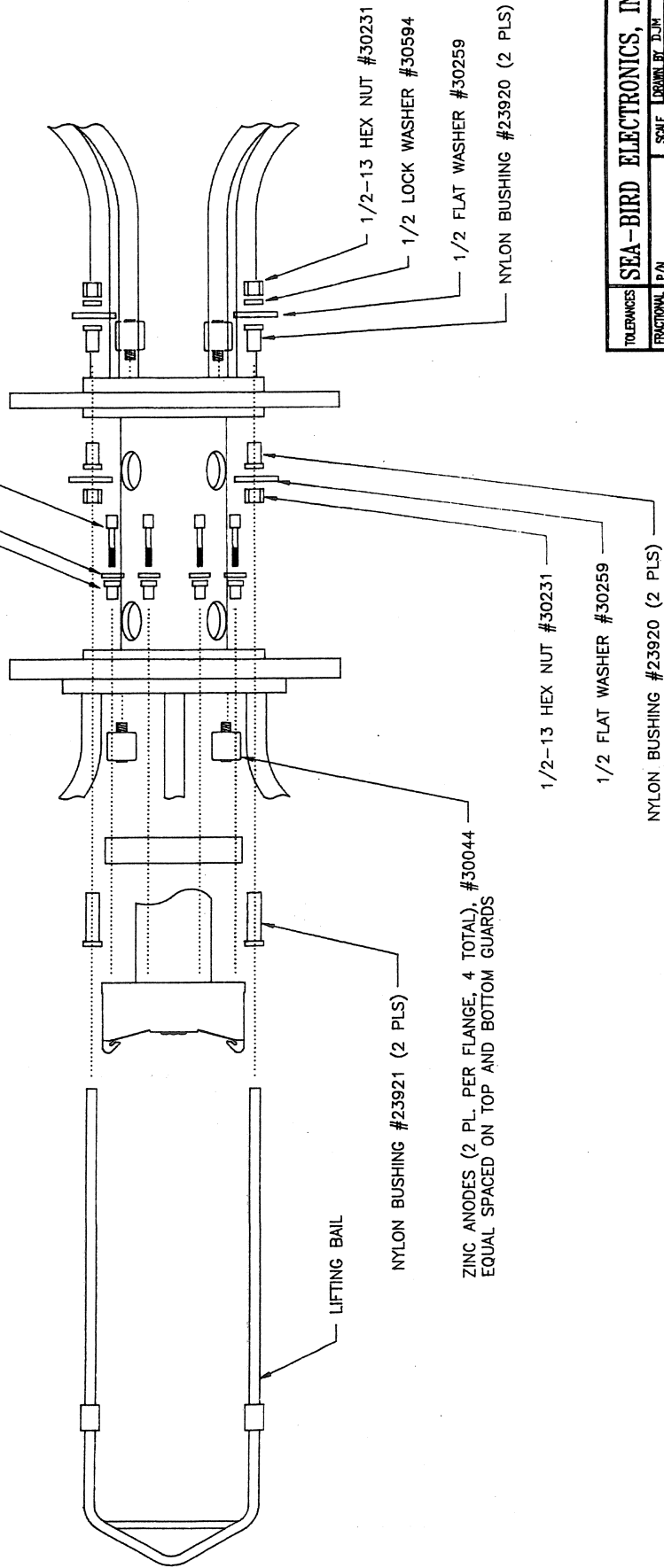
TOLERANCES	SEA-BIRD ELECTRONICS, INC					
FRACTIONAL	P/N	Many	SCALE	DRAWN BY	KHH	APPROVED BY
			-			
DECIMAL	TITLE					
	SBE 32/16 CAROUSEL FRAME COMPONENTS					
ANGULAR	DATE	10.26.2004	DWG NO.	40724	PAGE	2 of 2
					REV	D

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
2/94	A	HEX NUT P/N	PG	DG	
2/95	B	NYLON BAIL INSULATORS	PG	DG	

1/4-20 X 1/2 NYLON INSULATOR #30294
6 PER ASSEMBLY

1/4 FLAT WASHER #30570
6 EACH

1/4-20 X 2 1/4 SOCKET HEAD CAP SCREW
#30602 6 PER ASSEMBLY



TOLERANCES	SEA-BIRD ELECTRONICS, INC
FRACTIONAL	P/N
DECIMAL	SCALE
ANGULAR	DATE
	10/22/93
	DRAWING NUMBER
	40685
	REV
	B

NOTE: APPLY THREAD ANTI-SEIZE TO ALL THREADED HARDWARE PRIOR TO ASSEMBLY

DATE	SYM	REVISION RECORD	AUTH	DR	CK
5.9.2002	A	ADDED HARDWARE TABLE	KLP	MJ	
6.21.05	B	ADDED PN'S	KLP	CB	

② WASHER, 1/4" FLAT

PN 30294, SCREW INS, 1/4" ID X 1/4",
IN-14/4, 6 PER ASSEMBLY

SCREW, 1/4-20 X 2 1/4" ①

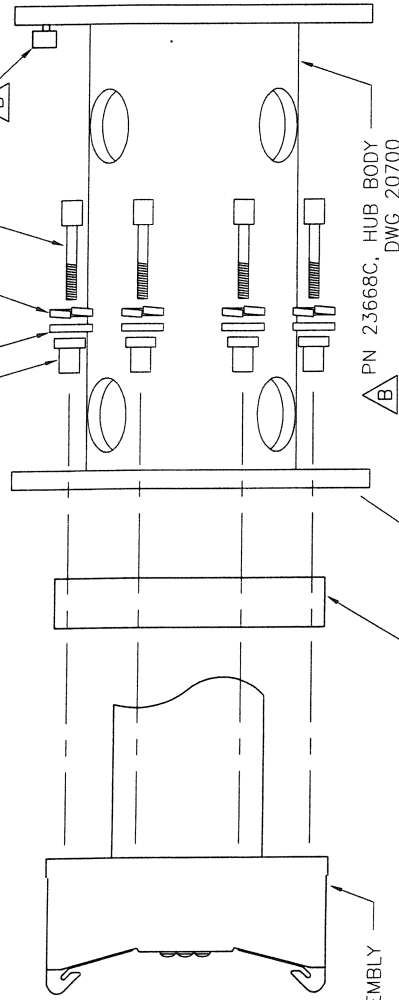
PN 30044 ANODE

FOR ALUMINUM PYLONS-PN 90247B

NUM	QTY	PN	DESCRIPTION
1	6	30602	CAP SCREW, 1/4-20 X 2 1/4, SOCKET HEAD, SS
2	6	30570	WASHER, 1/4" FLAT, SS
3	6	30254	WASHER, 1/4" SPLIT RING LOCK, SS

FOR TITANIUM PYLONS-PN 90247T

NUM	QTY	PN	DESCRIPTION
1	6	30630	MACHINE SCREW, 1/4-20 X 2 1/4, HEX HEAD, Ti
2	6	30634	WASHER, 1/4" FLAT, Ti
3	6	30633	WASHER, 1/4" SPLIT RING LOCK, Ti

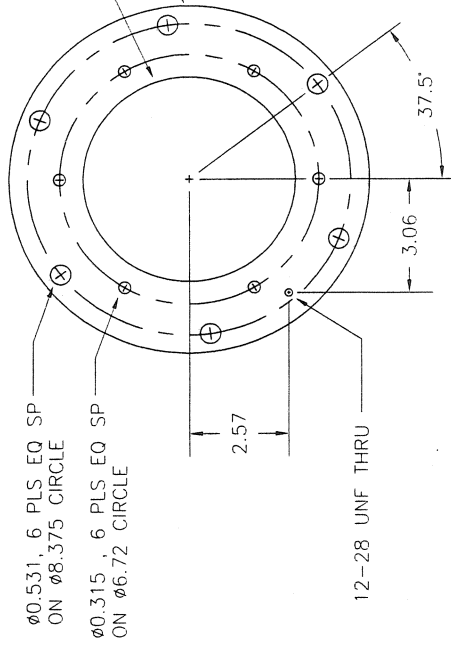


PYLON ASSEMBLY

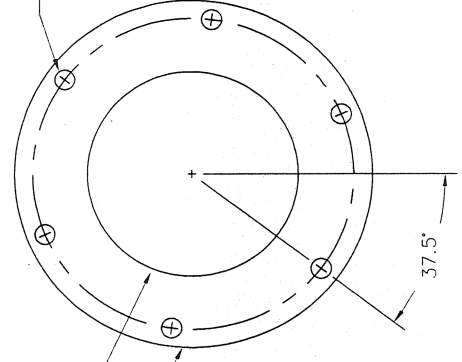
PN 23685, PLASTIC END CAP SPACER
DWG 20709

PN 23668C, HUB BODY
DWG 20700

TOP END VIEW



BOTTOM END VIEW



0.531, 6 PLS EQ SP
ON 08.375 CIRCLE

NOTE - HUB BODY FLANGE PLATES:
THE 0.531 TOP END HOLES
ARE ALIGNED WITH THE 0.531
BOTTOM END HOLES.

