

# SBE 33 Carousel Deck Unit

---

*For use with the SBE 32 Carousel Water Sampler*



## User's Manual

---

Sea-Bird Electronics, Inc.  
1808 136<sup>th</sup> Place NE  
Bellevue, Washington 98005 USA  
Telephone: 425/643-9866  
Fax: 425/643-9954  
E-mail: seabird@seabird.com  
Website: www.seabird.com

**Manual Version #006, 03/06/06**  
**SBE 33/36 Firmware Version 2.0 and later**  
**SBE 33/36 NMEA Firmware Version 2.3 and later**

# Limited Liability Statement

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

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.

# Table of Contents

<b>Section 1: Introduction .....</b>	<b>5</b>
About this Manual .....	5
How to Contact Sea-Bird .....	5
Unpacking SBE 33.....	6
<b>Section 2: Description of SBE 33 .....</b>	<b>7</b>
System Description .....	7
Specifications.....	8
System Communications .....	9
SBE 33 Front Panel.....	10
SBE 33 Back Panel .....	10
<b>Section 3: Setting Up System .....</b>	<b>11</b>
Installing Software.....	11
Setting CTD Baud Rate and Operating Parameters .....	12
Setting Dip Switches - General Information .....	14
Setting SBE 33 Receiver PCB Dip Switch .....	14
Checking CTD Configuration (.con) File in SEASAVE .....	15
Mounting SBE 33 .....	16
Wiring System .....	16
<b>Section 4: Setting Up Optional NMEA Interface and Surface PAR .....</b>	<b>18</b>
Setting NMEA Interface PCB Dip Switch.....	18
Baud Rate - NMEA Interface PCB to Computer .....	18
Data Bits and Parity – NMEA Interface PCB to Computer .....	18
NMEA Message to Decode .....	19
NMEA Interface Menu Time Out Mode.....	19
Data to Add to Hex String from CTD.....	19
Optional Surface PAR Light Sensor .....	20
NMEA Operating Modes.....	20
Testing NMEA and System Setup .....	21
Troubleshooting NMEA Interface .....	23
Problem 1: Yellow <i>NMEA Transmit</i> LED Not Flashing .....	23
Problem 2: Yellow <i>NMEA Transmit</i> LED Flashing, but Lat/Lon Data Not Displaying .....	23
Setting Up CTD Configuration (.con) File .....	24
<b>Section 5: Operating System .....</b>	<b>25</b>
Acquiring Real-Time Data and Firing Bottles from SEASAVE.....	25
Firing Bottles from SBE 33 Front Panel .....	29
Uploading CTD Data from Memory.....	30
Processing Data Using SBE Data Processing .....	30
Editing Raw Data File.....	31
<b>Section 6: Troubleshooting.....</b>	<b>32</b>
Problem 1: SEASAVE Does Not Collect Any Data .....	32
Problem 2: SBE 33 Completely Inoperable .....	32
Problem 3: Carousel or CTD Does Not Respond .....	32

<b>Glossary .....</b>	<b>33</b>
<b>Appendix I: NMEA Navigation Device Message and Data Formats.....</b>	<b>34</b>
Message Formats .....	34
Data Formats.....	35
<b>Appendix II: NMEA Message Simulation Program.....</b>	<b>36</b>
<b>Appendix III: Replacement Parts.....</b>	<b>38</b>
<b>Index.....</b>	<b>39</b>

# Section 1: Introduction

This section includes contact information and photos of a standard SBE 33 shipment.

---

## About this Manual

This manual is to be used with the SBE 33 Carousel Deck Unit.

It is organized to guide the user from installation through operation. We've included detailed specifications, setup and operation descriptions, and helpful notes throughout the manual.

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](mailto:seabird@seabird.com).

---

## How to Contact Sea-Bird

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

Telephone: 425-643-9866  
Fax: 425-643-9954  
E-mail: [seabird@seabird.com](mailto: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 SBE 33

Shown below is a typical SBE 33 shipment. Inclusion of test cables, cables for optional interfaces, etc. is dependent on the order.



SBE 33 Carousel Deck Unit



Rack mount kit (screws not shown)



SBE 33 power cable



Computer to SBE 33 cable for Serial Data & Carousel Data connectors (2 cables / SBE 33)



25-pin to 9-pin adapter (for use with computer with DB-25 connector)



SBE 33 to Carousel test cable



Sea Cable connector (at SBE 33 end of cable)



NMEA Input Interface test cable (optional)



SBE 33 Manual



Software, and Electronic Copies of Software Manuals and User Manual

# Section 2: Description of SBE 33

This section describes the functions and features of the SBE 33 Carousel Deck Unit, as well as system communications.

## System Description

The SBE 33 Carousel Deck Unit provides power and real-time data acquisition and control for an SBE 32 Carousel Water Sampler which has the SBE 33 interface option installed in its pylon. The SBE 33 is compatible with all Carousel sizes - standard (up to 24 bottles), compact, and sub-compact. When powered and controlled by the SBE 33, the Carousel can be used with:

- SBE 19, 19*plus*, or 25 CTD
- No CTD
- Neil Brown MK III CTD (requires an optional interface; contact Sea-Bird)

The system provides real-time data telemetry and surface power for the CTD, and permits Carousel control through the SBE 33 and via our SEASAVE software. Bottles may be fired sequentially or any order.

The rack-mountable SBE 33 supplies DC power for the underwater unit, decodes the serial data, and passes the data to a computer. The SBE 33 rear-panel switch permits operation from 120 VAC or 240 VAC 50/60 Hz input power. The front-panel LED display indicates which bottles have been fired.

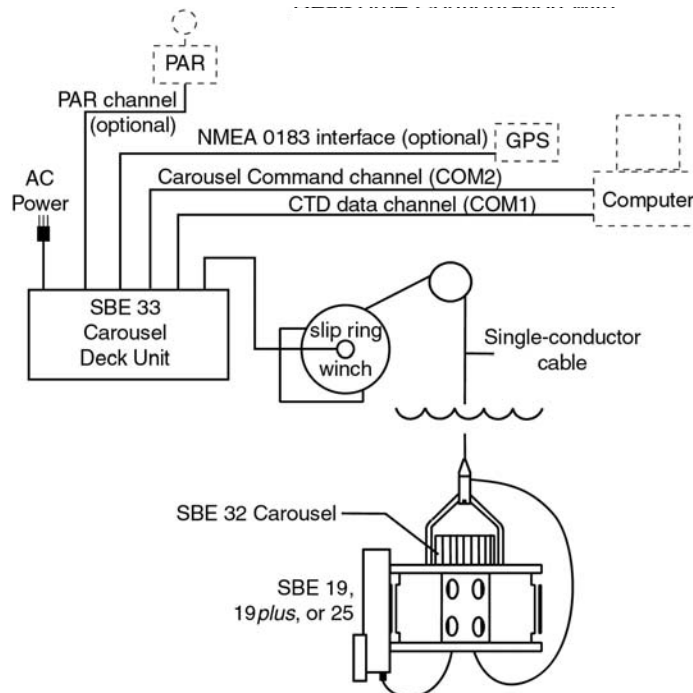
As an option, the SBE 33 includes a NMEA Interface that merges position data with CTD data; the NMEA Interface decodes messages that are output from navigation devices supporting NMEA 0183 protocol. If the NMEA Interface is included, the SBE 33 may also include an optional A/D converter for a Surface PAR light sensor; the SBE 33 supplies 12 volts to power the sensor. Decoded position data (latitude, longitude) and Surface PAR data are appended to the CTD data stream in the SBE 33, and are passed to the computer for storage and/or display with the CTD data.

**Note:**

The NMEA Interface is not available when the optional Neil Brown MK III CTD interface is installed.

**Note:**

**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 diagram for illustration only. You can use any two ports, in any order; set up the COM port configuration in SEASAVE to correspond.



The SBE 33 contains Analog, Receiver, and optional NMEA Interface PCBs. The Receiver PCB interfaces to the sea cable. As described above, the NMEA Interface PCB interfaces to a NMEA navigation device and optional Surface PAR sensor. Communication parameters are set with dip switches on the Receiver and NMEA Interface PCBs. The SBE 33 transmits data to / receives data from the computer at the following communications settings:

- CTD data - 4800 or 9600 baud, 7 or 8 data bits, and no or even parity.
- Carousel data – 300 baud, 8 data bits, and no parity.

The SBE 33 is supplied with a powerful Win 95/98/NT/2000/XP software package, SEASOFT-Win32, which includes:

- **SEATERM** – terminal program for easy setup.
- **SEASAVE** – program for acquiring, converting, and displaying real-time or archived raw data.
- **SBE Data Processing** – program for calculation and plotting of conductivity, temperature, pressure, auxiliary sensor data, and derived variables such as salinity and sound velocity.

**Notes:**

- Help files provide detailed information on SEATERM, SEASAVE, and SBE Data Processing.
- NMEATest, a NMEA navigation device simulation program, is part of the SBE Data Processing installation.
- Separate software manuals on CD-ROM contain detailed information on the setup and use of the software.
- Sea-Bird also supplies a DOS software package, **SEASOFT-DOS**. However, all procedures for software use in this manual refer to the Windows programs.

**NOTE:**

The SBE 32 Carousel Water Sampler can be used with several Sea-Bird CTD types, and can be controlled in several ways:

Data Acquisition and Control	CTD	Control
Real-Time	SBE <i>9plus</i>	SBE <i>11plus</i> Deck Unit
	<b>SBE 19 / 19plus / 25</b>	<b>SBE 33 Deck Unit (this manual)</b>
	<b>Neil Brown MK III</b>	
	<b>None</b>	
Autonomous (no conducting wire required)	SBE <i>9plus</i>	SBE <i>17plus</i> V2 SEARAM
	SBE 19 / 19plus / 25	Auto Fire Module (AFM) PN 90208
	SBE 50 Pressure Sensor	
	<b>None</b>	

For details on the Carousel use for each combination, see the appropriate control manual (this manual, or SBE *11plus*, SBE *17plus* V2, or AFM manual).

