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CTD Data Collection on Northeast Fisheries Science Center Cruises: Standard Operating Procedures

by

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ABSTRACT

Standard operating procedures for the collection of hydrographic data and the maintenance of CTD systems on Northeast Fisheries Science Center (NEFSC) cruises are presented. The intent of this document is to formalize the instructions that are routinely provided to sea-going personnel. Descriptions of the instruments, modes of operations, and software applications are included. More concise, step-wise instructions for easy reference at sea are provided in various appendices. This document will require updating on a routine basis as instrument and computer technologies evolve.

INTRODUCTION

The Oceanography Branch of the Ecosystem Processes Division is responsible for the routine collection and analysis of hydrographic data on nearly all Northeast Fisheries Science Center cruises. The data are collected using CTD (Conductivity, Temperature, Depth) instruments and used to characterize the hydrographic conditions on the Northeast Continental Shelf. This activity entails providing instrumentation, software and training for as many as four simultaneous field programs. As a result of increasing demand for the use of CTD instruments during the last decade, the Oceanography Branch has established standard data collection procedures for use on all sea-going platforms.

This document provides sea-going personnel with a single reference that describes the CTD instruments, modes of operation, maintenance and software applications. In addition, CTD instrument and software manuals provided by the manufacturer are always on-board the ships and may be used as the most detailed and accurate source of information. This reference will be revised on a time frame consistent with

technological improvements of the instruments and computer software routines. All information presented during training sessions conducted by Oceanography Branch staff is included in this reference manual.

BASIC INSTRUMENT DESCRIPTION

The Oceanography Branch maintains 10 Seabird Electronics (SBE, Inc.) Model 19 Profiling CTD instruments (Profilers). The Profiler is the model type of CTD most often used on NEFSC cruises. An illustration of the Profiler is provided in ***Appendix 1***. This instrument records measurements of pressure, temperature and conductivity twice per second and is powered by 6 D-cell batteries that are stored in a battery compartment located at the base of the instrument. All Profilers (except SN 0456) are equipped with a pump that improves the flushing of the conductivity cell by providing a steady flow of water through the sensor. The pump is configured by the manufacturer to turn on approximately 45 seconds after the Profiler senses a conductivity above a small threshold value (i.e. after it is in salt water). When the pump turns on, there will be additional drain on the battery supply and if the batteries are already low, may cause the voltage to fall below the minimum power requirement, and shut off the instrument. Profiler #2879 is also equipped with a fluorometer, which requires 9 D-cell batteries. A new set of batteries will typically last for between 30 – 50 casts (See ***Appendix 2*** for instructions on changing batteries and checking battery voltages). An internal lithium battery is used to keep logged data in memory and stores instrument settings established by the manufacturer. The cylindrical housing is made of plastic and has a depth rating of 600 meters, although the Profiler should not be lowered deeper than the shallowest depth

rating of any optional sensors. For example, the fluorometer attached to Profiler #2879 has a pressure rating of 500 meters and as a result should not be lowered deeper than this.

The sensor end of the instrument contains the thermistor, pyrex conductivity cell and pressure port. The sensors are protected by an aluminum cell guard that also holds a magnetic reed switch for turning the Profiler on or off. When not in use, the conductivity cell is kept "wet" by capping the ends with tygon tubing, which has been filled with fresh (preferably distilled) water. Individuals wanting more information about sensor accuracy and resolution should consult the instrument manual provided by the manufacturer. The top of the sensor end holds the watertight bulkhead connectors for data transmission and for the attachment of optional sensors. All Profilers have been purchased with internal optical isolation that will allow for real time data collection through a 7000-meter sea cable. The Profiler is not designed for rugged use and should be handled as a fragile instrument.

DEPLOYMENT PROCEDURES

There are four possible "modes" of CTD operation on NEFSC cruises: archived or real-time communication used either with or without a plankton net (bongo) attached. In archived communication, the cast data are stored in memory and are downloaded to a computer AFTER the cast is performed. During real-time operations, the CTD pigtail is hard-wired to the sea cable (See ***Appendix 3***) and the data are uploaded to a computer WHILE the cast is performed. Data are also logged internally by the CTD during real time operations, which is useful in the event that a problem with the sea cable wiring

develops during a cast. The deployment procedures will vary depending upon the mode of operation.