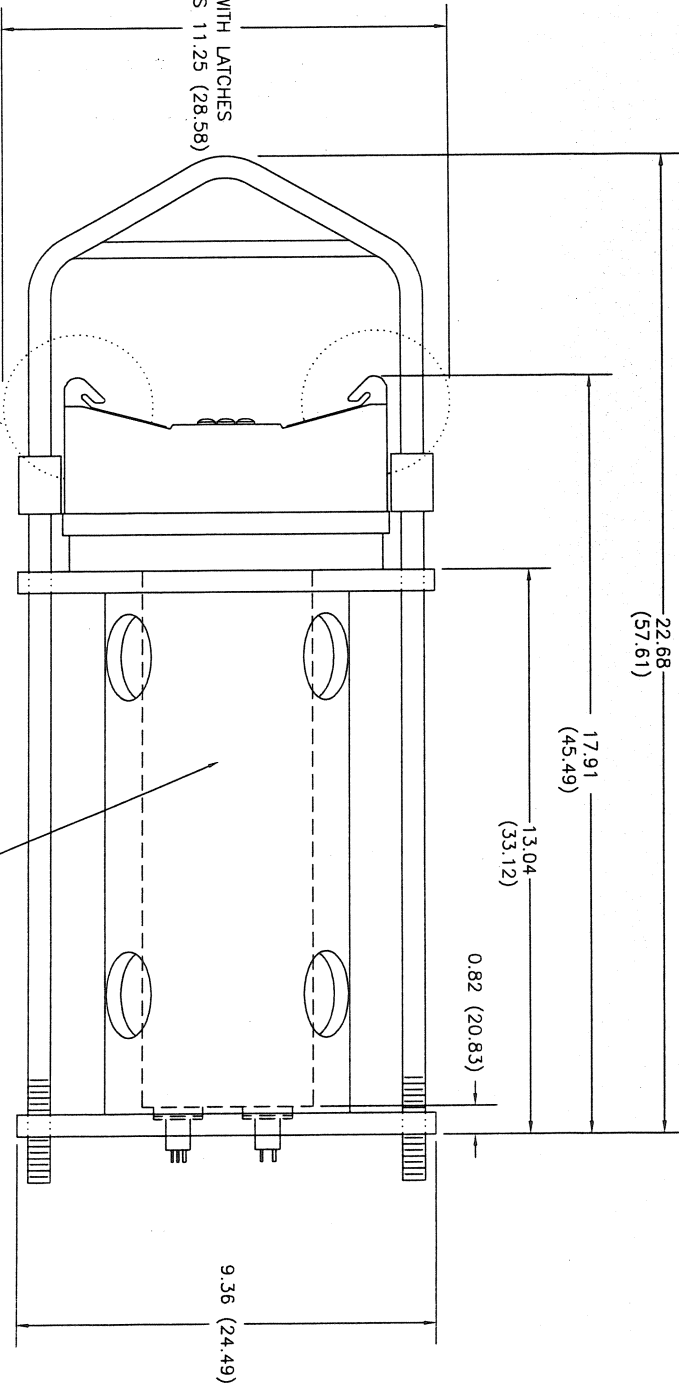
TOLERANCES	SEA-BIRD ELECTRONICS, INC				
FRACTIONAL	P/N	SCALE	DRAWN BY	DG	
DECIMAL	TITLE		SBE 32 PYLON/HUB DETAIL		
ANGULAR	DATE	DRAWING NUMBER	REV	B	
	6/15/94	40721			

LATCH SWINGS THROUGH DASHED CIRCLE WHEN CLOSING

DIAMETER WITH LATCHES
EXTENDED IS 11.25 (28.58)

ELECTRONICS ASSEMBLY IS HOUSED IN
PRESSURE CASE DENOTED BY DASHED LINES

NOTE: DRAWING IS NOT TO SCALE
ALL DIMENSIONS ARE IN INCHES (CM)



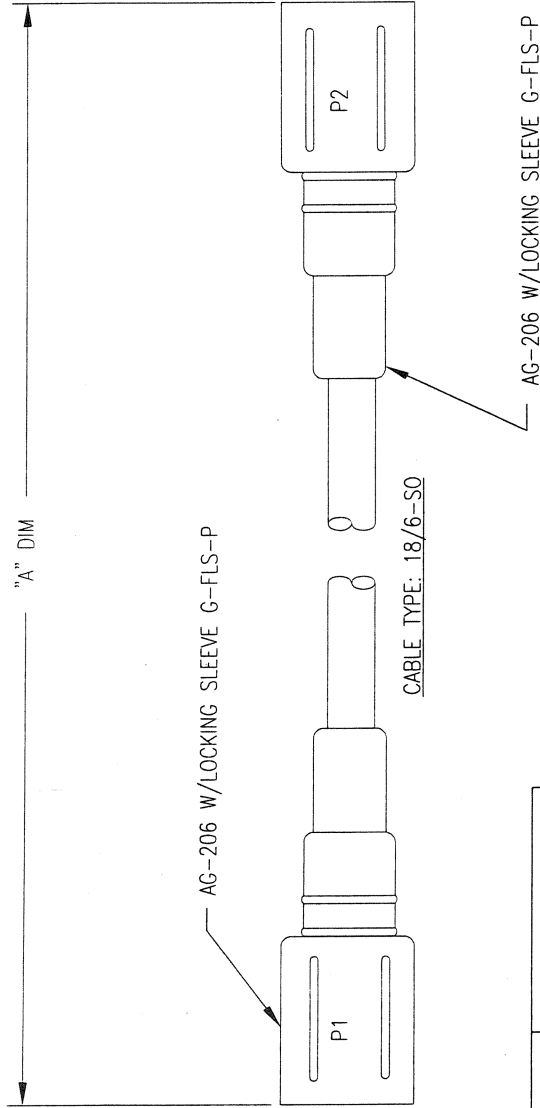
DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
6-02	B	CHANGED LATCH SWING DIA	DW		

TOLERANCES			
FRACTIONAL	P/N	SCALE	DRAWN BY D.J.M.
DECIMAL		NONE	APPROVED BY
ANGULAR	DATE	DRAWING NUMBER	REV
	1/3/94	20749	B

SEA-BIRD ELECTRONICS, INC

TITLE SBE 32 PYLON AND LIFTING
BAIL DIMENSIONS

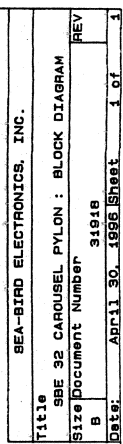
DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



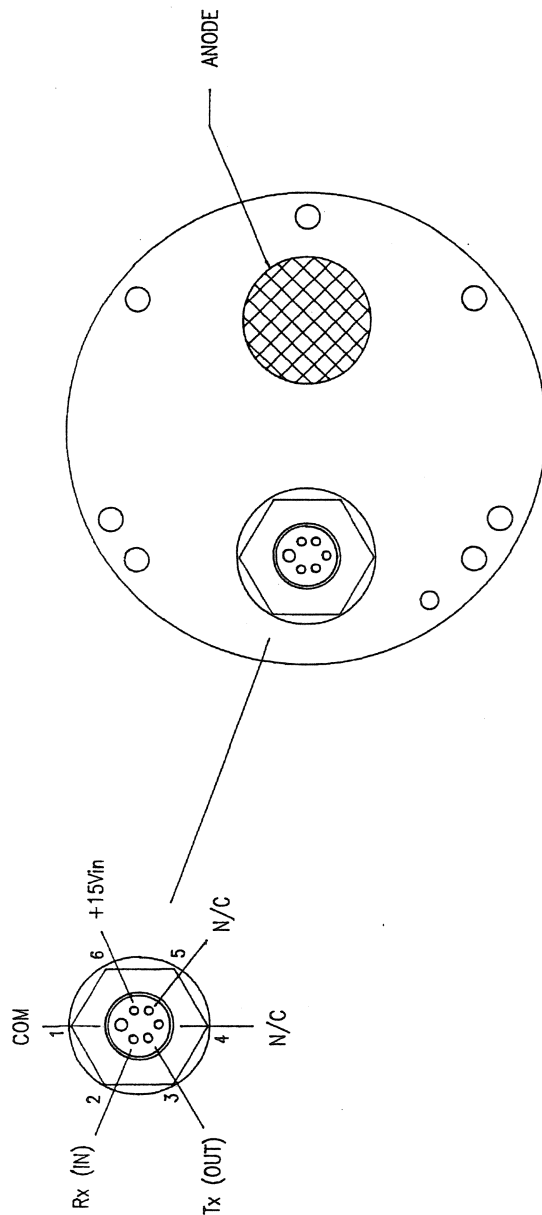
SBE PN	DIM A	
17033	36 IN	----
17132	13 IN	----
17162	30 FT	----
17168	44 IN	----
17197	98 IN	----
17198	79 IN	2 m
17260	120 IN	3 m
17368	30 IN	----
17597	20 IN	----
17607	50 IN	----
17950	60 IN	1.5 m
17954	17 FT	5.5 m
171097	27 FT	8 m
171098	40 FT	12 m
171745	33 FT	10 m
172181	158 IN	4 m
172238	197 IN	5 m