## Specifications

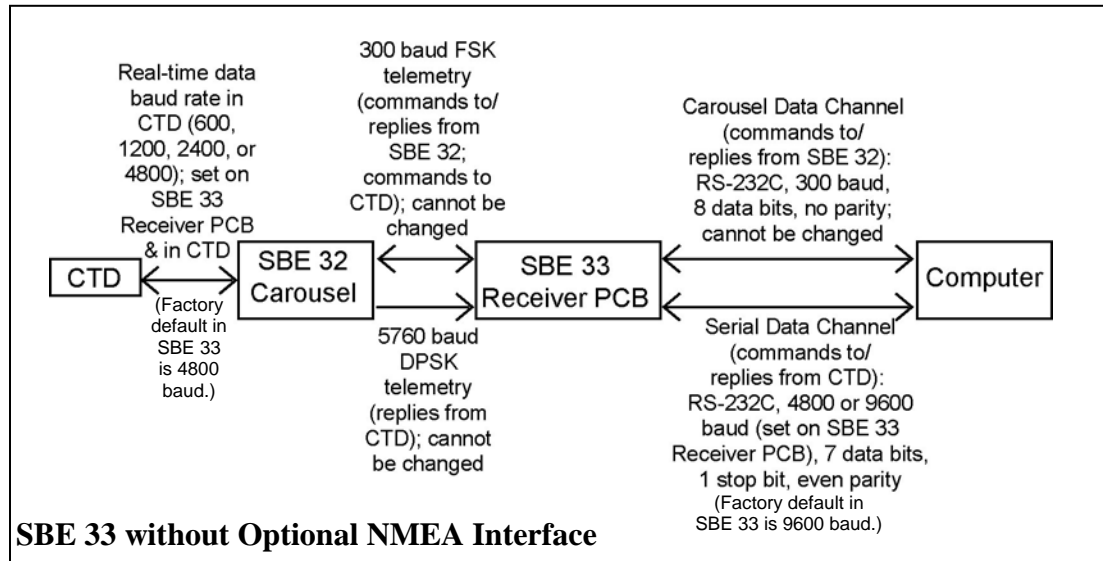
The SBE 33 supplies a constant 250 VDC power to the sea cable. The Carousel receives this voltage (minus the sea cable IR drop) and regulates it to a constant 64 VDC. This 64 VDC is input to a high-efficiency DC/DC converter, which outputs + 15 VDC. The +15 VDC is the supply voltage to the CTD. Approximately 1 amp, *in addition to CTD power*, is available at the CTD for support of auxiliary sensors.

<b>Power Input</b>	120 VAC or 240 VAC 50/60 Hz (selectable)
<b>Sea Cable Compatibility</b>	Single or multi-core armored cable up to 10,000 m (32,800 ft) long with inner core resistance of up to 350 ohms
<b>SBE 33 Dimensions and Weight</b>	89 mm (3.5 inch) high cabinet with standard 19-inch rack mounting brackets 89 mm high x 432 mm wide x 381 mm deep (3.5 x 17 x 15 inches); <i>Feet</i> add 13 mm (0.5 inches) to height; Rack mount <i>ears</i> add 51 mm (2 inches) to depth 9.0 kg (20 lbs)

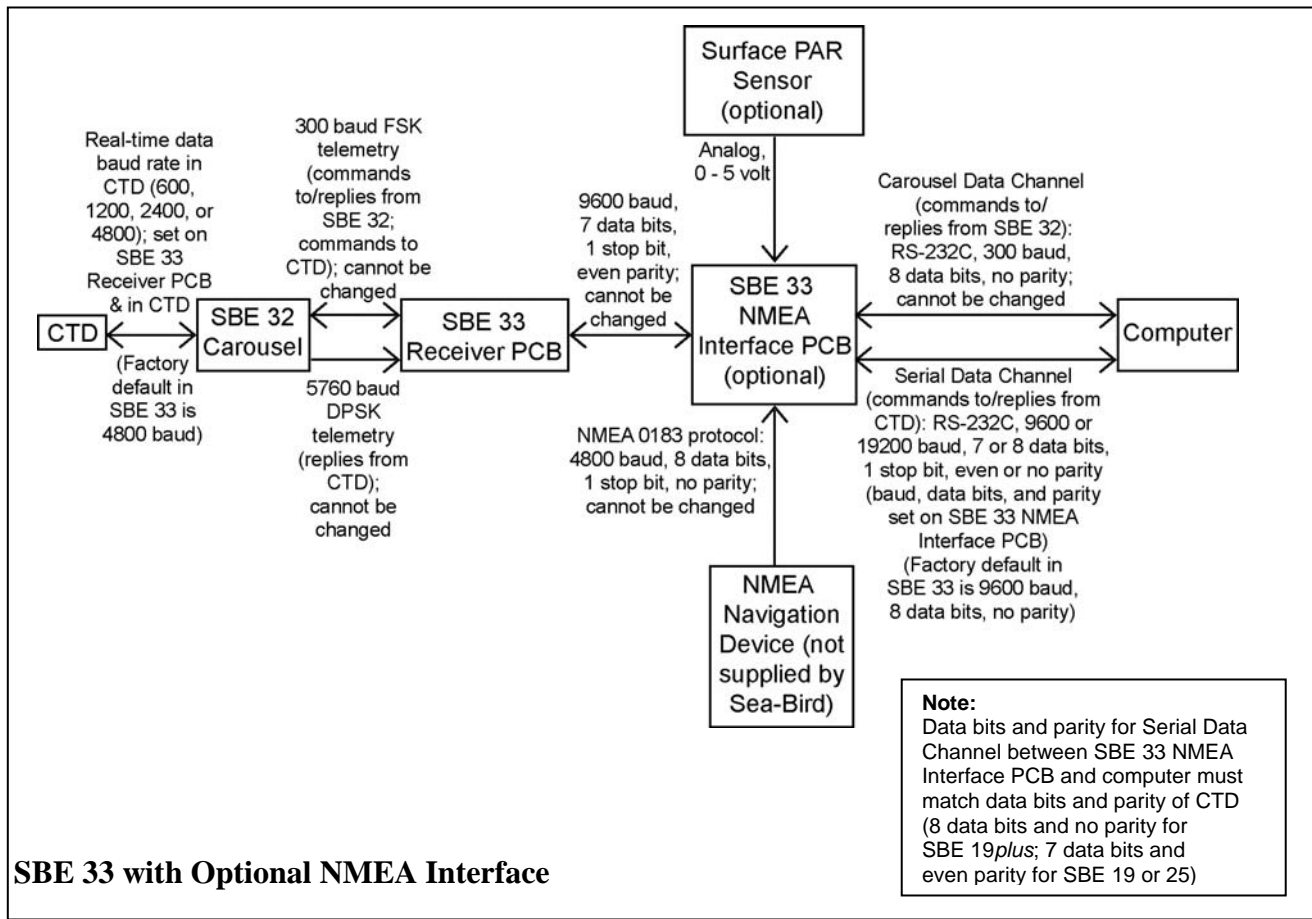


## System Communications

System communications are summarized below:



(DPSK = differential phase shift keyed; FSK = frequency shift keyed)



When sending commands to the Carousel to reset the system or to fire bottles, the SBE 33 sets the most significant bit low.

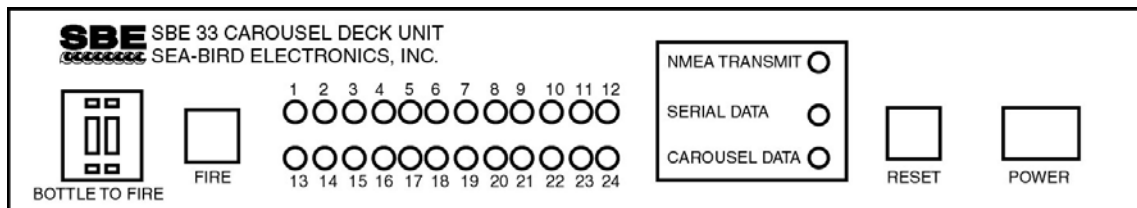
## SBE 33 Front Panel

**Note:**

Bottles can also be fired from the computer using SEASAVE real-time data acquisition software.

Looking at the SBE 33 front panel:

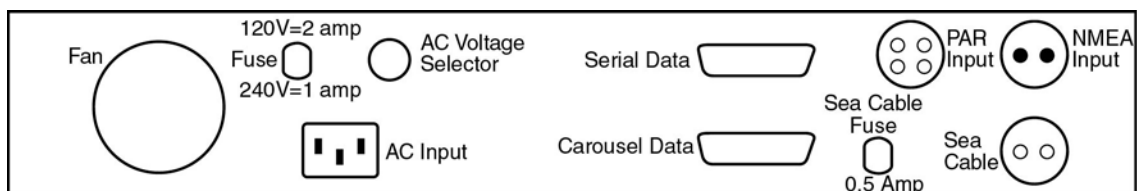
- *Bottle to Fire* pushbutton switch - selects which bottle to fire when Fire button is pushed; if set to 99, SBE 33 will fire bottles in sequential order
- *Fire* button - fires bottles
- *Reset* button - resets system; place *Bottle to Fire* switch to 00 before pressing *Reset*
- *Power* button - turns power to the SBE 33 on/off
- *LEDs* - indicate if the SBE 33 is communicating with other parts of the system:
  - Red bottle number LEDs (1, 2, etc.) - flash when the associated bottle is fired
  - Yellow *NMEA Transmit* LED - (if optional NMEA Interface PCB is installed) flashes when a carriage return character (decimal 13) is received from the NMEA navigation device
  - Green *Serial Data* LED - flashes when a carriage return character (decimal 13) is received from the CTD through the Carousel
  - Yellow *Carousel Data* LED - flashes when a message (such as a bottle fire confirmation) is received from the Carousel



## SBE 33 Back Panel

Looking at the connections to the SBE 33 back panel:

- SBE 33 communication with the computer is provided in two RS-232 channels. The *Carousel Data* channel sends commands to and receives replies from the SBE 32 Carousel. The *Serial Data* channel sends commands to and receives replies from the CTD (through the Carousel).
- *NMEA Input* connects to an optional NMEA navigation device.
- *PAR Input* connects to an optional Surface PAR sensor.
- *Sea Cable* connects to the SBE 32 Carousel.
- *AC Input* is 120 VAC or 240 VAC 50/60 Hz (selectable)



# Section 3: Setting Up System

This section covers:

- Installing Sea-Bird software
- Setting the baud rate in the CTD
- Setting the SBE 33 dip switches
- Setting up the CTD configuration (.con) file
- Mounting the SBE 33
- Wiring the system

---

## Installing Software

Recommended minimum system requirements for running SEASOFT-Win32: Pentium 90 CPU, 64 Mbyte RAM, Windows 98 or later.

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

1. With the CD in your CD drive, double click on **Seasoft-Win32.exe**.
2. Follow the dialog box directions to install the software.

**Notes:**

- Help files provide detailed information on SEATERM, SEASAVE, and SBE Data Processing.
- NMEATest, a NMEA navigation device simulation program, is part of the SBE Data Processing installation.
- Separate software manuals on CD-ROM contain detailed information on the setup and use of the software.
- Sea-Bird also supplies a DOS software package, **SEASOFT-DOS**. However, all procedures for software use in this manual refer to the Windows programs.

Install all the components, or just install SEATERM (terminal program), SEASAVE (real-time data acquisition), and SBE Data Processing (data processing). The default location for the software is c:/Program Files/Sea-Bird. Within that folder is a sub-directory for each program.