Vertical CTD Casts:

A vertical *cast* is the vertical down and up deployment of the Profiler while the ship remains nearly stationary. The Profiler is attached to the sea cable using modified Niskin bottle clamps and safety shackles (see illustration in ***Appendix 4a***). Step-wise instructions on how to attach the Profiler to the sea cable are provided in ***Appendix 8***. The instrument should be attached to the sea cable with the sensor end facing down. This is to ensure that the sensors sample the water column with the least disturbance that may be generated by the instrument housing. In addition, the Profiler should be allowed to soak at the surface for at least 1 minute prior to lowering to allow for the pump to turn on and for the sensors to become equilibrated. The CTD should sample to approximately 5 meters from the station depth or to a maximum dictated by the depth rating for the instrument housing and any optional sensors (generally, 500 meters). While data are recorded during both the down and up part of the cast, the downcast data are typically used in the final processing.

Bongo Hauls:

The CTD cast is often made simultaneously with a bongo haul for plankton on NEFSC cruises (Holzwarth-Davis, 1993). A plankton *haul* refers to the double oblique towing of a bongo net while the ship steams at approximately 1.5 – 2.0 knots. A more complete description of plankton haul operations may be found in *MARMAP Ecosystem*

Surveys: Operations Manual (Jossi, in press). During Bongo hauls, the Profiler should be attached to the sea cable with the sensor- end facing up (see illustration in ***Appendix 4b***). During the descent, the bongo nets create a considerable amount of flow disturbance, which results in poor "flushing" of the sensors and diminished data quality. The instrument is NOT allowed to soak at the surface during bongo hauls because this haul is designed to represent an evenly sampled water column. Allowing the nets to soak at the surface would cause difficulties in the analysis of the overall plankton distribution (Jossi, in press). Therefore, the Bongo/CTD are immediately lowered upon deployment and the CTD data from the upcast are typically used in the final processing. The Bongo/CTD should sample to approximately 5 meters from the station depth or to a maximum of 200 meters (Jossi, in press). However, if the station depth is significantly deeper than 200 meters (≥ 220 meters), a vertical CTD (without the bongo attached) should be made after the bongo haul using the procedures described above. If both vertical CTD casts and bongo hauls are scheduled for a cruise, the Profiler should be deployed with the sensors facing up for the entire cruise. This saves the operators from having to continuously adjust the instrument orientation on the wire and from breaking watertight connections.

SALINITY SAMPLES

Samples taken for salinity data calibration are typically collected twice daily during a cruise. The Chief Scientist or Watch Chief is responsible for scheduling the collection of these samples. A Niskin bottle is attached to the sea cable above the Profiler during vertical casts only. The operations are similar to those for a standard vertical deployment. When the Profiler has been lowered to its deepest point or to a

depth of uniform salinity, the computer operator will communicate to the deck crew to send a messenger weight down the sea cable in order to close the cocked Niskin bottle. The computer operator will then "mark" this sample in the data file by simultaneously typing <ctrl>-F5. Once on deck, the Niskin bottle is removed from the wire and the salt sample can then be taken. Salt cases containing numbered sample bottles are provided for every cruise. The sample bottle and cap should be rinsed with the sample water at least three times prior to filling. The case ID and sample number should then be recorded on the Profiler log sheet. Once on shore, these samples are analyzed on a Guildline Autosal salinometer. Instructions for cocking a Niskin bottle and taking the salt sample are provided in ***Appendix 5***.

COMPUTER SET UP AND CTD APPLICATIONS

The computer should be plugged into a "clean" power outlet that is on the same circuit as the ship's uninterrupted power supply (UPS). If the CTD is set up in real-time mode, it is the responsibility of the ship's Electronics Technician to terminate the sea cable and to supply an RS-232 cable leading from the winch slip rings into the computer lab. The slip ring cable is plugged into comm port 1 of the laptop. A short "test" cable is used to download archived data and to check battery voltages (using term19.exe). The test cable is plugged into comm port 2, if available. If the laptop has only 1 comm port, the user must unplug the real-time slip ring cable and replace it with the test cable each time archived communication is used. Another option is to use a data switch box for the use of comm 1. This way, the operator does not have to unplug anything, but instead switches to the setting labeled either "real-time" or "archived" communications. A general schematic of the computer set up is given in ***Appendix 6***.

The laptops that are presently sent to sea have either a Windows 95 or Windows 98 operating system. At the beginning of the field season (January), all computers used to collect or process CTD data are updated with the latest version of *Seasoft* software available from SBE, Inc. This software is installed into a directory named seasoft4 (c:\seasoft4). In addition, a directory has been set up for each instrument and users must be in the correct directory for successful collection and processing of data. The instrument directories are named "c:\scatXXXX" where XXXX is the corresponding serial number for the Profiler being used. If the laptop is used for CTD data collection only, the computer should be "re-started" in DOS mode and left running in the appropriate directory for the entire cruise. If the laptop is used for other operations, the data collection and post-processing routines may be run through a DOS-prompt window. The user should check to be sure that no other Windows applications are running prior to data collection. The data collection program, seasave.exe, will not run correctly if there are multiple DOS-windows open.