P1	P2
PIN 1	PIN 1
PIN 2	PIN 2
PIN 3	PIN 3
PIN 4	PIN 4
PIN 5	PIN 5
PIN 6	PIN 6

TOLERANCES	SEA-BIRD ELECTRONICS, INC			
FRACTIONAL	P/N SEE TABLE	SCALE 1:1	DRAWN BY JEB	
DECIMAL	TITLE CABLE, 6 PIN/ 6 PIN		APPROVED BY	
ANGULAR	DATE 4/19/96	DRAWING NUMBER 30568	REV	

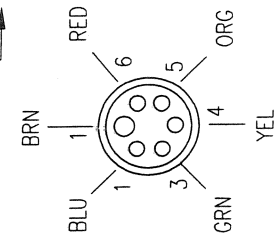
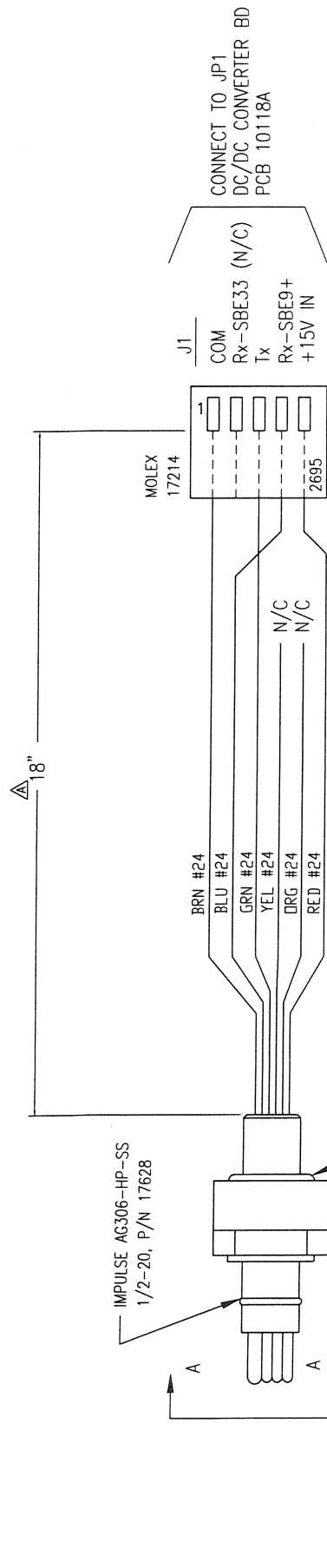


DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



TOLERANCES	SEA-BIRD ELECTRONICS, INC				
FRACTIONAL	P/N	WIRING	SCALE	DRAWN BY	DG
DECIMAL		31572	-	APPROVED BY	
	TITLE SBE 32 CAROUSEL BOTTOM END CAP CONNECTOR (STANDARD - 911plus CONTROL)				
ANGULAR	DATE	10/18/83	DWG NO.	40678	REV

DATE	REV	REVISION RECORD	AUTH.	DR.	CK.
11.19.03	A	CHANGED WIRE LENGTH	---	KLP	

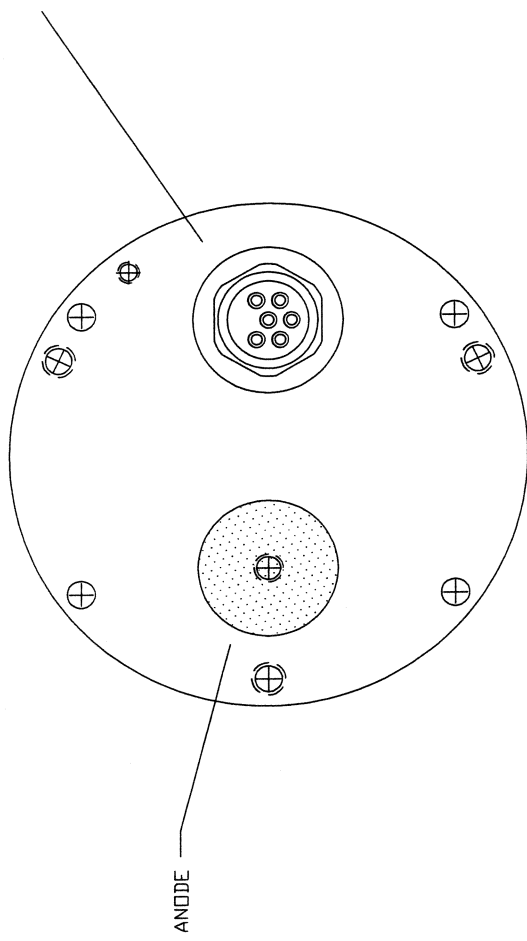
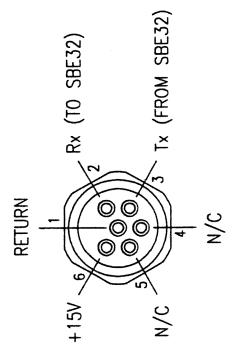


VIEW A-A

TOLERANCES	SEA-BIRD ELECTRONICS, INC
FRACTIONAL	P/N
DECIMAL	SCALE
ANGULAR	CONN 40678
	DRAWN BY
	APPROVED BY
	DC
	TITLE
	SBE 32 CAROUSEL BOTTOM END CAP WIRING
	(STANDARD - 911plus CONTROL)
	DATE
	1/7/94
	DWG NO.
	31614
	REV
	A

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.

SBE 9plus/AFM

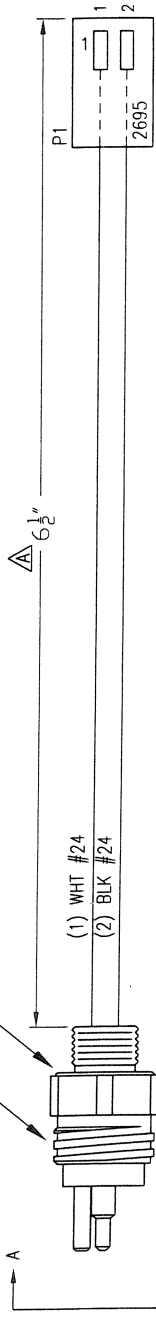
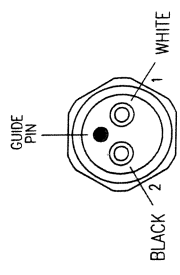


NOTE: INSTALL CONNECTORS RELATIVE
TO END CAP MOUNTING HOLES.

TOLERANCES	SEA-BIRD ELECTRONICS, INC			
FRACTIONAL	P/N	SCALE	DRAWN BY	CB
DECIMAL	WIRING : 32762	-	APPROVED BY	
ANGULAR	TITLE SBE32 : END CAP CONNECTORS (SUBCONN - 911plus/AFM CONTROL)			
	DATE	DRAWING NUMBER	50206	REV
	01/02/03			

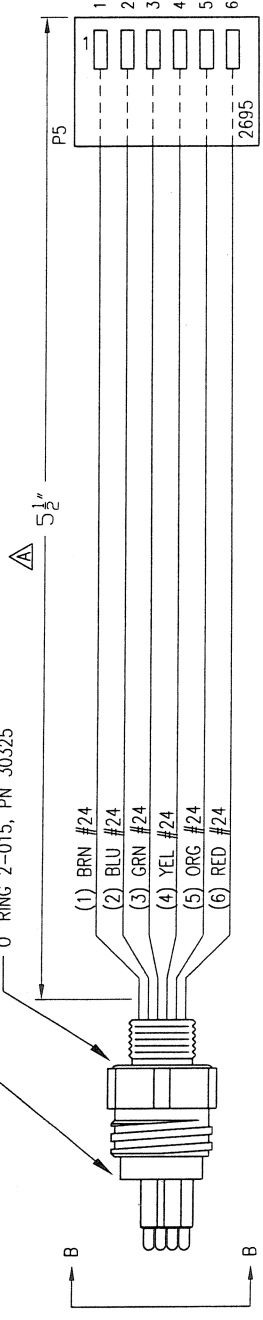
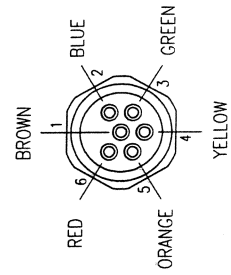
DATE	REV	REVISION RECORD	AUTH.	DR.	CK.
11.11.03	A	ADDED WIRE LENGTHS	CB	KLP	

SUBCONN MCBH-2-MAS, 1/2-20, ANODIZED ALUMINUM BASE, PN 171723
 SUBCONN MCBH-2-MTI, 1/2-20, TITANIUM BASE, PN 171495
 'O' RING 2-015, PN 30325