## Setting CTD Baud Rate and Operating Parameters

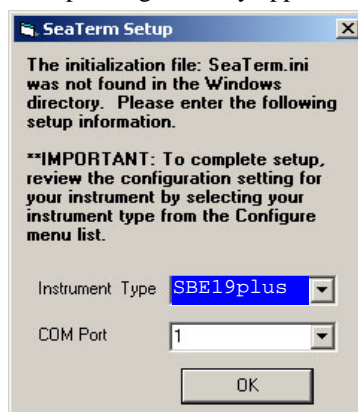
Carousel communication with the CTD is at 600, 1200, 2400, or 4800 baud. **For the most efficient operation, set the CTD baud rate to 4800 baud.**

CTD	CTD Baud Rates Compatible with Carousel / SBE 33	CTD Firmware Version
SBE 19	600 or 1200	3.0d and later, programmable
	600, 1200, or 4800	3.1d and later (but not 4.0 series), programmable
	600, 1200, 2400, or 4800	Prior to 3.0d, contact Sea-Bird for instructions on changing baud rate if necessary
SBE 19plus	1200, 2400, or 4800	All versions, programmable
SBE 25	600, 1200, or 4800	3.0K and later, programmable
	600, 1200, 2400, or 4800	Prior to 3.0K, contact Sea-Bird for instructions on changing baud rate if necessary

**The baud rate for Carousel communication with the CTD must be set in both the CTD and on the SBE 33 Receiver PCB.** See *Setting SBE 33 Receiver PCB Dip Switch* below for dip switch settings for baud rate.

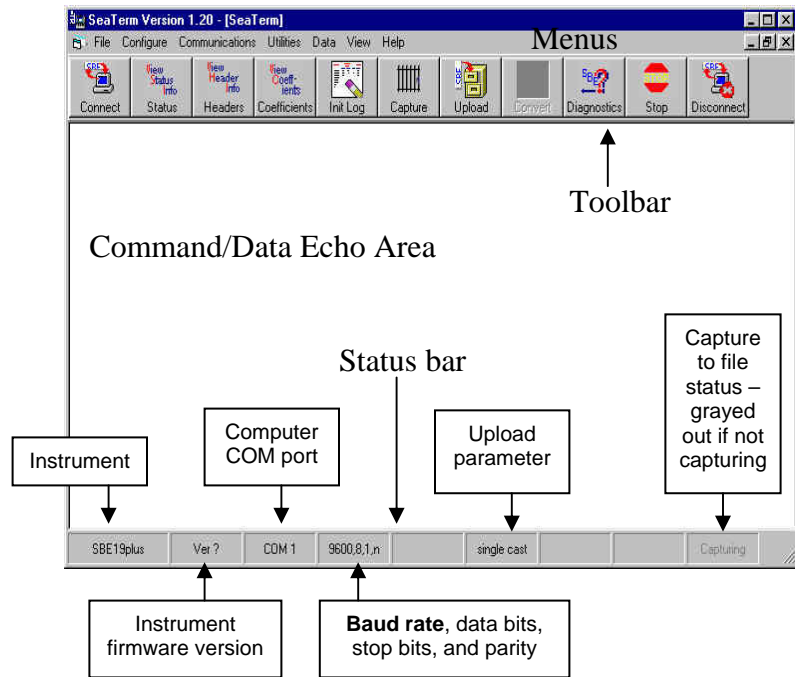
To set (if programmable) and/or verify the CTD baud rate, and establish CTD operating parameters:

1. Connect the CTD **directly** to the computer, using the data I/O cable supplied with the CTD.
2. Double click on Seaterm.exe. If this is the first time the program is used, the setup dialog box may appear:



Select the CTD and the computer COM port for communication with the CTD. Click OK.

3. The main screen looks like this (example shown is for SBE 19plus):



4. In the Configure menu, select the appropriate CTD.
5. In the dialog box, click the COM settings tab. Select the firmware version, COM port, baud rate, data bits, and parity (see the CTD's configuration sheet). Click OK to save the settings and exit the dialog box.
6. In the Communications menu, select *Options / Cycle baud when connecting*.
7. Click Connect on the Toolbar. SEATERM tries to connect to the CTD at the baud set in Step 5. If it cannot, it cycles through all other possible baud rates to try to connect. An S> prompt shows that communication has been established.
8. Look at the connection baud rate in the Status bar. If this is not a baud that can be used with the Carousel (600, 1200, 2400, or 4800), change the baud in the CTD. The command to change the baud is given below for CTDs with programmable baud (contact Sea-Bird for instructions on older CTDs):
  - SBE 19 - Send **SBn**, where n =1 (600 baud), 2 (1200 baud), or 6 (4800 baud - for firmware version 3.1d and above in the 3.0 series; not applicable to the 4.0 series).
  - SBE 19plus - Send **BAUD=x**, where x =1200, 2400, or 4800.
  - SBE 25 - Send **SRx**, where x=1 (600 baud), 2 (1200 baud), or 4 (4800).
9. Click Connect on the Toolbar again, and verify that the Status bar shows the new baud rate. Record the baud rate - you must also set the CTD baud rate on the SBE 33 Receiver PCB (see *Setting SBE 33 Receiver PCB Dip Switch*).
10. Establish other setup and logging parameters for the CTD (see the CTD manual).
11. Send **QS** to put the CTD in quiescent (sleep) state.

**Notes:**

- A dip switch in the SBE 33 is factory-set to command the Carousel to communicate with the CTD at 4800 baud. The setting in the SBE 33 must match the baud rate programmed in the CTD. **For the most efficient operation, keep the baud at 4800 baud if it is feasible for the CTD.** See *Setting SBE 33 Receiver PCB Dip Switch*.
- Once all baud rates are set, you can also communicate with and change the setup of the CTD **through** the SBE 33 and Carousel using SEATERM. See *Testing NMEA and System Setup* in *Section 4: Setting Up Optional NMEA Interface and Surface PAR*.

**Note:**

The SBE 19plus must be set to **OUTPUTFORMAT=0** (raw hex data) for use with the SBE 33 and Carousel.

## Setting Dip Switches - General Information

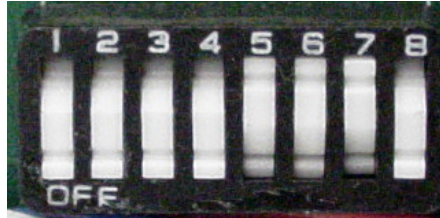
### WARNING!

Life-threatening high voltages are present in the SBE 33 and the underwater units when power is on. These hazardous voltages persist for up to 1 minute after removal of power. To protect against electrical shock, disconnect the AC power cord from the SBE 33 and then wait a full minute before attempting service. Always disconnect the AC power cord before checking fuses.

A switch is ON when pushed in at the position number.

For example, in the photo below:

- positions 1, 2, 3, 4, and 8 are ON
- positions 5, 6, and 7 are OFF.



## Setting SBE 33 Receiver PCB Dip Switch

### Note:

If the optional NMEA Interface PCB is installed in the SBE 33:

- Baud rate between the SBE 33 and computer is set by a dip switch on the NMEA Interface PCB instead of on the Receiver PCB.
- Baud rate between the SBE 33 Receiver PCB and optional NMEA Interface PCB is factory set to 9600 baud and cannot be changed.

See *Section 4: Setting Up Optional NMEA Interface and Surface PAR.*

A 4-position dip switch on the Receiver PCB (accessed by removing the SBE 33 **top** cover) sets the baud rate between:

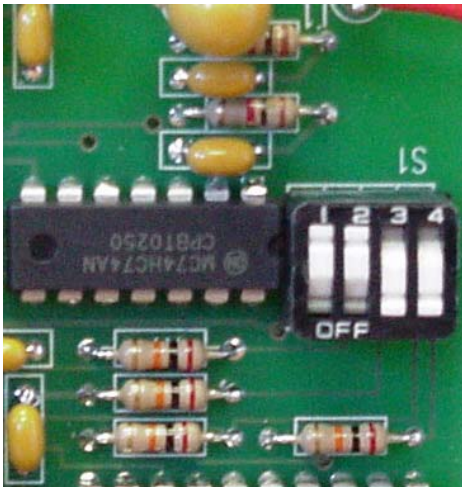
- **SBE 33 and computer** (if optional NMEA Interface PCB is **not** installed)

Baud Rate	Dip Switch Setting - Position 4
9600	ON (factory default)
4800	OFF

- **CTD and SBE 32 Carousel**

The Serial Data baud rate between the Carousel and CTD is factory-set in the SBE 33 to 4800 baud. Upon power-up, the SBE 33 reads this switch setting and automatically sends a command (listed in the Carousel manual) to the Carousel pylon to set its baud rate. **For the most efficient operation, keep the baud rate at 4800 baud if it is feasible for the CTD.**

Baud Rate	Dip Switch Setting	
	Position 1	Position 2
600	ON	ON
1200	OFF	ON
2400	ON	OFF
4800 (factory default)	OFF	OFF



Dip Switch on **Receiver PCB** – set for factory default 9600 baud between SBE 33 & computer (position 4 ON) and factory default 4800 baud between CTD & Carousel (position 1 & 2 OFF)

**The baud rate for Carousel communication with the CTD must be set in both the CTD and on the SBE 33 Receiver PCB. See *Setting CTD Baud Rate and Operating Parameters* above for CTD setup.**

## Checking CTD Configuration (.con) File in SEASAVE

### Note:

When Sea-Bird ships a new CTD, we include a .con file that reflects the current CTD configuration as we know it. The .con file is named with the CTD serial number, followed with the .con extension. For example, for a CTD with serial number 2375, Sea-Bird names the .con file 2375.con. You may rename the .con file if desired; this will not affect the results.

SEASAVE, Sea-Bird's real-time data acquisition and display program, requires a .con file, which defines the CTD - auxiliary sensors integrated with the instrument, and channels, serial numbers, and calibration dates and coefficients for all the integrated sensors (conductivity, temperature, and pressure as well as auxiliary sensors). SEASAVE (as well as 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 the data correctly.**

To verify the contents of the .con file:

1. Double click on Seasave.exe.
2. In SEASAVE's Configure menu, select *New Style Instrument Configuration/Select Instrument Configuration*. In the dialog box, select the appropriate .con file and click Open.
3. In the Configure menu, select *Modify Selected Instrument Configuration*. The configuration dialog box appears (example shown is for SBE 19plus). Verify that the sensors match those on your instrument, and that auxiliary sensors are assigned to the correct channels. Verify that the calibration coefficients for all the sensors are up-to-date.

Channel/Sensor table reflects this choice.

- Surface PAR - Select if SBE 33 includes optional Surface PAR channel, and Surface PAR sensor is being used. Adds 2 channels to Channel/Sensor table. Do not increase *External Voltage Channels* to reflect this; *External Voltage Channels* reflects only external voltages going directly to CTD from auxiliary sensors.
- NMEA - Select if SBE 33 includes optional NMEA interface, and NMEA navigation device is being used.

See Section 4: Setting Up Optional NMEA Interface and Surface PAR.

Shaded sensors cannot be removed or changed to another type of sensor. All others are optional.

Click a (non-shaded) sensor and click **Select** to pick a different sensor for that channel. A dialog box with a list of sensors appears. Select sensors after number of voltage channels have been specified above.