In order to reduce keystrokes out at sea, data collection and post-processing routines have been set up to run in batch. "Savedata" is a batch program that runs seasave.exe with a particular configuration suitable for the majority of NEFSC cruises. Upon request, this configuration may be customized to suit the particular needs of a sample design. "Prodatar" and "Prodataa" are batch routines that back up, post process, and prompt for station information about the data collected in real-time or archived modes respectively. Prodata(a/r) will also type out the post-processed data to the screen so that the maximum sample depth and the temperature at that depth can be recorded on the Profiler log sheet. The station information is stored in a file called "header.dat." This

file is continuously updated during a cruise so that there is a record for each time the Profiler is deployed. The batch routines are located in a directory c:\batchfil and copies along with software installation instructions are included in ***Appendix 7***. Procedures for deployment and data retrieval in archived mode are listed in ***Appendix 8***. For the majority of the NEFSC cruises, the CTD systems are used in real-time mode and these instructions are listed in ***Appendix 9***.

Step-wise instructions for the computer operations (***Appendix 8 or 9***) and for checking batteries (***Appendix 2***) are always secured next to the laptop. If there are no problems during a cruise, no other references may be needed. If problems do arise, detailed descriptions of all *Seasoft* routines are provided in the software manuals provided by SBE, Inc.

LOGSHEETS

A sample logsheet is provided in ***Appendix 10***. Each cast should have an entry on the logsheet. If the cast is repeated, it is best to increment the cast number and make another entry on the logs. Overwriting data files is generally not recommended because it may result in losing data that are actually good. Time is recorded in GMT (Greenwich Mean Time). The cast type should be noted: v = vertical profile, b=bongo, w=vertical profile with Niskin bottle attached above to collect a water sample. Latitude, longitude and station depth are recorded from the ship's underway data display (SCS System) located next to the CTD computer. BMAX and BTEMP, which refer to the deepest observation made by the Profiler and the temperature recorded at that depth, are noted after the data are post-processed. If a salinity sample was taken during the cast, the case

ID and bottle number should be recorded on the log. It is important to keep a log of the serial number of the CTD being used so that the appropriate calibration coefficients are used when the data are processed back on shore. Comments should be recorded in a separate notebook provided for each cruise. Problems should be documented in as much detail as possible so that there is a better chance of determining the cause back on shore or describing its symptoms to the manufacturer.

MAINTENANCE AT SEA

A listing of "helpful tips" is provided in ***Appendix 11***. The Profiler should be rinsed with fresh water after each cast. The tygon tubing should be looped around the conductivity cell and filled with fresh water after each deployment. If the temperature is below or near freezing, the tygon tubing should NOT be filled with water because the water may freeze and break the cell. Instead, the cell should be capped with air. The 4-pin pigtail connection should be cleaned with non-abrasive "Kimwipes" and lightly coated with DC-4 grease after every time the seal is broken on the sea cable. The 0-rings and threads that seal the battery compartment should be cleaned with "Kimwipes" and re-greased after changing batteries. The instrument housing should NOT be opened out on deck and instead should be brought into a relatively clean and dry location to change batteries or inspect bulkhead connections. If the Profiler accidentally hits bottom during a cast, the pump tubing should be removed and cleaned of any sand that would clog the plumbing or damage the conductivity cell. If stormy weather is predicted that will shut down scientific operations, the Profiler should be taken inside, rinsed off with fresh water, and stored in its crate. The sea cable should be sealed with a dummy plug when not in use to protect the recessed pins from corrosion. The Profiler should be routinely

inspected during a cruise. Make sure all connections, including the magnetic on/off switch, and all attachment hardware are secure.