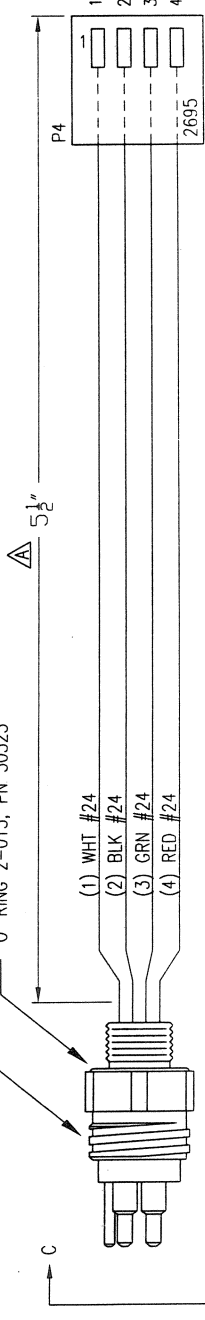
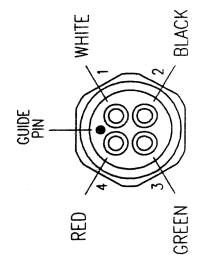
MOLEX P/N 17331
 CONNECT TO SBE32
 ANALOG INTERFACE JP1

SUBCONN MCBH-6-MAS, 1/2-20, ANODIZED ALUMINUM BASE, PN 171726
 SUBCONN MCBH-6-MTI, 1/2-20, TITANIUM BASE, PN 171496
 'O' RING 2-015, PN 30325

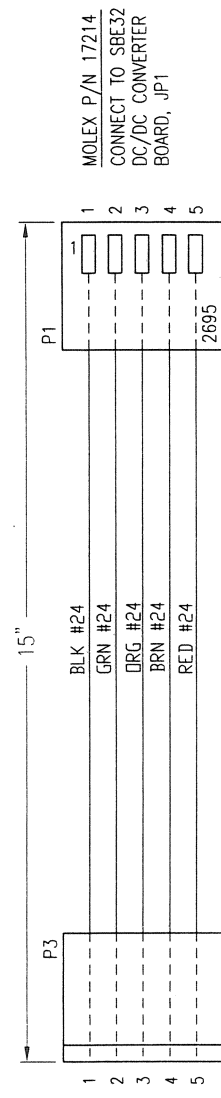


MOLEX P/N 17067
 CONNECT TO SBE32
 ANALOG INTERFACE JP5

SUBCONN MCBH-4-MAS, 1/2-20, ANODIZED ALUMINUM BASE, PN 171725
 SUBCONN MCBH-4-MTI, 1/2-20, TITANIUM BASE, PN 171347
 'O' RING 2-015, PN 30325



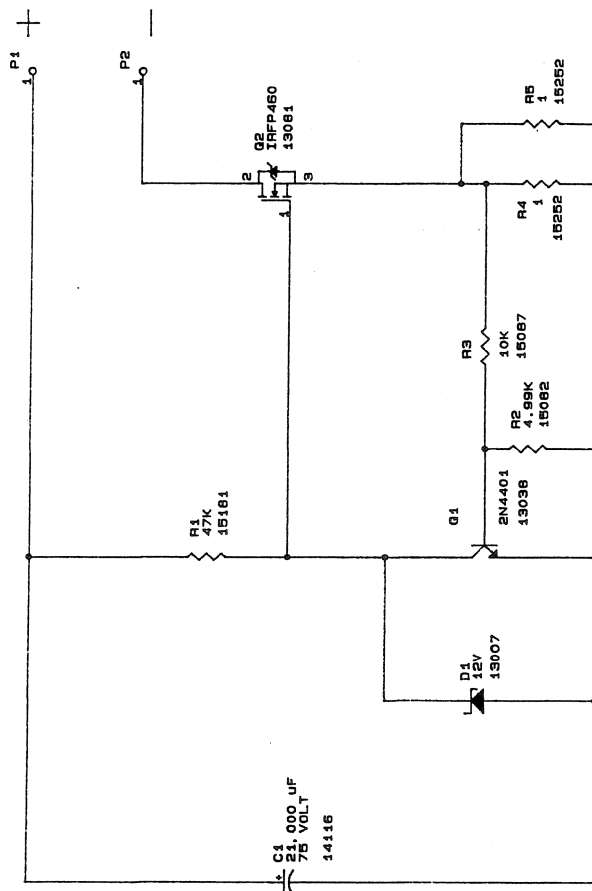
MOLEX P/N 17065
 CONNECT TO SBE32
 ANALOG INTERFACE JP4



MOLEX P/N 17214
 CONNECT TO SBE32
 DC/DC CONVERTER
 BOARD, JP1

MOLEX P/N 17214
 CONNECT TO SBE32
 ANALOG INTERFACE
 BOARD, JP3

SEA-BIRD ELECTRONICS, INC			
TOLERANCES	P/N	SCALE	DRAWN BY
FRACTIONAL	EXT 50207	-	CB
DECIMAL	TITLE SBE 32 CAROUSEL BOTTOM END/PCP WIRING (SUBCONN - SERIAL INTERFACE)	APPROVED BY	
ANGULAR	DATE 01/03/03	DWG NO. 32764	REV A



21138

SEA-BIRD ELECTRONICS, INC.

AGSY: 40656 / 80707

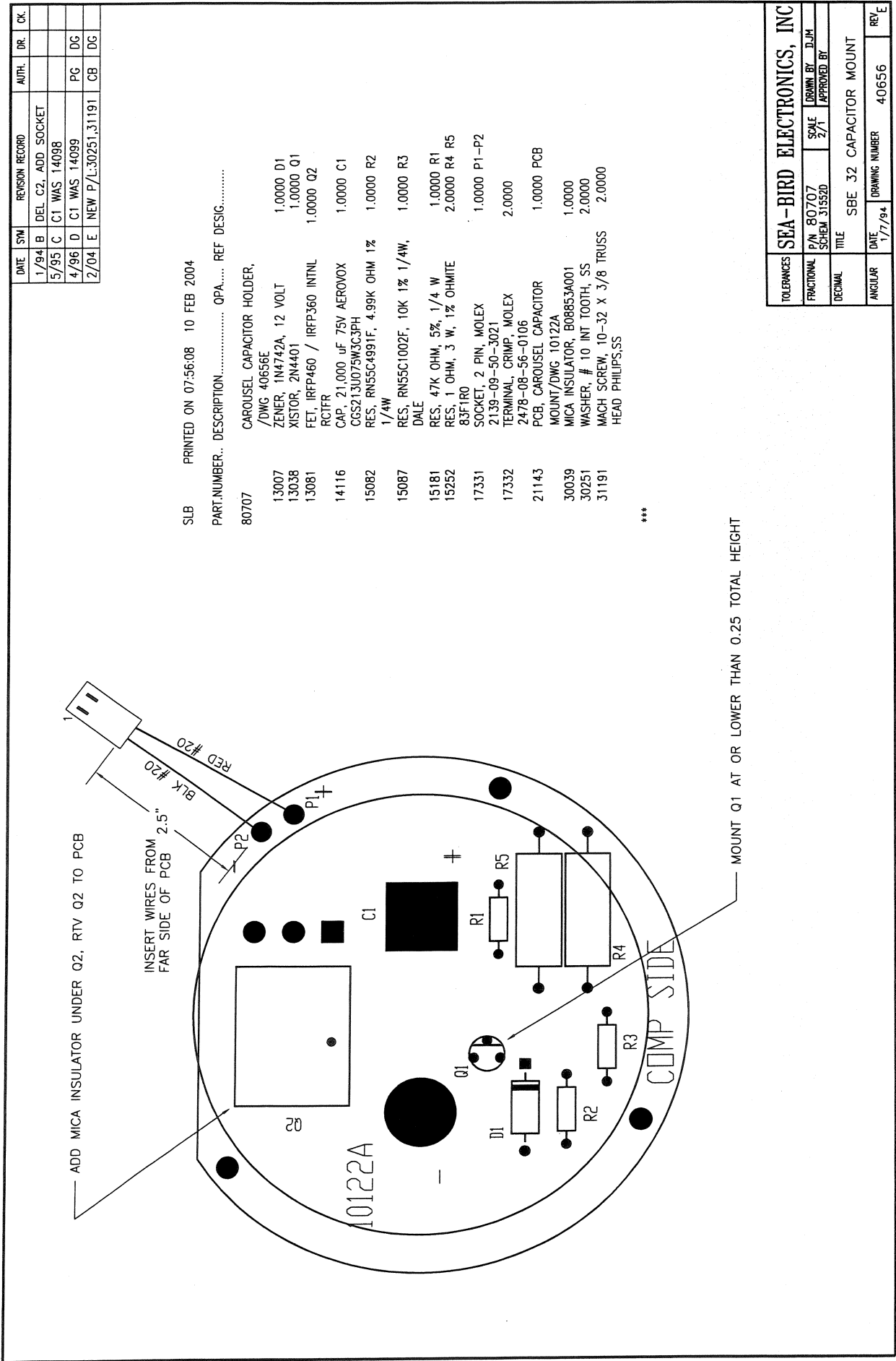
ASSY: 40666 / 80707	Title
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CAROUSEL: CAPACITOR HOLDER BOARD

Size	Document Number	REV
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B	31652	D
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Date:	April 5, 1996	Sheet 1 of 1
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SLB PRINTED ON 13:56:20 31 OCT 2006

PART NUMBER.. DESCRIPTION..... OPA..... REF DESIG.....