Click a sensor and click **Modify** to view/change calibration coefficients for that sensor.

Channel	Sensor
1. Count	Temperature
2. Frequency	Conductivity
3. Count	Pressure, Strain Gauge
4. A/D voltage 0	Free
5. A/D voltage 1	Free
6. A/D voltage 2	Free
7. A/D voltage 3	Free
8. SPAR voltage	Unavailable
9. SPAR voltage	SPAR/Surface Irradiance

4. Click *Save* or *Save As* to save any changes to the .con file.

## Mounting SBE 33

Detachable rack mount *ears* are provided for mounting the Deck Unit to standard 19-inch electronics bays.

## Wiring System

### WARNING!

Life threatening voltage (+250 VDC) is present on the sea cable when the SBE 33 is powered. This voltage persists for up to 1 minute after removing power. Verify that the SBE 33 is disconnected from the AC power source before connecting the sea cable to the SBE 33. Unplug the AC power cord and wait 1 minute after power is removed before working on the SBE 33 sea cable connector or sea cable circuits.

### Sea Cable from SBE 33 to Carousel

Mold the bottom end of the sea cable to the 2-pin pigtail (RMG-2FS for standard connector) supplied with the Carousel. Connect positive power (+, cable inner conductor) to the small pin (black on the pigtail) and negative power (-, cable armor) to the large pin (white on the pigtail). If you inadvertently connect the power with the wrong polarity, no damage will be done, because there is a protective diode in series with the + power line. However, the system will not work until the condition is corrected. **For safety reasons and for the most reliable performance, Sea-Bird strongly recommends use of the cable armor for the Carousel/CTD data and power return.**

Make a secure mechanical connection between the cable armor and the Carousel lifting bail. Connect the sea cable to the Carousel pylon, using care to dress the cable termination so that it will not be pinched by the shackle or clevis. Install a cotter pin or seize the shackle securely.

Terminate the sea cable leads from the winch slip rings with the supplied 2-pin connector (MS3106A12S-3P). Connect positive power (+, cable inner conductor) to pin B and negative power (-, cable armor) to Pin A. Connect to *Sea Cable* on the SBE 33 rear panel.

### SBE 33 to Computer

SBE 33 communication with the computer is provided in two RS-232 channels. The *Carousel Data* channel sends commands to and receives replies from the SBE 32 Carousel. The *Serial Data* channel sends commands to and receives replies from the CTD (through the Carousel). Connect the computer to *Carousel Data* and *Serial Data* on the SBE 33 rear panel using the supplied cables.

### Optional NMEA Navigation Device to SBE 33

Connect the NMEA navigation device to *NMEA Input* on the SBE 33 rear panel with the supplied 2-pin connector (MS3106A12S-3S). The connector pin designations are:

SBE 33	Function
Pin A	NMEA A (signal)
Pin B	NMEA B (signal return)



## Optional Surface PAR Sensor to SBE 33

Connect the Surface PAR sensor to *PAR Input* on the SBE 33 rear panel. A 4-pin connector (MS3106A14S-2P) was supplied if a cable was not provided. The connector pin designations are:

Deck Unit	Function	Biospherical Surface PAR Sensor with Switchcraft Connector
Pin A	Signal (ground)	Pin 3
Pin B	Power (+12 volts)	Pin 4
Pin C	Power (ground) – SBE 33 with NMEA PCB Assembly 40785b/40786b or greater use pin C. All previous versions do not use pin C.	Pin 1
Pin D	Signal	Pin 2
-	-	Pin 5

*Note:* Biospherical sold the Surface PAR sensor with other connector types in the past. See the appropriate drawing for pinout details if your sensor does not have a Switchcraft connector.

## Carousel to CTD

Connect the CTD's data I/O connector to the Carousel's 4-pin connector using the cable supplied with the CTD / Carousel.

### Note:

The CTD optical isolation feature (SBE 25 - standard; SBE 19 - optional) must be disabled when the CTD is used with the Carousel:

1. Open the CTD main housing.
2. Solder a jumper wire across the neon bulb on the *above board*.

See the CTD manual for details on accessing the *above board* and for the board schematic.

This note is not applicable to the SBE 19*plus*.

## Power to SBE 33

Verify that the SBE 33 rear panel power selector switch is in the correct position for your mains power source. Connect power to the *AC Input* connector on the SBE 33 rear panel using the supplied cable.

### WARNING!

**Some oceanographic vessels isolate (un-ground) the AC power ground circuit. If the SBE 33 is being installed on a vessel with an isolated AC power ground, a secure separate ground connection must be made between the SBE 33 chassis and the ship's hull for SAFETY REASONS.**

### CAUTION:

Connecting an SBE 33 set for 120 volts to a 240 volt power supply will cause severe damage to the SBE 33.

# Section 4: Setting Up Optional NMEA Interface and Surface PAR

As an option, the SBE 33 may include a NMEA 0183 Interface that permits position data to be merged with the CTD data; the NMEA Interface is designed to decode messages output from navigation devices supporting NMEA 0183 protocol. If the NMEA Interface is included, an optional A/D converter for a Surface PAR light sensor may also be added to the SBE 33.

The decoded Latitude and Longitude and Surface PAR data can be appended to the CTD data stream in the SBE 33 and passed to the computer for storage and/or display with the CTD data. The Yellow *NMEA Transmit* LED on the SBE 33 front panel flashes each time a NMEA message is received (should be the same rate at which your navigation device is transmitting). The SBE 33 appends the same NMEA message multiple times, until a new message is decoded.

*Example:* A navigation device outputs its NMEA message once every 5 seconds. The Yellow *NMEA Transmit* LED flashes every 5 seconds, and the same message is appended to each scan of CTD data within that 5 seconds.

## Setting NMEA Interface PCB Dip Switch

### WARNING!

**Life-threatening high voltages are present in the SBE 33 and the underwater units when power is on. These hazardous voltages persist for up to 1 minute after removal of power. To protect against electrical shock, disconnect the AC power cord from the SBE 33 and then wait a full minute before attempting service. Always disconnect the AC power cord before checking fuses.**

An 8-position dip switch on the NMEA Interface PCB (accessed by removing the SBE 33 **bottom** cover) sets the NMEA Interface PCB-to-computer baud rate and the NMEA Interface operating parameters.

### Baud Rate - NMEA Interface PCB to Computer

Baud Rate	NMEA Interface PCB Dip Switch - Position 5
9600 (factory default)	ON
19200	OFF

### Data Bits and Parity – NMEA Interface PCB to Computer

Data bits and parity between the SBE 33 and computer **must match** the data bits and parity used by the CTD:

For use with	Data bits and parity between SBE 33 and Computer	NMEA Interface PCB Dip Switch - Position 6
<b>SBE 19 or 25</b>	7 data bits, even parity	ON
<b>SBE 19plus</b>	8 data bits, no parity (factory default)	OFF



Dip Switch on **NMEA Interface** PCB – set for:

- factory default RMC message (positions 1 & 2 OFF, position 3 ON)
- factory default do not time out (position 4 ON)
- factory default 9600 baud between NMEA Interface PCB & computer (position 5 ON)
- factory default 8 data bits and no parity between NMEA Interface PCB & computer (position 6 OFF)
- Add Lat/Lon data to CTD data string (position 7 OFF, position 8 ON)

## NMEA Message to Decode

Message to Decode	NMEA Interface PCB Dip Switch		
	Position 1	Position 2	Position 3
GGA - Global Positioning System Fix Data	ON	ON	ON
GLL - Geographic Position: Latitude/Longitude	OFF	ON	ON
RMA - Recommended Minimum Specific Loran-C Data	ON	OFF	ON
RMC (factory default) - Recommended Minimum Specific GPS/TRANSIT Data	OFF	OFF	ON
TRF - TRANSIT Fix Data	ON	ON	OFF

If you are not sure which NMEA messages your navigation device is sending, see *Troubleshooting NMEA Interface* for information on viewing the raw NMEA message using the NMEA interface's diagnostic mode.

## NMEA Interface Menu Time Out Mode

Time Out Mode affects the behavior of the SBE 33 **while communicating with it from the NMEA Interface menu**. See *Testing NMEA and System Setup* for use of the NMEA Interface menu.

Menu Time Out Mode	NMEA Interface PCB Dip Switch - Position 4
Do not time out (factory default)	ON
If no reply is received within 30 seconds, time out and set mode to <i>Add Lat/Lon to Hex Data</i>	OFF

## Data to Add to Hex String from CTD

Data to Add to Hex String from CTD	NMEA Interface PCB Dip Switch	
	Position 7	Position 8
Do not add Lat/Lon or Surface PAR data	ON	ON
Add Lat/Lon data	OFF	ON
Add Surface PAR data	ON	OFF
Add Lat/Lon and Surface PAR data	OFF	OFF

**Note:**

You can override these settings with Sea-Bird software:

- In SEATERM, in the NMEA Interface menu, Lat/Lon and/or Surface PAR data transmission is determined by the mode.
- In SEASAVE, Lat/Lon and/or Surface PAR data transmission is determined by the setting in the CTD configuration (.con) file.

Surface PAR and position data are appended to the end of the CTD data, with the position data always last. Surface PAR data is 3 bytes (6 hex characters). Position data format is detailed in *Appendix I: NMEA Navigation Device Message and Data Formats*.

## Optional Surface PAR Light Sensor

When configured with the optional A/D converter, the SBE 33 can acquire the 0 to 5 volt output of a Biospherical (QSR-240, QCR-240, QSR-2200, or QCR-2200) Surface PAR sensor, append it to the CTD data stream, and pass it to the computer for storage and/or display with the CTD data. SEASOFT-Win32, and Versions 4.214 and later of SEASOFT-DOS, fully support acquisition and display of data from a Biospherical Surface PAR sensor.

As described above, set position 8 on the NMEA Interface PCB's dip switch to OFF to add Surface PAR voltage to the data stream, increasing the number of Hex data bytes by three (Surface PAR data is 6 hex characters).