TROUBLE SHOOTING

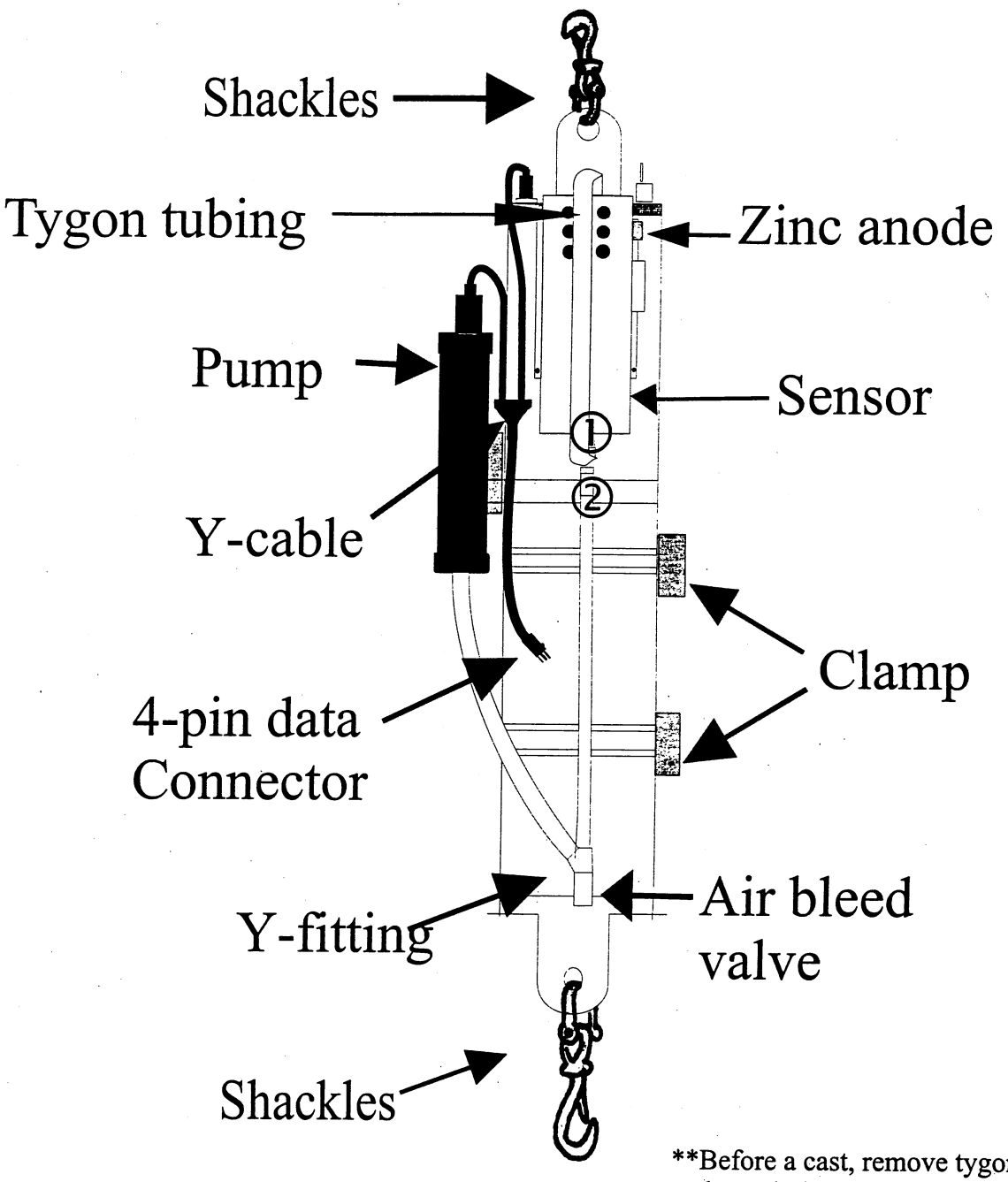
Appendix 12 describes some of the common problems that may occur while out at sea. Some problems have easy solutions, while others may require the assistance of the ship's Electronics Technician. The appendix lists "symptoms" followed by steps that the user can take to diagnose and fix the problem. In the event that the problem cannot be solved, the back up CTD should be put on-line and someone from the Oceanography Branch (Woods Hole) should be notified via email or as soon as the ship returns in order to arrange for a replacement CTD and for repairs if necessary. However, if data collection problems persist even after a second Profiler has been used, the problem more than likely is located in the sea cable wiring. It is ultimately the responsibility of the Chief Scientist to report problems or provide suggestions on procedures to members of the Oceanography Branch.

REFERENCES:

Holzwarth-Davis, Tamara (1993). *Test and Evaluation of the SBE 19 Seacat Profiler*, NEFSC Lab Reference Series, Document 93-10, 16 pp.

Jossi, J. W. (2000). *MARMAP Ecosystem Surveys: Operations Manual,* NEFSC Lab Reference Series, in press.

Appendix 1. **The Instrument**



**Before a cast, remove tygon tubing and attach the end of 2 to 1.

Appendix 2a. Batteries

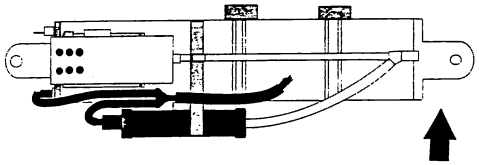
Check battery voltage after about 25-30 casts. To do this, do a "TERM19".