40657P SBE32 CAROUSEL DC/DC CONVERTER /40657P

10118F PCB, CAROUSEL DC/DC CONVERTER /DWG 10118F

11065 1C, LT1081CN, LINEAR TECH, RS232

12001 DIODE, ICL8069CCSQ, 1.23V REF.

12037 1C, LP2950ACZ-5.0, 5 VOLT REGULATOR

12085 IC, HP6N139 OPTO ISOLATOR

13002 DIODE, IN4005, HI-VOLTAGE

13003 DIODE, IN4154, UNITRODE

13008 DIODE, INS818, SCHOTKEY

13038 XI5TOR, 2N4401

13039 XI5TOR, 2N4403

13046 XI5TOR, MJE 350, PNP

13067 ZENER DIODE, 13 VOLT, IN4743A

13088 XI5TOR, MJE340, MOTOROLA

13139 DIODE, SMBJ20CA 20V BIDIRECTIONAL, SRFC MNT

14004 CAP, 150 pF, 100V CER, SR151A151KAA, NPO

14029 CAP, 1 uF, 50V CER, SR305E105WAA, Z5U

14033 CAP, 1.5 uF, 50V CER, C330C155M5USCA, Z5U

14034 CAP, .001 uF, 200V CER, C32C102J2G5CA, NPO

14069 CAP, 10 uF, 20V DIPPED TANT, T350E106K020AS

14072 CAP, 33 uF, 25V DIPPED TANT, TAP336K025HSB

14123 CAP, 1uF, 50V 20% KEMET C1825C105MSUACTU

15037 RES, 60.4 OHM, 1%, 1/4 W

15084 RES, 6.98K OHM, 1%, 1/4 W

15105 RES, 30.1K OHM, 1%, 1/4 W

15168 RES, 2.7K OHM, 5%, 1/4 W

15169 RES, 3.3K OHM, 5%, 1/4 W

15170 RES, 4.7K OHM, 5%, 1/4 W

15172 RES, 10K OHM, 5%, 1/4 W

15174 RES, 20K OHM, 5%, 1/4 W

15181 RES, 47K OHM, 5%, 1/4 W

15183 RES, 100K OHM, 5%, 1/4 W

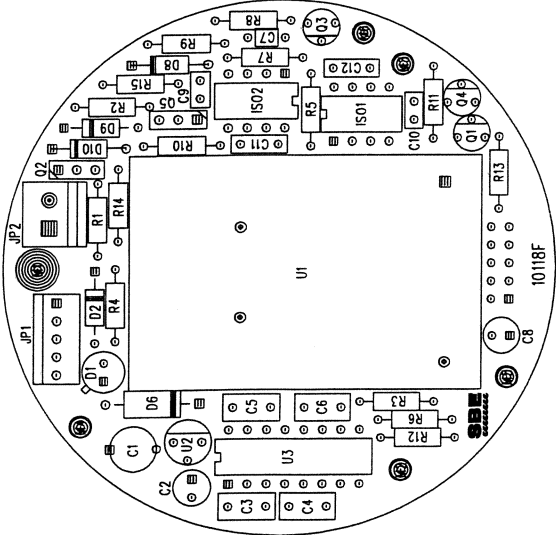
171028 SOCKET, 10 PIN TWO ROW, .385", SD-105-G-2

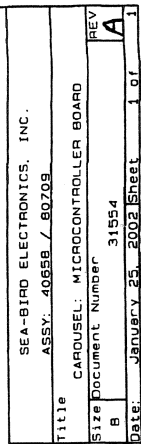
17215 HEADER, 5 PIN, MOLEX 6373-22-11-2052

17330 HEADER, 2 PIN, MOLEX 41671-26-48-2025

22056 CONVERTER, DC/DC ENDICOTT, E1615-.7570S

DATE	SYM	REVISION RECORD	AUTH	DR	CK
1/7/94	B	04, D7, R17, U1			
2/17/94	C	DEL D3,D7, ADD R13,R14			
	D	R2 WAS 16.9, IS 30.1 OHM	JB	DC	
	E	R2 WAS 30.1, IS 121 OHM	JB	DC	
8/4/94	F	DEL D4,D5, ADD 05,R15,D8			DJM
8/15/94	G	PCB D3&D7 CHG TO R13,R14			BMC
12/2/94	H	ECN401, CHG R2, ADD D9	JB	DC	
6/8/95	J	ADD D10, CUT TRACE	JB	DC	
6/13/95	K	ADD REV D PCB			BMC
8/4/96	L	CORRECT D1 DESCRIPTION			DC
2/24/97	M	ECN447: NEW PCB			DC
9/7/04	N	ECN796: PCB F, ADD D11,C13	JB	DC	
10/31/06	P	ECN1020: JP3 WAS 17489	CB	JK	

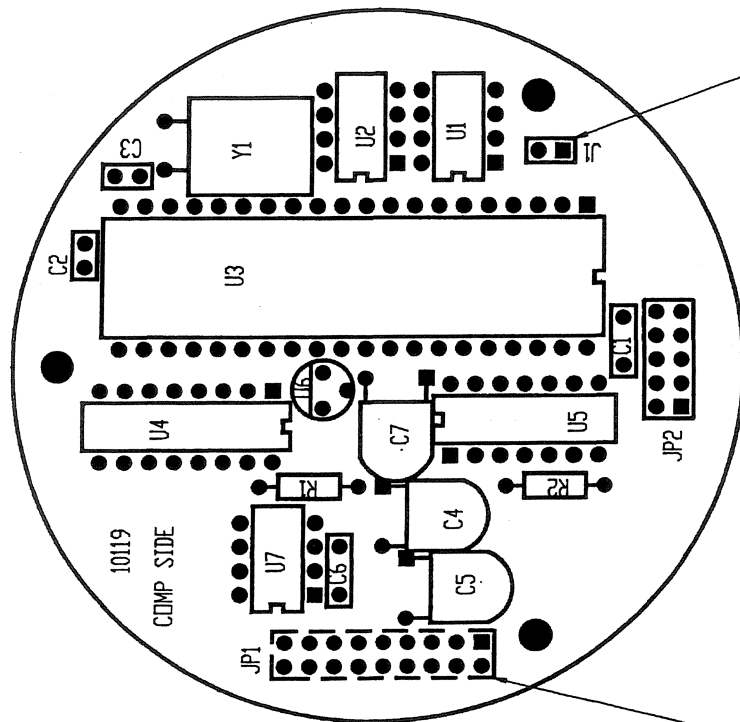




SINGLE LEVEL BILLS PAGE 1
SLB PRINTED ON 09:22:08 28 SEP 1993

PART NUMBER. DESCRIPTION..... GPA..... ITM REF
DESIG.....