## NMEA Operating Modes

The NMEA Interface has three normal operating modes and two diagnostic modes. The mode is set in the NMEA Interface menu while communicating with the SBE 33 with SEATERM (see *Testing NMEA and System Setup* below). The modes are:

### Notes:

- In SEATERM, use the @ character to access and exit the NMEA Interface menu.
- To enter diagnostic modes (4 or 5), first put the NMEA Interface in Mode 3. Then, enter a 4 or 5 at the mode selection prompt.
- To exit diagnostic modes (4 or 5), turn off power to the SBE 33.
- In the NMEA Interface menu, Diagnostic level 1 = Mode 4  
Diagnostic level 2 = Mode 5

Type	Mode	Description
Operating	1: Echo only (default power-up mode)	Characters to and from CTD pass through NMEA Interface. No position or Surface PAR data is sent. Useful for setting up CTD without needing to disconnect CTD from system and connect it directly to computer.
	2: Add Lat/Lon and/or Surface PAR to hex data	7 bytes of hex latitude/longitude data are added to each line of hex data from CTD. Used when position data is required with CTD data. If optional Surface PAR interface installed, 3 bytes of Surface PAR hex data also added.
	3: Transmit Lat/Lon only	Data from CTD is not transmitted. Hex latitude/longitude data is converted to ASCII text whenever a new position is received from NMEA navigation device. Format is: <i>LAT 47 37.51 N</i> <i>LON 122 09.41 W</i>  If NMEA message RMC is decoded, date and time display on next line with this format: <i>DDMMYY HHMMSS</i>
Diagnostic	4 (diagnostic level 1): Transmit raw NMEA message only	All NMEA messages received are echoed to computer in raw form. Used to determine which NMEA messages are being received by NMEA Interface.
	5 (diagnostic level 2): Transmit raw and decoded NMEA message	All NMEA messages received are echoed to computer in raw form. If a correct NMEA message is received, decoded data displays below raw data. Decoded format same as for Mode 3.

## Testing NMEA and System Setup

**Note:**

The SBE 33 must be connected to the Carousel to test the NMEA interface. If it is not connected, noise on the open *Sea Cable* connector will interfere with communication with the SBE 33.

After connecting the NMEA navigation device, SBE 33, computer, Carousel, and CTD, run SEATERM.

1. Double click on seaterm.exe.
2. In the Configure menu, select the SBE 33.
  - A. In the Configuration Options dialog box, click on the COM Settings tab.
  - B. Set the COM Settings to the same values as the Serial Data Channel in the SBE 33:
    - Comm Port – for connection to SBE 33 *Serial Data* channel
    - 9600 (default) or 19200 baud - match the value set on position 5 on the SBE 33 NMEA Interface PCB dip switch
    - 7 or 8 data bits, and no or even parity – match the value set on position 6 on the SBE 33 NMEA Interface PCB dip switch
 Click *OK* to save the settings and exit the dialog box.
3. Turn on power to the SBE 33. The display in SEATERM looks like this:

```
SBE 33/36 NMEA interface V2.3 setup:
PC baud rate = 9600
interboard baud rate = 9600
8 data bits, no parity
NMEA message to decode = RMC
Mode = echo only
```

```
Surface PAR disabled
NMEA decoding enabled
Press @ to change the NMEA interface setup
SBE 33 V2.0 power on
```

Looking at selected lines:

Text	Description
PC baud rate	Baud for communication between computer and NMEA Interface PCB - set on NMEA Interface PCB switch position 5 to 9600 or 19200
Interboard baud rate	Baud for communication between NMEA Interface and Receiver PCBs - factory set to 9600
8 data bits, no parity	Data bits and parity for communication between computer and NMEA Interface PCB – set on NMEA Interface PCB switch position 6 to 8 data bits and no parity or 7 data bits and even parity (must match data bits and parity of CTD)
NMEA message to decode	Set on NMEA Interface PCB switch positions 1 to 3 - must match output from NMEA navigation device
Mode = echo only	Default power-up mode, used to set up CTD
Surface PAR disabled	Surface PAR and NMEA are enabled/disabled with NMEA Interface PCB switch positions 7 and 8
NMEA decoding enabled	

4. Type @ to access the NMEA Interface menu. The display looks like this:

NMEA interface set up menu:

1. Echo characters to and from the instrument
2. Add Lat/Lon and/or PAR to the real-time HEX data from the instrument
3. Transmit Lat/Lon only

the current mode = 1. Echo characters to and from the instrument

enter 1, 2, or 3 to change the NMEA interface box mode, or press @ to exit the set up menu

selection =

5. Type 3 and press the Enter key to switch to mode 3. The display looks like this:

NMEA interface set up menu:

1. Echo characters to and from the instrument
2. Add Lat/Lon and/or PAR to the real-time HEX data from the instrument
3. Transmit Lat/Lon only

the current mode = 3. Transmit Lat/Lon only

enter 1, 2, or 3 to change the NMEA interface box mode, or press @ to exit the set up menu

selection =

6. Type @ to exit the menu. You should begin seeing position data display in SEATERM. Each time position data is received, the yellow *NMEA Transmit* LED on the SBE 33 should flash. If the data is correct and is updating properly, the NMEA interface is working.
- If position data does not appear, verify that the SBE 33 is connected to the NMEA navigation device and that the proper cable is used.
  - See *Troubleshooting NMEA Interface* for additional instructions.
7. When finished testing the NMEA navigation device, verify that the system is connected properly to the CTD:
- A. Type @ to return to the NMEA Interface menu.
  - B. Type 1 and press the Enter key to switch to mode 1 (echo characters to and from the instrument).
  - C. Type @ to exit the NMEA Interface menu.
  - D. Press the Enter key several times to establish communication with the CTD (through the SBE 33 and Carousel).
  - E. Type **DS** and press Enter to display the CTD status. If the status information displays and is correct, the system is connected properly.
  - F. Send **QS** to put the CTD in quiescent (sleep) state.
8. Turn off the SBE 33.

## Troubleshooting NMEA Interface

### Problem 1: Yellow *NMEA Transmit* LED Not Flashing

**Cause/Solution 1:** Wiring may be incorrect. Check cables and connections between the SBE 33, NMEA navigation device, and computer.

**Cause/Solution 2:** NMEA navigation device may be set to the wrong baud rate (SBE 33 requires 4800 baud). Reset device's baud rate.

**Cause/Solution 3:** NMEA navigation device may not be transmitting data. See the device manual for setup details. To verify that it is sending data, connect an oscilloscope with ground on NMEA B (T17) and the probe on NMEA A (T16). The signal should be less than 0.5 volts between messages and have pulses greater than 4 volts for at least 0.2 milliseconds during the message.

**Cause/Solution 4:** NMEA Interface PCB may not be operating properly. To verify, use the NMEA simulation program supplied with SEASOFT. This program simulates a NMEA navigation device transmitting a NMEA message (see *Appendix II: NMEA Message Simulation Program*).

### Problem 2: Yellow *NMEA Transmit* LED Flashing, but Lat/Lon Data Not Displaying

**Cause/Solution 1:** NMEA Interface PCB may be set up for an incorrect NMEA message. To verify, view the raw NMEA messages:

1. In the NMEA Interface menu in SEATERM (see *Testing NMEA and System Setup* above), type 3 and press the Enter key to switch to mode 3.
2. When in mode 3, type 4 and press the Enter key to switch to mode 4 (diagnostic mode not listed on the menu). Mode 4 will pass all characters received to the screen. The menu response indicates that the SBE 33 has *diagnostic level 1 enabled*.
3. Type @ to exit the menu. You should begin seeing **raw** NMEA messages display in SEATERM. A typical RMC NMEA message is:

```
$LGRMC,123113.21,A,3625.12,N,12121.34,W,1.2,4.5,231294,1.2,a*45
<CR><LF>
```

See *Appendix I: NMEA Navigation Device Message and Data Formats* for a description of all the NMEA messages the NMEA Interface can decode.

4. **If a different NMEA message is received in mode 4 than the NMEA Interface PCB is set up to decode**, reconfigure the interface:
  - A. Turn off power to the SBE 33 and remove the power cord.
  - B. Reset positions 1 through 3 on the NMEA Interface PCB dip switch as needed (see *Setting NMEA Interface PCB Dip Switch* above).
  - C. Restore power and repeat Step 1, putting the SBE 33 in mode 3.
  - D. Type @ to exit the menu. You should begin to see position data.
5. **If no NMEA messages are received in mode 4**, the problem could be in the NMEA Interface PCB, cable, or NMEA navigation device. Verify that the NMEA Interface PCB is operating properly using the simulation program supplied with SEASOFT. This program simulates a NMEA navigation device transmitting a NMEA message. See *Appendix II: NMEA Message Simulation Program*.

#### Notes:

To exit diagnostic mode, turn off power to the SBE 33.

#### WARNING!

Life-threatening high voltages are present in the SBE 33 and the underwater units when power is on. These hazardous voltages persist for up to 1 minute after removal of power. To protect against electrical shock, disconnect the AC power cord from the SBE 33 and then wait a full minute before attempting service. Always disconnect the AC power cord before checking fuses.

## Setting Up CTD Configuration (.con) File

**Notes:**

When Sea-Bird ships a new CTD, we include a .con file that reflects the current instrument configuration as we know it. The .con file is named with the CTD serial number, followed with the .con extension. For example, for a CTD with serial number 2375, Sea-Bird names the .con file *2375.con*. You may rename the .con file if desired; this will not affect the results.

The NMEA Interface PCB integrates the position data from the NMEA navigation device and/or the Surface PAR sensor into the CTD data stream. SEASAVE, Sea-Bird's real-time data acquisition and display program, stores and optionally displays the NMEA and/or PAR data along with the CTD data. SEASAVE requires a .con file, which defines the CTD - auxiliary sensors integrated with the instrument, and channels, serial numbers, and calibration dates and coefficients for all the integrated sensors (conductivity, temperature, and pressure as well as auxiliary sensors). SEASAVE (as well as 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 the data correctly.

**The .con file must indicate if position data and/or PAR data is being added to the CTD data by the NMEA Interface.** See *Checking CTD Configuration (.con) File in SEASAVE* in *Section 3: Setting Up System* for details on viewing and modifying the .con file in SEASAVE. Note that the .con file setup overrides the dip switch setting on the NMEA Interface PCB. In other words, the real-time transmission of NMEA position data and/or Surface PAR data is dependent on the .con file setting, not on the SBE 33 dip switch setting.



# Section 5: Operating System

This section covers:

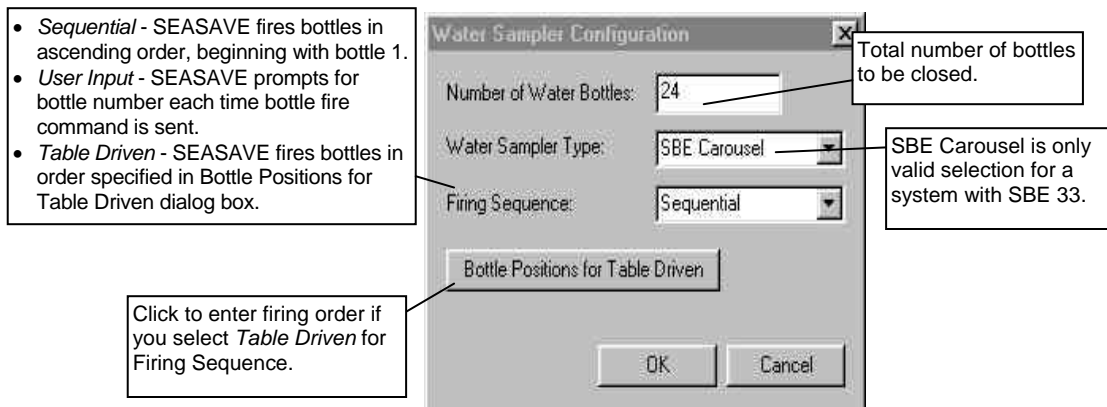
- Acquiring real-time data and firing bottles from SEASAVE
- Firing bottles from the SBE 33 front panel
- Uploading CTD data from memory
- Processing data using SBE Data Processing
- Editing raw data file

See *Wiring System* in *Section 3: Setting Up System* for wiring details.