TERM19:

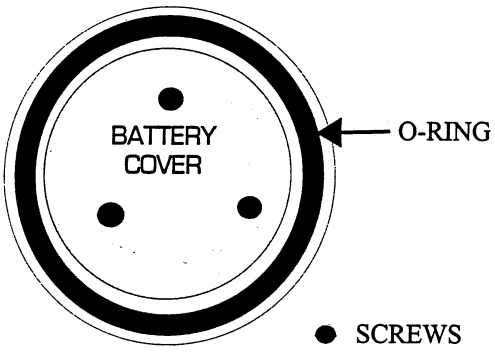
From whatever directory you are in (c:\scatXXXX)

- At the c:\scatXXXX> type **TERM19**
- You will get a blue screen with a section up top that has a list of commands. Press **F6** – this wakes up the instrument. This will take a few seconds. Once it's 'woken up' the screen will say, "communication established".
- Now press **F3**. Look for **vmain=x.x** (x.x will be a number) This tells you the voltage. If it's 6.5 or below, you need to change batteries.
- If you did not change batteries, type **QS** (this puts the Profiler into 'quiescent mode')
- Press **F10** to exit out of the program

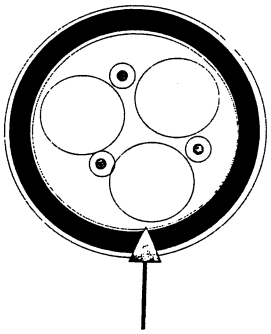
Appendix 2B. How to Change Batteries



To change batteries, unscrew this end - the one WITHOUT all the sensors on it.



- Lay the Profiler on its side and unscrew the battery endcap. This is the end without the plugs and cables emerging from it.
- Carefully remove the 3 Phillips head screws from the battery retainer plate immediately inside the pressure housing. Lift the plate clear, set in a safe place with the screws. Dump the batteries out.
- Place 6 fresh batteries carefully into the slots, the + terminal against the flat battery contacts and the - terminal against the spring contacts.
- Align the retainer plate so that the flat and spring contacts are over the + and - battery contacts respectively. Tighten the screws but please DO NOT OVER TIGHTEN; they must be properly in place or the battery power will be intermittent.
- Check the O-ring on the battery endcap and on the end of the Profiler for any nicks or scratches, replace if necessary.
- Clean the battery endcap threads and the O-ring with a Kim Wipe. Lightly grease with DC-4.
- Replace battery endcap and hand tighten. Use a large wrench to give it half a turn to really get a good seal, but please don't tighten too much (just enough so that there isn't a gap in between)
- Hook up Profiler to the computer and follow the instructions on how to do a TERM 19. Make sure voltage reads at ~8.4. When you are ready to exit the program instead of pressing F10, you will press F8 - this initializes logging.