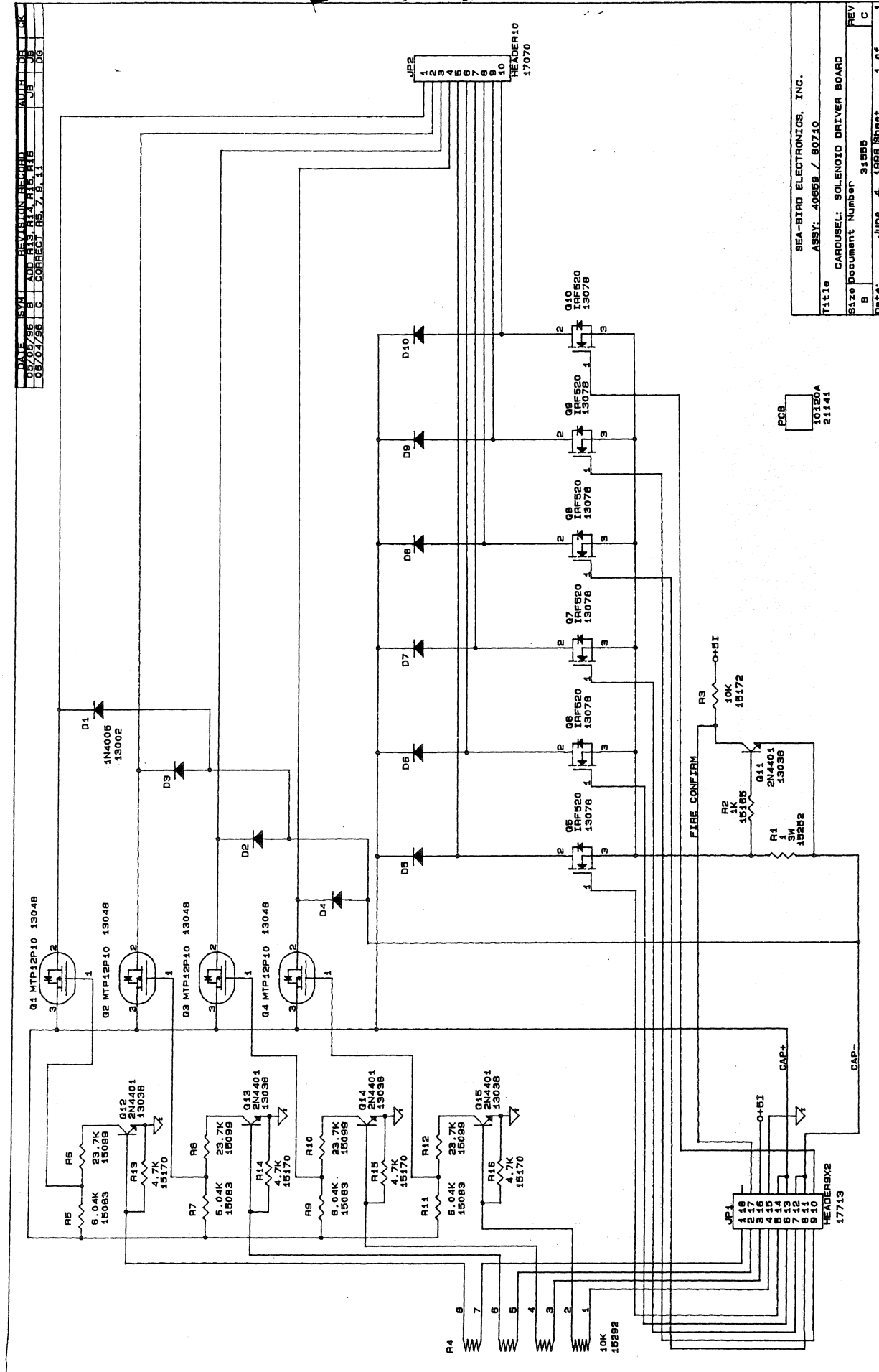
80709	CARDUSEL uCONTROLLER, /DWG				
11075	40658				
11114	IC, CD4081BE, QUAD 2-INPUT AND	1.0000	U5		
11126	IC, MAXIM, MAX7000CPA	2.0000	U1 U2		
11127	IC, VI.0 CARDUSEL SC87C51	1.0000	U3		
12037	uCONTROLLER				
12042	IC, MC14504BCP, MOT. HEX LEVEL	1.0000	U4		
14002	SHIFTER				
14018	IC, LP2950ACZ-5.0, 5 VOLT	1.0000	U6		
14025	REGULATOR				
14069	IC, LP2951CN, VAR. VOLT. REG.	1.0000	U7		
14072	CAP, 33 pf, 100V CER,	2.0000	C3 C2		
15109	SR151A330KAA, NPO				
15136	CAP, .01 uf, 100V CER,	1.0000	C6		
17712	SR211C103KAA, X7R				
17566	CAP, .1 uf, 100V CER,	1.0000	C1		
17714	SR211C104KAA, X7R				
18022	CAP, 10 uf, 20V DIPPED TANT,	2.0000	C5 C7		
21140	T350E106K020AS				
	CAP, 33 uf, 25V DIPPED TANT,	1.0000	C4		
	TAP336K025HSB				
	RES, 49.9K OHM, 1%, 1/4 W	1.0000	R2		
	RES, 365K OHM 1%, 1/4 W	1.0000	R1		
	HEADER, 10 PIN, 2 ROW, SAMTEK	1.0000	JP2		
	BBD-105-GA				
	SOCKET, 40 PIN, LD-PRO, AUGAT	1.0000	U3		
	540-AG11D				
	SOCKET, 18 PIN (.375") SAMTEC	1.0000	JP1		
	SD109G2				
	CRYSTAL, FDX 0368-20, 3.6864	1.0000	Y1		
	MHZ				
	PCB, CARDUSEL uCONTROLLER,	1.0000	PCB		
	/DWG 10119				



MOUNT ON SOLDER SIDE OF BOARD

J1 INSTALLED FOR 1/2 PLACE CAROUSEL
J1 NOT INSTALLED FOR 24 PLACE CAROUSEL

TOLERANCES	SEA-BIRD ELECTRONICS, INC
FRACTIONAL	P/N 80709
DECIMAL	SCALE 21
ANGULAR	DRAWN BY LOJN
	APPROVED BY
	TITLE
	SBE 32 CAROUSEL uCONTROLLER
	DATE 9/27/93
	DRAWING NUMBER 40658
	REV



SEA-BIRD ELECTRONICS, INC.

AGSY: 40659 / 80710

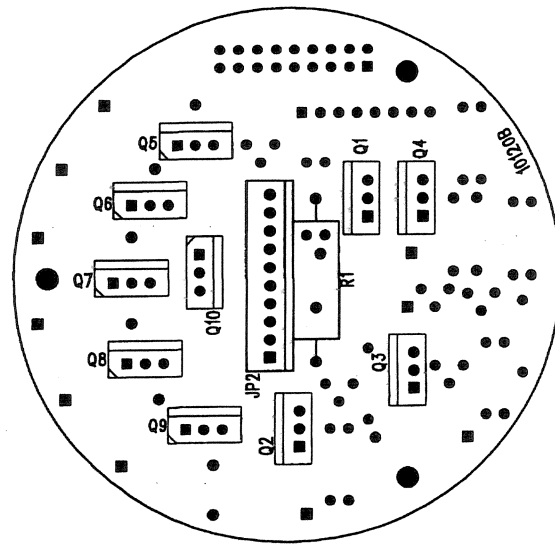
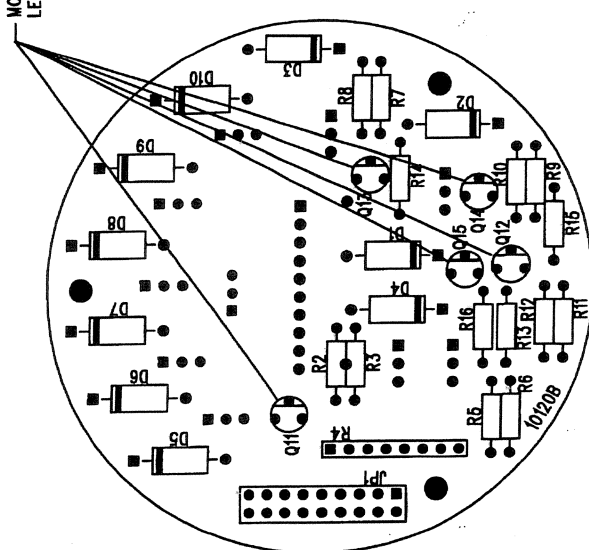
Ratio

CAROUSEL: SOLE

Size	Document Number

9	31555
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Date: June 4, 1998 Sheet:



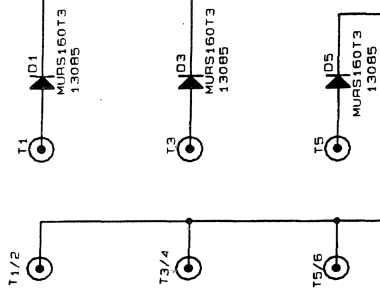
PART NUMBER.	DESCRIPTION.	QPA.	ITM REF DESIG.	NBR

[illegible]

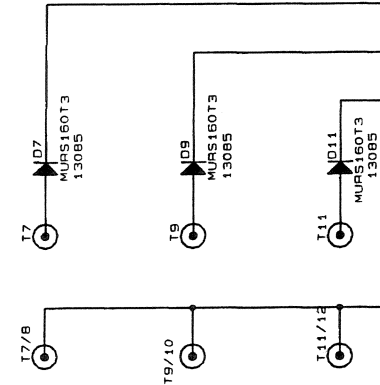
TOLERANCES		SEA-BIRD ELECTRONICS, INC			
FRACTIONAL	P/M	80710	SCALE	DRAWN BY JDM APPROVED BY	
DECIMAL	TITLE		SBE 32 SOLENOID DRIVER		
ANGULAR	DATE	12/16/83	DRAWING NUMBER	40659	
	REV				

DATE	SYN	REVISION RECORD	AUTH	DR	CK
07/28/98	A	ECN552: CHANGE 13084 TO 13085			

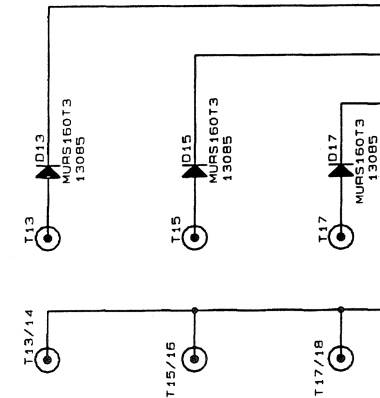
BANK 1



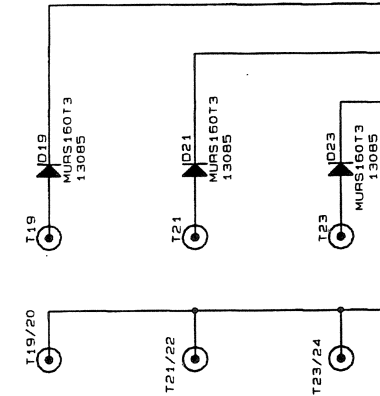
BANK 2



BANK 3



BANK 4



OP1
OP2
OP3
OP4
OP5
OP6
OP7
OP9

PCB
10121A
21142

SEA-BIRD ELECTRONICS, INC.	
ASSY: 40734 / 80821	
Title	12 POSITION
CAROUSEL: SOLENOID TERMINATION BOARD	
Size	Document Number
B	31856
REV	A
Date	JULY 28, 1998
Sheet	1 of 1