## Acquiring Real-Time Data and Firing Bottles from SEASAVE

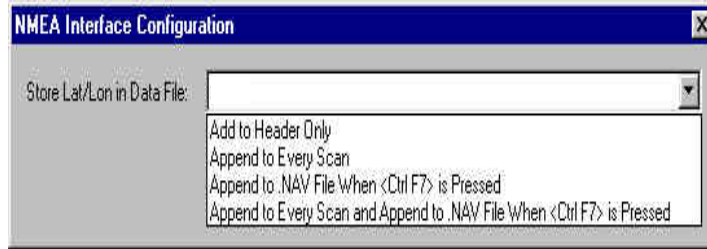
Run SEASAVE to acquire real-time data and fire bottles. Proceed as follows:

1. Double click on *Seasave.exe*.
2. In the Configure menu, select *Water Sampler Configuration*. The dialog box looks like this:



Make the desired selections and click OK.

3. (For SBE 33 connected to NMEA navigation device) In the Configure menu, select *NMEA [Lat/Lon] Interface*. The dialog box looks like this:



Select how to store the NMEA data:

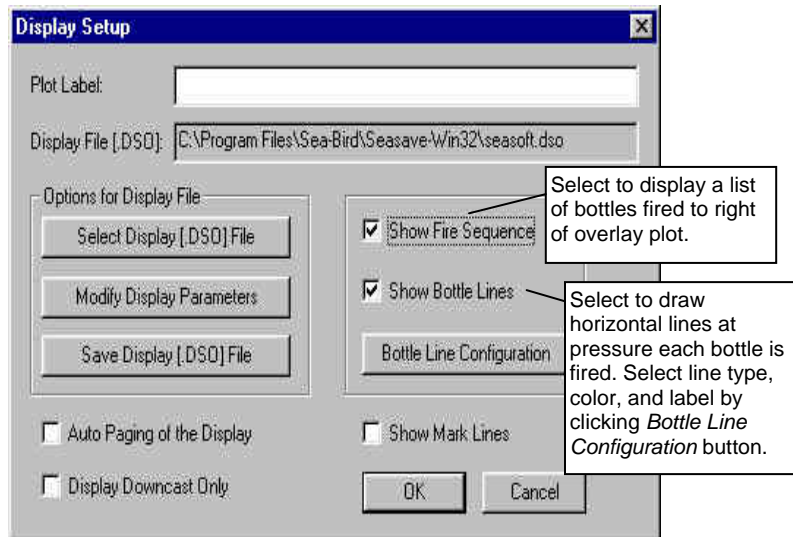
- *Add to Header Only* - Latitude, longitude, and time are written to the header when data acquisition is started.
- *Append to Every Scan* - Latitude, longitude, and time are written to the header when data acquisition is started. Additionally, 7 bytes of Lat/Lon data are appended to every scan of CTD data.
- *Append to .NAV File when <Ctrl F7> is Pressed* - Latitude, longitude, and time are written to the header when data acquisition is started. Additionally, latitude, longitude, time, scan number, and pressure are written to a .nav file every time Ctrl F7 is pressed or Add to .NAV File is clicked (View menu, NMEA Data Display dialog box).
- *Append to Every Scan and Append to .NAV File when <Ctrl F7> is Pressed* - Latitude, longitude, and time are written to the header when data acquisition is started. Additionally, 7 bytes of Lat/Lon data are appended to every scan of CTD data. And, latitude, longitude, time, scan number, and pressure are written to a .nav file every time Ctrl F7 is pressed or Add to .NAV File is clicked (View menu, NMEA Data Display dialog box).

Click OK.

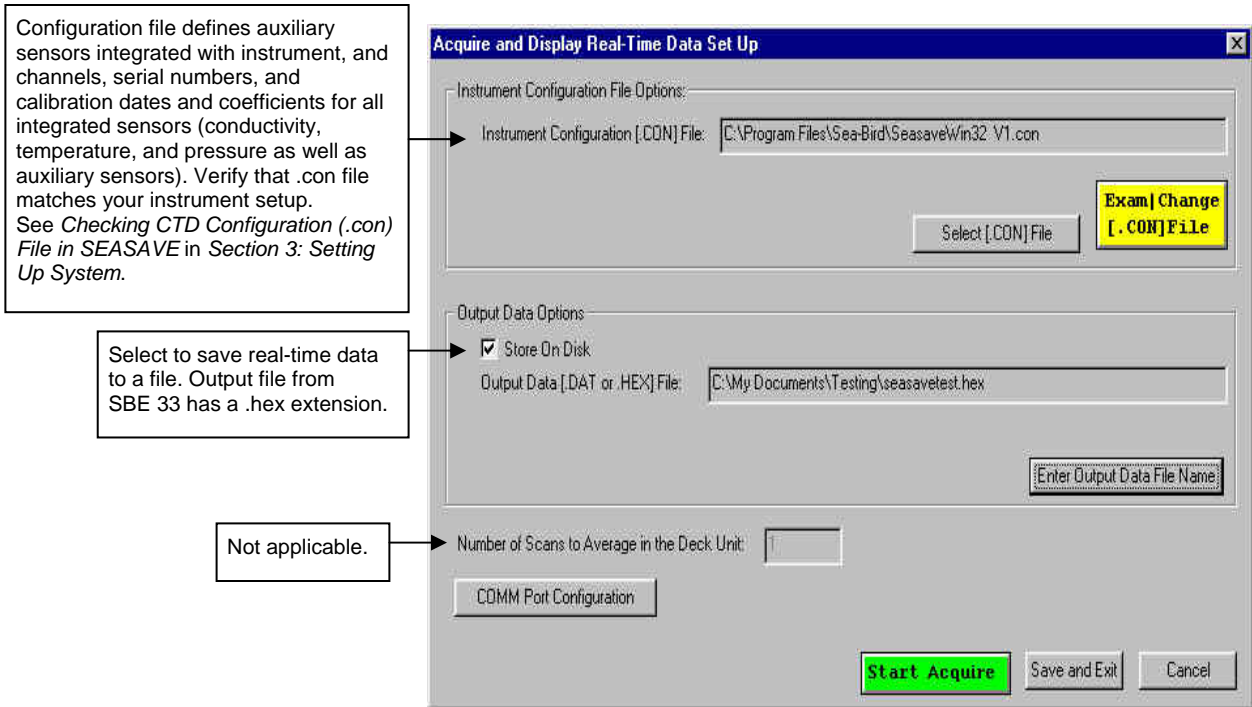
**Notes:**

- The .nav file has the same file name and is placed in the same directory as the raw data (.hex) file. For example, if the data file is test.hex, the .nav file is test.nav.
- When running the post-processing software (Data Conversion module in SBE Data Processing): if a .nav file is found in the same directory as the .hex raw data file, the contents of the .nav file are added to the output converted data file (.cnv) header.

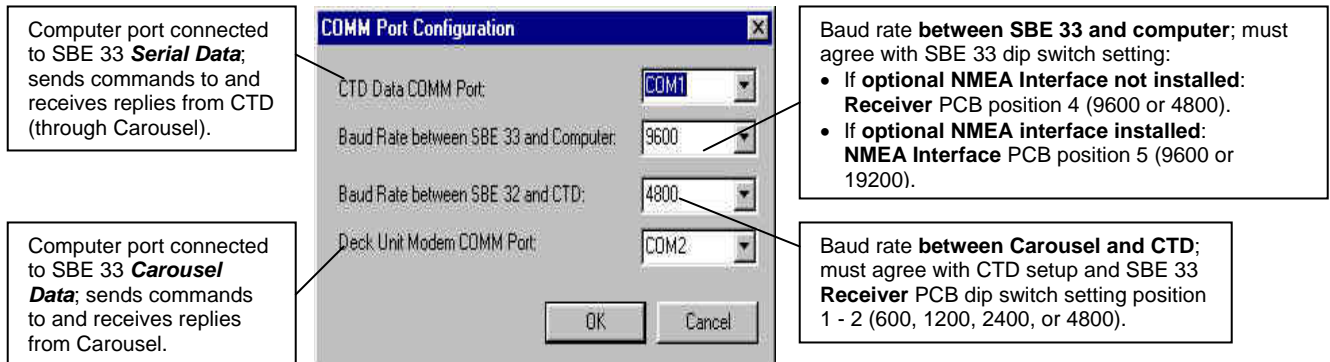
4. Perform any other desired setup in the Configure menu.
5. Perform any desired setup in the ScreenDisplay menu.  
For example, to set up the display of bottle firing parameters in an overlay plot, click in the overlay plot window and select *Edit Selected Display Window* in the ScreenDisplay menu. The Display Setup Form appears.



6. In the RealTime Data menu, select *Start Acquisition*. The dialog box looks like this:



7. Click *COMM Port Configuration*. The dialog box looks like this:



Make the desired selections and click OK.

8. In the Acquire and Display Real Time Data Set Up dialog box, click *Start Acquire*. SEASAVE sends a Reset command to the Carousel (equivalent to pushing the Reset button on the SBE 33), and waits for a confirmation. If a confirmation is not received, verify that:
- there is a connection between the computer serial port and the SBE 33
  - the Deck Unit Modem COMM Port selected in Step 7 is correct

9. If SEASAVE was set up to prompt for header information (Configure menu / Header Form), the Header Information dialog box appears. Fill in the desired information to be added to the header portion of the real-time data acquisition .hex file, and click OK.

**Note:**

The SBE 19 (not *19plus*) and 25 CTD must be in quiescent (sleep) state when the magnetic switch is turned on to start logging. If not, when the switch is turned on the CTD will **not** log data. A common problem is that communications are established with the CTD using SEATERM, and then SEATERM is exited without putting the CTD into quiescent state with **QS**.

When 2 minutes pass without any communication between the computer and CTD, the CTD times out and enters quiescent state automatically. To ensure that SEASAVE works correctly, verify that the CTD is in quiescent state or is already logging data when SEASAVE is started.

10. (For SBE 33 with optional NMEA Interface)  
SEASAVE automatically sends a command to put the NMEA Interface in Mode 1 (do not transmit NMEA data) or Mode 2 (append position and/or Surface PAR data to CTD data), depending on whether the CTD .con file was set to add NMEA and/or PAR data. If the .con file was set to add NMEA data, the screen then displays:

Getting Latitude, Longitude and Time from the NMEA Interface

11. If the CTD is not already sampling data, SEASAVE prompts you to turn on the CTD's magnetic switch. Data starts appearing in the screen displays approximately 10 seconds after the switch is turned on.