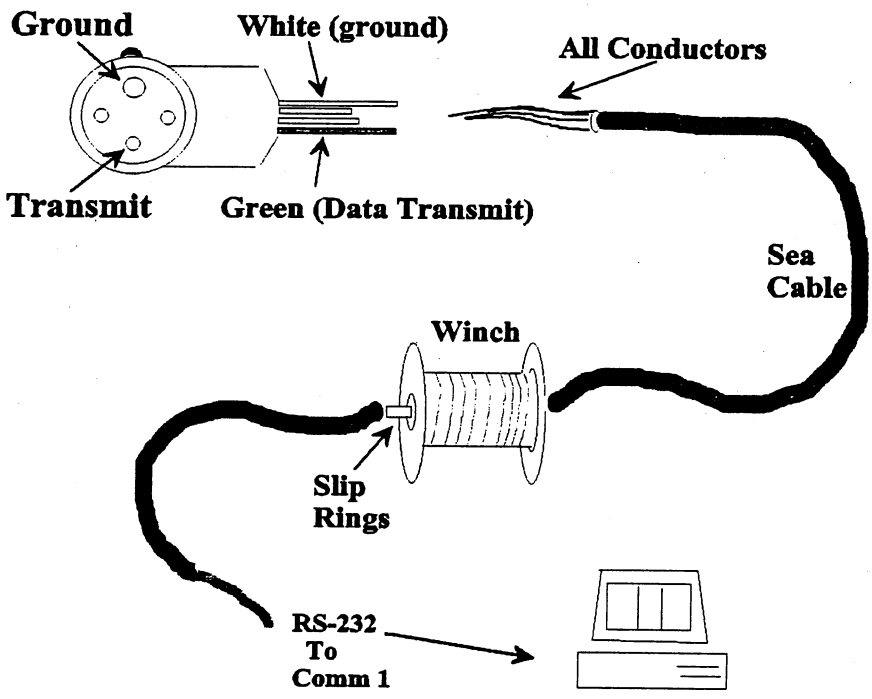


Battery

Appendix 3. Sea Cable Wiring and the Water Tight Connection

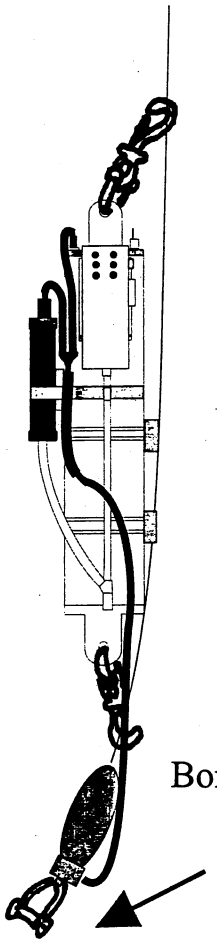
A schematic illustrating the wiring of the CTD pigtail to the sea cable is shown below. The Electronics Technician typically terminates the sea cable but CTD users should familiarize themselves with this information. The sea cable conductors are twisted together (in parallel) and are soldered to the green "data" wire of the pigtail. The cable armor is used as the ground wire and is connected to the white wire (Fat pin). The termination is made watertight by alternate applications of Skotch-kote and vulcanizing tape. Lastly, electrical tape should be wrapped around the splice for further protection. There should be no strain on the termination when instruments are deployed.
To connect the CTD to the sea cable or test cable:

- Clean the terminal end of the sea cable and CTD pigtail with a non-abrasive cloth such as a Kimwipe.
- Apply a light coating of DC-4 grease to the bulkhead surfaces (not on the pins).
- Align the raised "bumps" on the sea cable and pigtail (above the fat pin)
- Hold the bulkheads close to the ends to avoid accidentally slipping and breaking wires.
- Make the connection and listen for the "pop" as the seal is made
- Run your fingers along the sealed connection to ensure that all air has been removed.
- Slide the plastic locking sleeves over the seal and screw them together
- If plastic locking sleeves are not available, cover the connection with a few wraps of electrical tape to prevent the seal from twisting or bending.



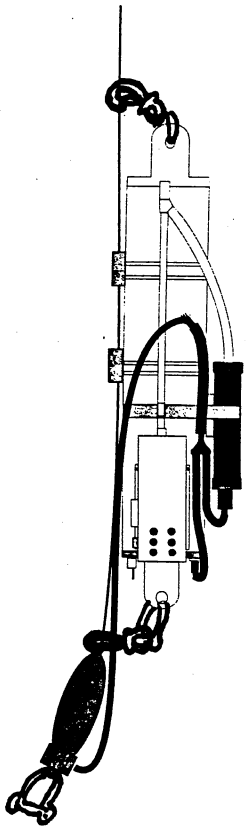
Appendix 4. **Attaching the Profiler to the Sea Cable**

With bongo - sensors UP



Bongo is attached here

Without bongo - sensors DOWN

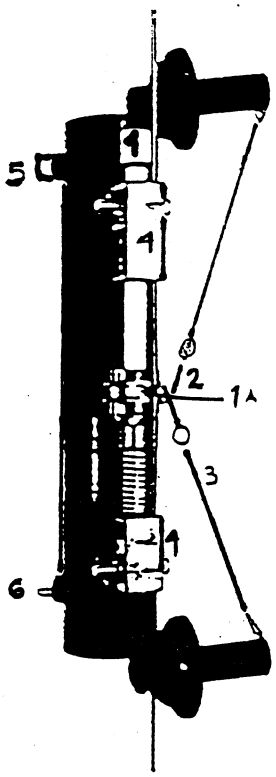


- Place wire in clamps. Tighten wingnuts
- Hook shackles to the wire
- Connect pigtail from Profiler to that of Sea Cable.
  - -Lightly grease the rim of Sea Cable pigtail, and the edge of the Profiler pigtail.
  - -Line up the bumps on both of the pigtails and connect the two. Listen for a "pop" sound. This lets you know that a seal was made.
  - -Tape the connection with several wraps of electical tape.