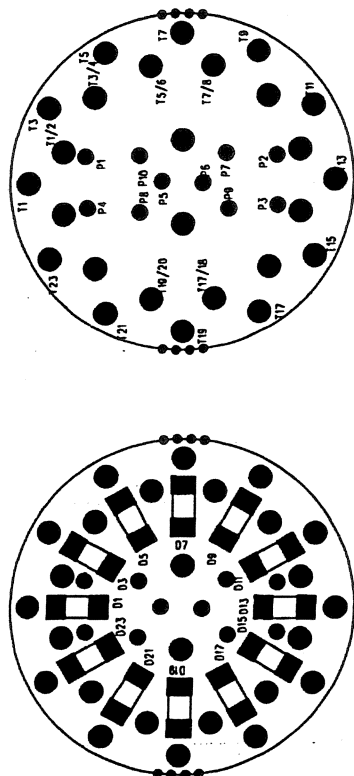
4/2/10

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
7/98	A	ECN562: 13085			06

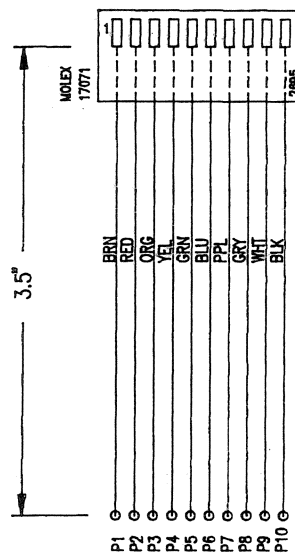
SLB PRINTED ON 14:39:23 28 JUL 1998

PART NUMBER. DESCRIPTION..... SREFC OPA..... ITM REF DESIG.....
MNT NBR

80821	SBE 32 12 PLACE COIL TERMINATE /DWG 40734A	S	12.0000	ODD NBR'D DIODES D1-D23
13085	DIODE, MURS160T3, 600V, 1A, SREFC MNT			P1 P2 P3 P4 P5 P6 P7 P8 P9 P10
15001.1	JUMPER WIRE, 1 POSITION		1.0000	
17052	PIN, GOLD, MOLEX		10.0000	J1
17071	2759-08-56-0110 (0.156") SOCKET, 10 PIN MOLEX		1.0000	
17620	2695-22-01-3107 (0.1") TERMINAL, 1/16" FORKED, CONCORD 12-471-2-01		24.0000	ODD NBR'D TERM'S T1 TO T23 T1/2 T3/4 T5/6 T7/8 T9/10 T11/12 T13/14 T15/16 T17/18 T19/20 T21/22 T23/24
21142	PCB, CAROUSEL SOLENOID, /DWG 10121A & 40710		1.0000	PCB

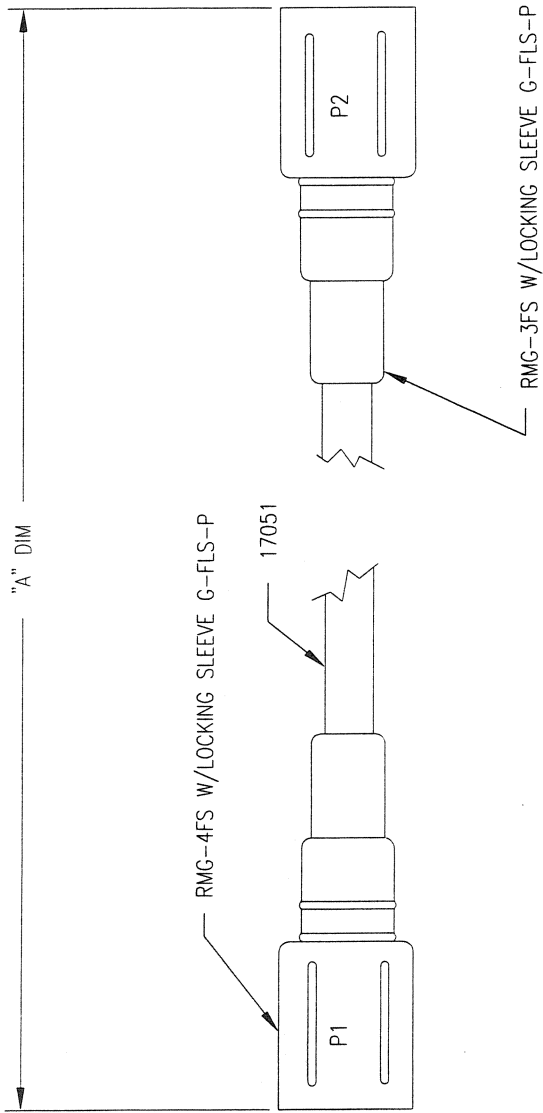


- NOTES:
1. ALL DIODES INSTALLED WITH CATHODE (NOTCH) LOCATED TOWARDS CENTER OF PCB.
 2. TERMINALS AND 10 PIN MOLEX CABLE ARE INSTALLED FROM THE "BOTTOM" SIDE.
 3. TO MOUNT TERMINATE BOARD, ALIGN T1 WITH LOCATOR PIN ON TOP OF END CAP. SECURE WITH 2-56 X 3/8 P.H. SCREWS, #2 NYLON WASHERS AND #2 X 1/8 NYLON SPACERS.
 4. FOR 12 POSITION APPLICATION: T1, T3, T5, ETC AND T1/2, T3/4, T5/6, ETC ARE USED. SOLDER POSITION 1 COIL RED WIRE TO T1, BLACK WIRE TO T1/2. SOLDER POSITION 2 RED WIRE TO T3, BLACK WIRE TO T3/4. WIRE ALL 12 COILS IN THE SAME WAY.



TOLERANCES	SEA-BIRD ELECTRONICS, INC
FRACTIONAL	P/N 31856 SCALE DRAWN BY D.J.M.
DECIMAL	TITLE SBE 32 SOLENOID TERMINATE 12 POSITION APPROVED BY
ANGULAR	DATE 11/9/94 DWG NO. 40734 REV A

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



P1	P2
PIN 1	PIN 1
PIN 2	PIN 2
PIN 3	PIN 3
PIN 4	N/C

SBE PART NO	A DIM
17821	48 IN
17884	72 IN
171979	36 IN
172014	24 IN

TOLERANCES	SEA-BIRD ELECTRONICS, INC			
FRACTIONAL	P/N SEE TABLE	SCALE	DRAWN BY	BUC
DECIMAL	TITLE CABLE, 4 PIN / 3 PIN	1:1	APPROVED BY	
ANGULAR	RMG-4FS TO RMG-3FS			
	DATE 6/6/94	DRAWING NUMBER	31670	REV

WARRANTY POLICY

2006

5-YEAR LIMITED WARRANTY (NEW PRODUCTS)

For a period of five years after the date of original shipment from our factory, products manufactured by Sea-Bird are warranted to function properly and be free of defects in materials and workmanship. Should a Sea-Bird instrument fail during the warranty period, return it freight pre-paid to our factory. We will repair it (or at our option, replace it) at no charge, and pay the cost of shipping it back to you. Certain products and components have modified coverage under this warranty as described below.

LIMITED WARRANTY ON SERVICE & REPAIRS

Service work, repairs, replacement parts and modifications are warranted to be free of defects in materials or workmanship for the remainder of the original 5-year warranty or one year from the date of shipment from our factory after repair or service, whichever is longer. Certain products and components have modified coverage under this warranty as described below.