It also possible to start the CTD sampling data while in the terminal program and then to run SEASAVE. In this case the *turn CTD on message* flashes momentarily on the screen before the data display screen appears.

For the SBE *19plus* or 25, data starts appearing in a few seconds.

For the SBE 19, there may be a wait of up to 1 minute before data appears.

12. To fire a bottle from SEASAVE, do one of the following:
  - Press Ctrl F3, or
  - In the View menu, select *Fire Bottle Control*. The *Bottle Fire* dialog box appears on screen (you can leave this open throughout the cast). The dialog box shows what bottle will be fired next (for sequential or table driven bottle firing). Click *Fire Bottle* when desired.

If user input bottle firing was selected in Step 2, SEASAVE prompts for the bottle number.

When SEASAVE receives a bottle fired confirmation from the Carousel, it writes a line to an output file (same filename as the data file) with a .bl extension. The .bl file contains the bottle firing sequence number, bottle position, date, time, and beginning and ending scan number (to provide 1.5 seconds of scans) for the fired bottle.

13. When done acquiring data, select *Stop Acquisition* in the RealTime Data menu. Close SEASAVE.
14. Stop the CTD logging, using the method applicable to your CTD:
  - Turn off the CTD's magnetic switch, **or**
  - Open SEATERM, establish communications with the CTD, and send the appropriate command to stop logging. Then send the command to put the CTD in quiescent (sleep) state.

## Firing Bottles from SBE 33 Front Panel

Instead of firing bottles in SEASAVE, you can fire bottles directly from the SBE 33 if desired. Bottles fired from the SBE 33 can be in random or sequential order, regardless of the firing sequence you input in SEASAVE.

**Note:**

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

Even though you are firing the bottles from the SBE 33, SEASAVE still receives a bottle fired confirmation from the Carousel if the SBE 33 rear panel *Carousel Data* and *Serial Data* are connected to the computer. When SEASAVE receives the confirmation, it writes a line to an output file (same filename as the data file) with a .bl extension. The .bl file contains the bottle firing sequence number, bottle position, date, time, and beginning and ending scan number (to provide 1.5 seconds of scans) for the fired bottle.

See *Acquiring Real-Time Data and Firing Bottles from SEASAVE* above for setting up SEASAVE and starting and stopping real-time data acquisition. Proceed as follows for firing bottles from the SBE 33:

**Note:**

**Sea-Bird strongly recommends that you do not *mix* firing bottles from both SEASAVE and the SBE 33 in the same cast.** That is, use only one method to fire bottles to ensure that each bottle is fired only once and in the desired order.

1. Reset the system before beginning to fire bottles:
  - A. Set the *Bottle to Fire* pushbutton switch to 00.
  - B. Press the *Reset* button.
2. **To fire bottles in random order:**
  - A. Set the *Bottle to Fire* pushbutton switch to the desired bottle.
  - B. Press the *Fire* button.
  - C. Repeat Steps A and B for each bottle.
3. **To fire bottles in sequential order:**
  - A. Set the *Bottle to Fire* pushbutton switch to **99**.
  - B. Press the *Fire* button. The Carousel will fire bottle 1.
  - C. Repeat Step B to fire each bottle; the Carousel will fire bottles in sequential order.

## Uploading CTD Data from Memory

Typically, data processing is performed on the real-time data acquired in SEASAVE. However, some users choose to upload the data in the CTD's memory as a back-up to the real-time data. This allows for comparison of the data in memory to the real-time data, to ensure that cable problems, noise, etc. did not corrupt the real-time data.

Upload data from the CTD's memory as follows:

1. When the cast is complete, turn the CTD magnetic switch off.
2. Turn power to the SBE 33 off.
3. Disconnect the CTD from the Carousel.
4. **Connect the CTD directly to the computer**, using the data I/O cable provided with the CTD. Follow directions in the CTD manual for uploading data.

---

## Processing Data Using SBE Data Processing

**Note:**

See the SBE Data Processing manual and/or Help files.

1. Use SBE Data Processing's Data Conversion module to convert the **real-time** .hex raw data file and the .bl bottle log file created by SEASAVE to:
  - A .cnv file, with all data converted to engineering units
  - A .ros water bottle file, containing data for a user-selected range of scans before and after each bottle firing
2. If desired, convert the .hex (raw data) file **uploaded** from the CTD memory to a .cnv file in SBE Data Processing's Data Conversion module, for comparison to the real-time data.
3. Once the data is converted: perform further processing (align, filter, remove bad data, etc.), calculate derived variables, and plot data using SBE Data Processing's other modules.

## Editing Raw Data File

Sometimes users want to edit the raw .hex data file before beginning processing, to remove data at the beginning of the file corresponding to instrument *soak* time, to remove blocks of bad data, to edit the header, or to add explanatory notes about the cast. **Editing the raw .hex file can corrupt the data, making it impossible to perform further processing using Sea-Bird software.** Sea-Bird strongly recommends that you first convert the data to a .cnv file (using SBE Data Processing's Data Conversion module), and then use other SBE Data Processing modules to edit the .cnv file as desired.

### Note:

Although we provide this technique for editing a raw .hex file, **Sea-Bird's strong recommendation, as described above, is to always convert the raw data file and then edit the converted file.**

The procedure for editing a .hex data file described below has been found to work correctly on computers running Windows 98, 2000, and NT. **If the editing is not performed using this technique, SBE Data Processing may reject the edited data file and give you an error message.**

1. **Make a back-up copy of your .hex data file before you begin.**
2. Run **WordPad**.
3. In the File menu, select Open. The Open dialog box appears. For *Files of type*, select *All Documents (\*.\*)*. Browse to the desired .hex data file and click Open.
4. Edit the file as desired, **inserting any new header lines after the System Upload Time line**. Note that all header lines must begin with an asterisk (\*), and \*END\* indicates the end of the header. An example is shown below (for an SBE 21), with the added lines in bold:

```
* Sea-Bird SBE 21 Data File:
* FileName = C:\Odis\SAT2-ODIS\oct14-19\oc15_99.hex
* Software Version Seasave Win32 v1.10
* Temperature SN = 2366
* Conductivity SN = 2366
* System UpLoad Time = Oct 15 1999 10:57:19
* Testing adding header lines
* Must start with an asterisk
* Place anywhere between System Upload Time & END of header
* NMEA Latitude = 30 59.70 N
* NMEA Longitude = 081 37.93 W
* NMEA UTC (Time) = Oct 15 1999 10:57:19
* Store Lat/Lon Data = Append to Every Scan and Append to .NAV
File When <Ctrl F7> is Pressed
** Ship:          Sea-Bird
** Cruise:       Sea-Bird Header Test
** Station:
** Latitude:
** Longitude:
*END*
```

5. In the File menu, select Save (**not Save As**). If you are running Windows 2000, the following message displays:

You are about to save the document in a Text-Only format, which will remove all formatting. Are you sure you want to do this?

Ignore the message and click *Yes*.

6. In the File menu, select Exit.

# Section 6: Troubleshooting

**WARNING!**

Life-threatening high voltages are present in the SBE 33 and the underwater units when power is on. These hazardous voltages persist for up to 1 minute after removal of power. To protect against electrical shock, disconnect the AC power cord from the SBE 33 and then wait a full minute before attempting service. Always disconnect the AC power cord before checking fuses.

This section reviews common problems in operating the SBE 33, and provides the most likely causes and solutions.

Servicing should be performed by experienced technicians who have been trained to work with complex mechanical/electrical equipment.

For protection of the circuitry, we also recommend removing AC power and then waiting for 1 minute for supply capacitor discharge before opening housings, changing connections, removing or inserting circuit cards, or otherwise working on the equipment.

---

## Problem 1: SEASAVE Does Not Collect Any Data

**Cause/Solution 1:**

This may be caused by incorrect instrument configuration in the .con file. Verify that the settings in the .con file match the current CTD configuration - number and type of auxiliary sensors, sensors assigned to correct channels, NMEA and Surface PAR selected if applicable.

---

## Problem 2: SBE 33 Completely Inoperable

**WARNING!**

Use extreme caution when making these tests.

**Cause/Solution 1:**

If the power switch is on but the power switch pilot light is out, no other panel lights are on, and the fan is not running, either AC power has been disconnected or the main fuse has blown. Check the AC power source. Turn off the SBE 33, remove the power cable, wait 1 minute, and check the main fuse. Replace if necessary.

**If the main fuse blows again**, there is probably a short in the main chassis AC wiring. See the chassis wiring diagram - it may be necessary to disconnect one section after another to locate the problem.

---

## Problem 3: Carousel or CTD Does Not Respond

**WARNING!**

Use extreme caution when making these tests.

**Cause/Solution 1:**

There may be no voltage on the sea cable. Turn off the SBE 33, remove the power cable, and wait 1 minute. Connect a voltmeter (range set to at least 300 volts DC) to the rear-panel *Sea Cable* connector. Turn on the SBE 33. The voltmeter should read 250V.

**If no sea cable voltage is observed**, the sea cable supply is inoperative. Turn off the SBE 33, remove the power cable, and wait 1 minute. Check the rear-panel *Sea Cable Fuse*. If this fuse is blown, the sea cable may have been inadvertently shorted, or the Carousel or CTD may be malfunctioning. Check the resistance across the sea cable and correct if shorted.



# Glossary

**NMEA Test** – Sea-Bird’s Win 95/98/NT/2000/XP NMEA message simulation program, which simulates NMEA messages for testing purposes (installed with SBE Data Processing).

**PCB** – Printed Circuit Board.

**SBE Data Processing** – Sea-Bird’s Win 95/98/NT/2000/XP data processing software, which calculates and plots temperature, conductivity, pressure, data from auxiliary sensors, and derived variables such as salinity and sound velocity.

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

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

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

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

**SEATERM** – Sea-Bird’s Win 95/98/NT/2000/XP terminal program used to communicate with the SBE 33 and/or the CTD.

# Appendix I: NMEA Navigation Device Message and Data Formats

## Message Formats

### Notes:

- -- represents two device-specific characters.
- See the table below for definitions of message parameters.
- <CR> is carriage return.
- <LF> is line feed.

### GGA - Global Positioning System Fix Data

Time, position, and fix related data for a GPS receiver.

\$--GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,b,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx\*hh<CR><LF>

### GLL - Geographic Position - Latitude/Longitude

Latitude and Longitude of present position, time of position fix, and status.

\$--GLL,llll.ll,a,yyyyy.yy,b,hhmmss.ss,A\*hh<CR><LF>

### RMA - Recommended Minimum Specific Loran-C Data

Position, course, and speed data provided by a LORAN-C receiver.

\$--RMA,A,llll.ll,a,yyyyy.yy,b,x,x,x,x,x,x,x,x,x,x,a\*hh<CR><LF>

### RMC - Recommended Minimum Specific GPS/TRANSIT Data

Time, date, position, course, and speed data provided by a GPS or TRANSIT navigation receiver.