Appendix 5. Salinity Samples

ATTACHING THE NISKIN TO THE WIRE:

- Cock Niskin bottle before placing on the wire
- With one hand push down on 1. With the other hand open the top of the bottle and hook the lanyard (2) into 1A.
- Let go of 1.
- Open the bottom end of the Niskin and clip that lanyard (3) to the other lanyard (2) BELOW the white ball.
- Clamp onto wire. Place the wire into the clamps (4) and tighten the wing nuts so that the wire can't slip from the clamps.
- Make sure the knob (5) is turned all the way to the right and the spigot (6) is pulled out towards you.
- Now you're ready to do the cast.



TAKING A SAMPLE:

Once the Niskin is back on board:

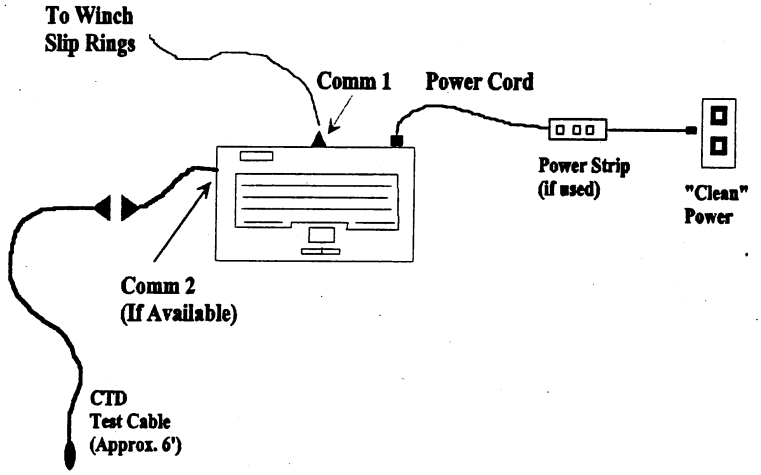
- Take the next corresponding salt bottle from the case (check the logsheet to make sure you took the right one)
- Dump out the water that was in there
- Fill salt bottle 1/3 with water from the Niskin
    - Push the spigot (6) in.
    - Turn the knob (5) to the left – this acts like a faucet. When you're done filling just turn the knob to the right, OR push the spigot out and flow will stop
- Shake salt bottle well.
- Dump water out.
- Do this 3 times and after the 3rd one fill the salt bottle up to the neck and cap tightly.

Appendix 6. Setting up the Computer for Data Collection

- Plug the power cord into the ship's clean power supply (UPS).
- Plug the 9 or 25 pin slip ring cable for real time data collection into Comm 1. Adaptors (9 pin to 25 pin) and RS-232 gender changers are available in the supply bin if the slip ring cable will not plug directly into the Comm port.
- Plug the 6' CTD test cable into Comm 2, if available, or to the data switch box port labeled "archived / check batteries" Note: if a switch box is not used, the slip ring cable must be unplugged so that the test cable may be used on Comm 1.
- Turn the computer on and adjust screen brightness if necessary.
- If the computer is not being used for anything but CTD operations, restart it in DOS mode (From windows: Start, shutdown, restart).
- If the computer will be used for other applications such as word processing or MOCNESS hauls, run the CTD software through a MS-DOS prompt.
- There are currently 10 Seabird Profiler directories, each containing a file (cfigxxxx.con) that stores the unique calibration coefficients for that CTD.
- The directories are:

c:\scat0360	c:\scat0456	c:\scat0851	c:\scat0853	c:\scat1447
c:\scat1468	c:\scat1495	c:\scat1496	c:\scat2277	c:\scat2879

- Go to the correct directory for the "main" CTD being used on the cruise by typing cd\scatxxxx where xxxx = the instrument serial number
- Put the data back up floppy in the disk drive
- If you see the message: "SBExxx.HEX or SBExxx.CNV already exists, overwrite or enter new name o/e ?" The safe recommendation is to enter a new name to avoid overwriting good data files from previous casts.
- If you are running Prodata(a/r) and you see the message "Insufficient Disk Space" Remove the floppy disk, label it with the cast numbers, put it away and place a new floppy in the drive. Run Prodata(a/r) again.
- If the computer fails, the back up computer should be set up in the same manner as described above and should have all the necessary directories and software installed.