MODIFICATIONS / EXCEPTIONS / EXCLUSIONS

1. The SBE 43 DO sensor is warranted to function properly for 5 years. Under normal use however, the electrolyte in an SBE 43 DO sensor will require replenishment after about 3 years. Purchase of an SBE 43 includes one free electrolyte replenishment (as necessitated by chemical depletion of electrolyte) anytime during the warranty period. To obtain the replenishment, return the sensor freight pre-paid to our factory. We will refurbish it for free (electrolyte refill, membrane replacement, and recalibration) and pay the cost of shipping it back to you. Membrane damage or depletion of electrolyte caused by membrane damage is not covered by this warranty.
2. Because pH and other dissolved oxygen (DO) electrodes have a limited life caused by the depletion of their chemical constituents during normal storage and use, our warranty applies differently to such electrodes. Electrodes in SBE 13Y and 23Y DO sensors, SBE 18 pH sensors, and SBE 27 pH/ORP sensors are covered under warranty for the first 90 days only. Other components of the sensor are covered for 5 years.
3. Equipment manufactured by other companies (e.g., fluorometers, transmissometers, PAR, optical backscatter sensors, altimeters, etc.) are warranted only to the limit of the warranties provided by their original manufacturers (typically 1 year).
4. Batteries, zinc anodes or other consumable/expendable items are not covered under this warranty.
5. Electrical cables and dummy plugs are warranted to function properly and be free of defects in materials and workmanship for 1 year.
6. This warranty is void if in our opinion the instrument has been damaged by accident, mishandled, altered, improperly serviced, or repaired by the customer where such treatment has affected its performance or reliability. In the event of such misuse/abuse by the customer, costs for repairs plus two-way freight costs will be borne by the customer. Instruments found defective should be returned to the factory carefully packed, as the customer will be responsible for freight damage.
7. Incidental or consequential damages or costs incurred as a result of product malfunction are not the responsibility of SEA-BIRD ELECTRONICS, INC

Warranty Administration Policy

Sea-Bird Electronics, Inc. and its authorized representatives or resellers provide warranty support only to the original purchaser. Warranty claims, requests for information or other support, and orders for post-warranty repair and service, by end-users that did not purchase directly from Sea-Bird or an authorized representative or reseller, must be made through the original purchaser. The intent and explanation of our warranty policy follows:

1. Warranty repairs are only performed by Sea-Bird.
2. Repairs or attempts to repair Sea-Bird products performed by customers (owners) shall be called *owner repairs*.
3. Our products are designed to be maintained by competent owners. Owner repairs of Sea-Bird products will NOT void the warranty coverage (as stated above) simply as a consequence of their being performed.
4. Owners may make repairs of any part or assembly, or replace defective parts or assemblies with Sea-Bird manufactured spares or authorized substitutes without voiding warranty coverage of the entire product, or parts thereof. Defective parts or assemblies removed by the owner may be returned to Sea-Bird for repair or replacement within the terms of the warranty, without the necessity to return the entire instrument. If the owner makes a successful repair, the repaired part will continue to be covered under the original warranty, as if it had never failed. Sea-Bird is not responsible for any costs incurred as a result of owner repairs or equipment downtime.
5. We reserve the right to refuse warranty coverage *on a claim by claim basis* based on our judgment and discretion. We will not honor a warranty claim if in our opinion the instrument, assembly, or part has been damaged by accident, mishandled, altered, or repaired by the customer *where such treatment has affected its performance or reliability*.
6. For example, if the CTD pressure housing is opened, a PC board is replaced, the housing is resealed, and then it floods on deployment, we do not automatically assume that the owner is to blame. We will consider a claim for warranty repair of a flooded unit, subject to our inspection and analysis. If there is no evidence of a fault in materials (e.g., improper or damaged o-ring, or seal surfaces) or workmanship (e.g., pinched o-ring due to improper seating of end cap), we would cover the flood damage under warranty.
7. In a different example, a defective PC board is replaced with a spare and the defective PC board is sent to Sea-Bird. We will repair or replace the defective PC board under warranty. The repaired part as well as the instrument it came from will continue to be covered under the original warranty.
8. As another example, suppose an owner attempts a repair of a PC board, but solders a component in backwards, causing the board to fail and damage other PC boards in the system. In this case, the evidence of the backwards component will be cause for our refusal to repair the damage under warranty. However, this incident will NOT void future coverage under warranty.
9. If an owner's technician attempts a repair, we assume his/her qualifications have been deemed acceptable to the owner. The equipment owner is free to use his/her judgment about who is assigned to repair equipment, and is also responsible for the outcome. The decision about what repairs are attempted and by whom is entirely up to the owner.

Service Request Form

To return your instrument for calibration or other service, please take a few moments to provide us with the information we need, so we can serve you better.

PLEASE:

1. Get a Returned Material Authorization (RMA) number from Sea-Bird (*phone 425-643-9866, fax 425-643-9954, or email seabird@seabird.com*). Reference the RMA number on this form, on the outside shipping label for the equipment, and in all correspondence related to this service request.
2. Fill out 1 form for each type (model) of instrument.
3. Include this form when shipping the instrument to Sea-Bird for servicing.
4. Fax us a copy of this form on the day you ship. **FAX: (425) 643-9954**

RETURNED MATERIAL AUTHORIZATION (RMA) NUMBER: _____

DATE EQUIPMENT REQUIRED BY: _____

DO YOU REQUIRE A WRITTEN QUOTE? _____

CONTACT INFORMATION

Your name: _____

Institution/Organization/Company: _____

Shipping/Delivery address for packages: _____

Telephone: _____ Fax: _____

e-mail: _____

SERVICE INFORMATION

Date Shipped: _____

Sea-Bird Model Number (for example, SBE 37-SM): _____

Quantity: _____

Serial Numbers: _____

(Note: Specify instrument serial numbers below if specific services are required for some instruments. For example, if 10 instruments are being returned for calibration, and 1 of the 10 also requires repairs, specify the serial number for the instrument requiring repairs in the appropriate section of the form.)

SEASOFT Version you have been using with this instrument(s): _____

[] Calibration Services:

____ Calibration (includes basic diagnostic):

____ Temperature ____ Conductivity ____ Pressure ____ DO ____ pH

(Please allow a minimum of 3 weeks after we receive the instrument(s) to complete calibration.)

____ Other (specify): _____

[] Internal Inspection and O-Ring Replacement (includes hydrostatic pressure test):

Additional charges may apply.

[] System Upgrade or Conversion:

Specify (include instrument serial number if multiple instruments are part of shipment): _____

[] Diagnose and Repair Operational Faults:

Please send a disk containing the raw data (.hex or .dat files) that shows the problems you describe. Also send the .con files you used to acquire or display the data.

Problem Description (continue on additional pages if needed; include instrument serial number if multiple instruments are part of shipment): _____

PAYMENT/BILLING INFORMATION

Credit Card: Sea-Bird accepts payment by VISA, MasterCard, or American Express.

☐ MasterCard ☐ Visa ☐ American Express

Account Number: _____ Expiration Date: _____

Credit Card Holder Name (printed or typed): _____

Credit Card Holder Signature: _____

Credit Card Billing Address (if different than shipping address): _____

Invoice/Purchase Order: If you prefer us to invoice you, please complete the following or enclose a copy of your Purchase Order:

Purchase Order Number: _____

Billing Address (if different than shipping address): _____

Instructions for Returning Goods to Sea-Bird

1. **Domestic Shipments (USA) - Ship prepaid** (via UPS, FedEx, DHL, etc.) directly to:

Sea-Bird Electronics, Inc.

1808 136th Place NE

Bellevue, WA 98005, USA

Telephone: (425) 643-9866

Fax: (425) 643-9954

2. **International Shipments –**

Option A. Ship via PREPAID AIRFREIGHT to SEA-TAC International Airport (IATA Code “SEA”):

Sea-Bird Electronics, Inc.

1808 136th Place NE

Bellevue, WA 98005, USA

Telephone: (425) 643-9866

Fax: (425) 643-9954

E-mail: seabird@seabird.com

Notify: MTI Worldwide Logistics for Customs Clearance

Seattle, WA, USA

Telephone: (206) 431-4366

Fax: (206) 431-4374

E-mail: bill.keeble@mti-worldwide.com

E-mail flight details and airway bill number to seabird@seabird.com and bill.keeble@mti-worldwide.com when your shipment is en-route. Include your RMA number in the e-mail.

Option B. Ship via EXPRESS COURIER directly to Sea-Bird Electronics:

If you choose this option, we recommend shipping via UPS, FedEx, or DHL. Their service is door-to-door, including customs clearance. It is not necessary to notify our customs agent, MTI Worldwide, if you ship using a courier service.

E-mail the airway bill / tracking number to seabird@seabird.com when your shipment is en-route. Include your RMA number in the e-mail.

For All International Shipments:

Include a **commercial invoice** showing the description of the instruments, and **Value for Customs purposes only**.

Include the following statement:

“U.S. Goods Returned for Repair/Calibration. Country of Origin: USA. Customs Code: 9801001012.”

Failure to include this statement in your invoice will result in US Customs assessing duties on the shipment, which we will in turn pass on to the customer/shipper.

Note: Due to changes in regulations, if Sea-Bird receives an instrument from outside the U.S. in a crate containing non-approved (i.e., non-heat-treated) wood, we will return the instrument in a new crate that meets the requirements of ISPM 15 (see http://www.seabird.com/customer_support/retgoods.htm for details). We will charge for the replacement crate based on the dimensions of the crate we receive, determined as follows:

1. Multiply the crate length x width x height in centimeters (overall volume in cm³, not internal volume).
2. Determine the price based on your calculated overall volume and the following chart:

Overall Volume (cm ³)	< 52,000	52,000 to < 65,000	65,000 to < 240,000	> 240,000
Example Instrument	37-SM MicroCAT	SEACAT, no cage	CTD in cage	--
Price (USD)	\$45	\$70	\$125	consult factory

These prices are valid only for crate replacement required in conjunction with return of a customer's instrument after servicing, and only when the instrument was shipped in a crate originally supplied by Sea-Bird.