\$--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,b,x,x,x,x,ddmmyy,x,x,a\*hh<CR><LF>

### TRF - TRANSIT Fix Data

Time, date, position, and information related to a TRANSIT fix.

\$--TRF,hhmmss.ss,ddmmyy,llll.ll,a,yyyyy.yy,b,x,x,x,x,x,x,x,xxx,A\*hh<CR><LF>

Field Type	Symbol	Definition
Status	A	Single character field: A = Yes, data valid, warning flag clear V = No, data invalid, warning flag set
Latitude	llll.ll	Fixed/Variable length field: degrees minutes.decimal - 2 fixed digits of degrees, 2 fixed digits of minutes, variable number of digits for decimal-fraction of minutes. Leading zeros always included for degrees and minutes to maintain fixed length. Decimal point and associated decimal-fraction optional if full resolution not required.
	a	N or S
Longitude	yyyyy.yy	Fixed/Variable length field: degrees minutes.decimal - 3 fixed digits of degrees, 2 fixed digits of minutes, variable number of digits for decimal-fraction of minutes. Leading zeros always included for degrees and minutes to maintain fixed length. Decimal point and associated decimal-fraction optional if full resolution not required.
	b	E or W
Time	hhmmss.ss	Fixed/variable length field: hours minutes seconds.decimal - 2 fixed digits each of hours, minutes, and seconds; variable number of digits for decimal-fraction of seconds. Leading zeros always included for hours, minutes, and seconds to maintain fixed length. Decimal point and associated decimal-fraction optional if full resolution not required.
Checksum	*	Optional Checksum Delimiter.
	hh	Optional Checksum Field: Absolute value calculated by exclusive OR'ing 8 data bits (no start or stop bits) of each character in message, between, but excluding \$ and *.

## Data Formats

Seven bytes of position data are appended to each scan of hex data from the instrument. If a Surface PAR sensor is also connected to the SBE 33, the Surface PAR data (three bytes) is appended *before* the position data.

Our data processing software calculates latitude and longitude as follows:

$$\text{Latitude (deg)} = (\text{byte 1} * 65536 + \text{byte 2} * 256 + \text{byte 3}) / 50000$$

$$\text{Longitude (deg)} = (\text{byte 4} * 65536 + \text{byte 5} * 256 + \text{byte 6}) / 50000$$

Notes:

1. If bit 1 in byte 7 is 1, this is a new position.
2. If bit 8 in byte 7 is 1, Latitude is negative.
3. If bit 7 in byte 7 is 1, Longitude is negative.
4. North latitudes are positive, south latitudes are negative.
5. East longitudes are positive, west longitudes are negative.

*Example:*

Appended position data = 2455FC5D32B141

byte 1 = 24 hex = 36 decimal

byte 2 = 55 hex = 85 decimal

byte 3 = FC hex = 252 decimal

byte 4 = 5D hex = 93 decimal

byte 5 = 32 hex = 50 decimal

byte 6 = B1 hex = 177 decimal

byte 7 = 41 hex = 01000001 binary

This is a new position (bit 1 in byte 7 is 1).

Latitude is positive (bit 8 in byte 7 is 0).

Longitude is negative (bit 7 in byte 7 is 1).

Latitude =  $(36 * 65536 + 85 * 256 + 252) / 50000 = 47.62616$  degrees

Longitude =  $(93 * 65536 + 50 * 256 + 177) / 50000 = -122.1565$  degrees

# Appendix II: NMEA Message Simulation Program

Sea-Bird provides a NMEA message simulation program, NMEATest, as a troubleshooting aid. NMEATest, part of the SEASOFT-Win32 package, simulates a NMEA navigation devices transmitting NMEA messages. If the system does not work with the actual NMEA navigation device, but works with NMEATest, the problem is with the interface cable from the NMEA navigation device to the SBE 33 or in the NMEA navigation device itself.

NMEATest is just a simulation, and does not provide an actual data stream from an actual NMEA navigation device. The data transmission baud rate (4800 or 9600) and time between messages are user-programmable. The NMEA message format (RMA, RMC, GLL, or GGA) generated by the program is also user-programmable. Alternatively, the user can specify an existing raw NMEA data file to use for the simulation; see *Appendix I: NMEA Navigation Device Message and Data Formats* for the required raw data format.

**Note:**

**You can also run the simulation using only one computer**, if the computer has a spare COM port.

To execute the simulation program, a **second computer** (computer 2) is needed to emulate the NMEA navigation device. A laptop computer is adequate for this purpose. Install NMEATest on computer 2 (NMEATest is part of the SBE Data Processing installation).

Use the NMEA Interface test cable (PN 801422 - supplied with the SBE 33 if the optional NMEA interface is ordered) to connect *NMEA Input* on the SBE 33 to the simulation computer. The simulation test cable connections are:

MS3102A12S-3P	DB-9S	Function
Pin A	Pin 3	NMEA A (signal)
Pin B	Pin 5	NMEA B (signal return)

**Note:**

The SBE 33 must be connected to the Carousel to test the NMEA interface. If it is not connected, noise on the open *Sea Cable* connector will interfere with communication with the SBE 33.

Proceed as follows (instructions are written assuming you are using a second computer to emulate the NMEA navigation device):

1. On computer 1, set up SEATERM to communicate with the SBE 33 at 9600 or 19200 baud, 7 or 8 data bits, no or even parity (Steps 1 and 2 in *Testing NMEA and System Setup in Section 4: Setting Up Optional NMEA Interface and Surface PAR*).
2. Turn on power to the SBE 33. The NMEA Interface PCB status message displays in SEATERM:

```
SBE 33/36 NMEA interface V2.3 setup:
PC baud rate = 9600
Interboard baud rate = 9600
8 data bits, no parity
NMEA message to decode = RMC
Mode = echo only
```

```
Surface PAR disabled
NMEA decoding enabled
Press @ to change the NMEA interface setup
SBE 33 V2.0 power on
```

3. Type @ to access the NMEA Interface menu.
4. Type 3 and press the Enter key to switch to mode 3.
5. When in mode 3, type 5 and press the Enter key to switch to mode 5 (diagnostic mode not listed on the menu). Mode 5 transmits all NMEA messages in raw format and (if a correct NMEA message is received) in decoded form. The menu response indicates that the SBE 33 has *diagnostic level 2 enabled*.
6. On computer 2, double click on **nmeatest.exe** (in same directory as SBE Data Processing). The NMEATest screen appears.
7. On the NMEATest screen, click on the Configure menu. The Configure dialog box appears. Select:
  - NMEA message to be simulated (RMA, RMC, GLL, or GGA) **or** select an existing NMEA data file on your computer by clicking *Send File* and browsing to the desired file. The NMEA message to be simulated **must match the NMEA Message to Decode** (set with dip switches on the NMEA Interface PCB) shown in the status message in Step 2.
  - Baud rate for transmission of simulated NMEA data to Deck Unit – **must set to 4800**.
  - COMM port on computer 2 for transmission of NMEA data to Deck Unit.
  - Message interval (time between simulated messages to be transmitted to Deck Unit).Click OK.
8. On the NMEATest screen, click Start. NMEA data should begin to display on the NMEATest screen on computer 2 and in SEATERM on computer 1. The yellow *NMEA transmit* light should flash each time the simulation program transmits a new position.

The data displayed by SEATERM should correspond to that of the simulation program (see *Appendix I: NMEA Navigation Device Message and Data Formats* for the raw and decoded NMEA message formats). If properly decoded data appears on the screen, the NMEA Interface in the SBE 33 is working properly. If the system works with the simulation program but does not work when connected to the actual NMEA navigation device, the problem is with the cable from the NMEA navigation device to the SBE 33, or in the NMEA navigation device itself.

- Verify that the cable pinouts are correct, especially at the NMEA navigation device. See *Wiring System* in *Section 3: Setting Up System* and also refer to the NMEA navigation device documentation.
- If the cable is correct, verify that the NMEA navigation device is on and is configured to send data. Many NMEA navigation devices have programmable NMEA outputs and may need to be configured before they will transmit NMEA messages. Again, refer to the NMEA navigation device documentation, or contact the device's manufacturer for customer support.

# Appendix III: Replacement Parts

Part Number	Part	Application Description	Quantity
171886	25-pin DB-25P to 9-pin DB-9S cable, 3 m (10 ft)	Connect <i>Serial Data</i> and <i>Carousel Data</i> on SBE 33 to computer COM ports	2
801422	2-pin MS3106A-12S-3S to 9-pin DB-9S NMEA Interface test cable, 1.8 m (6 ft)	Connect <i>NMEA Input</i> on SBE 33 to computer running NMEA simulation program for test purposes	1
171888	25-pin DB-25S to 9-pin DB-9P cable adapter	For use with computer with DB-25 connector	-
17015	SBE 33 power cable	Connect SBE 33 to AC power source	1
80915	2-pin MS3106A-12S-3P to 2-pin RMG-2FS cable, 10 m (33 ft)	Connect <i>Sea Cable</i> on SBE 33 to Carousel for testing	1
801367	4-pin MS3106A-14S-2P to 5-pin Switchcraft EN3C5F cable, 15 m (50 ft)	Connect <i>PAR Input</i> on SBE 33 to Biospherical Surface PAR sensor with Switchcraft connector	1

# Index

---

.con file · 15, 24

## A

About Sea-Bird · 5

## B

Back panel · 10  
 Baud rate · 9, 12, 14, 18  
 Bottle firing · 25, 29

## C

Communications · 9  
 Configuration file · 15, 24  
 CTD  
   configuration file · 15, 24  
   upload · 30  
 CTD setup · 12

## D

Data bits · 9, 18  
 Data processing · 30  
 Description · 7  
 Dip switch · 14

## E

Editing data files · 31

## F

Firing bottles · 25, 29  
 Front panel · 10

## G

Glossary · 33

## I

Installation · 16

## M

Mounting · 16

## N

NMEA · 16, 18  
   data formats · 34  
   message formats · 34  
   operating modes · 20  
   simulation program · 36  
   troubleshooting · 23  
 NMEATest · 8, 11, 36

## O

Operating system · 25

## P

Parity · 9, 18  
 Parts  
   replacement · 38  
 Processing data · 30

## R

Real-time acquisition · 25  
 Replacement parts · 38

## S

SBE 33  
   back panel · 10  
   front panel · 10  
 SBE Data Processing · 8, 11  
 SEASAVE · 8, 11, 15, 24, 25  
 SEASOFT-DOS · 11  
 SEASOFT-Win32 · 8, 11  
 SEATERM · 8, 11, 12, 21, 36  
   main screen · 13  
 Software · 8, 11  
   installation · 11  
 Specifications · 8  
 Surface PAR · 17, 18, 20  
 System communications · 9  
 System description · 7  
 System operation · 25  
 System wiring · 16

## T

Testing · 21  
 Troubleshooting · 23, 32

## U

Unpacking SBE 33 · 6  
 Uploading data · 30

## W

Wiring · 16