Appendix 7. Seasoft and Batch file Installation

Installation:

- In the back of the "FOI" CTD manual, there are two installation floppy disks that have instructions on them. Depending on which drive your are using (a:\ or b:\), type the following from the c:\ prompt (DOS)

  a:\installa XXXX <enter>
  or
  b:\installb XXXX <enter>

  Where XXXX = the four digit serial number of the CTD

- Follow the prompts until the program types "Good Luck"
- Disk 1 contains directories for each Profiler that the Oceanography Branch currently maintains
- The directories are named "scatxxxx" where xxxx = the CTD serial number
- Disk 2 contains Seasoft executable programs manufactured by SBE, Inc.
- The installation software will make three directories:

  c:\batchfil c:\seasoft4 c:\scatxxxx

- You must run the installation routine for each Instrument being used. For instance, if you are using Profilers 0851 and 0853, you would have to type **'a:\installa 0851'** (follow prompts until complete) and then **'a:\installa 0853'**.
- Don't worry about the "directory already exists" message because c:\batchfil and c:\seasoft4 are created and written to each time you run the installation software. They overwrite the same files.
- In the autoexec.bat file, add the following directories to the path statement

  c:\seasoft4 and c:\batchfil

Savedata.bat

- The following is a copy of the batch routine "Savedata" located in c:\batchfil. This routine runs seasave.exe with a configuration stored in the file Tseasave.cfg. The output raw data file is called sbexxx.hex (where xxx represents the cast number that the user entered.
  For example, "Savedata 001" creates sbe001.hex

```
@echo off
seasave –etseasave.cfg –osbe%1.hex
```

Appendix 7. Seasoft and Batch file Installation (cont.)

Prodata(a/r).bat (processing for data collected in real time)

- There are three parts to Prodatar.bat: The cast data are backed up to a floppy, the raw data are processed using Seasoft routines, and finally station header information is appended to a file named "header.dat"
- The following code is for data collected in real time (Prodatar.bat).
- Prodataa.bat includes the following command line just before the data back up lines of code: "seasave –etseasave.cfg –isbe%1.hex"
- Note that the above is very similar to "Savedata.bat" except for the –i (to indicate the input filename) rather than the –o (for output filename) in Prodatar.bat
- Understanding this code is not a requirement for a successful cruise, but users may find it useful information.

```
@echo off
cls
echo You entered station # %1
echo Are you sure that is the correct station number ?
echo If it was not the right number, Press: [CTRL] [C] now
echo otherwise
pause
cls
echo Make sure there is a formatted floppy disk in drive a:
pause
copy sbe%1.HEX a:>nul:
copy sbe%1.con a:>nul:
echo * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
dir/w a:
echo * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
echo *                                                               *
echo *        Now the data will be converted                         *
echo *                  and binaveraged                              *
echo *                                                               *
echo *   PLEASE WAIT FOR PROCESSING TO BE COMPLETED                  *
echo *                                                               *
echo * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
DATCNV -ISBE%1.hex
copy sbe%1.cnv avgdata\*.*>nul:
alignctd -isbe%1
binavg -ISBE%1
derive -ISBE%1
asciiout -fx -isbe%1
cls
echo  Hello CTD operators, Prodatar will now type out the cast
echo  profile one page at a time (just hit any key to continue the
echo  scrolling).  Record the deepest pressure (depth) and the temp
echo  at that depth on the CTD logs (bmax and btemp).  Thanks
pause
type AVGDATA\sbe%1.asc|more
echo  !         !         !         !         !         !         !
echo  ! Make sure to note the maximum depth and bottom temp !
echo  !         !         !         !         !         !         !
```

Appendix 7. Seasoft and Batch file Installation (cont.)

```
pause
new
copy header.dat+temp.dat header.dat >nul:
del temp.dat
copy header.dat avgdata\*.*>nul:
copy header.dat a:>nul:
```

Appendix 8. Archived Data Collection, Display, and Processing.

REMEMBER! ANY TIME YOU SWITCH TO ARCHIVED MODE, CLEAR THE MEMORY FIRST!

To deploy instrument:

1. Attach it to wire
2. Slide switch to ON
3. Lower to desired depth.
4. Bring back to surface, take it off wire, slide switch to OFF and hook it up to the computer.

From the directory C:\SCATXXXX (XXXX being the profiler serial number)

Type the **Highlighted** commands.

1. **TERM19 <ENTER>**
2. Press **[F6]** "wakes up" the instrument
3. Press **[F4]** displays headers, should only be one cast
4. Press **[F3]** displays status, note the voltage (VMAIN = X.X)
5. Press **[F9]** uploads data
6. Enter upload filename = **SBEXXX <enter>** (XXX = consecutive cast #)

    6a. Enter cast number = **X <enter>** (this appears when there is more than one cast stored in the memory)
7. Wait for several messages and dots to finish writing to the screen.
8. When completion message appears, press **<ESC>**
9. Press **[F10]** to exit
10. If YES is highlighted press **<enter>**
11. **PRODATAA XXX <enter>** (XXX is the consecutive cast number – same one that you just uploaded)
12. Check that you did enter the correct cast #, **press any key**
13. Wait for plot to finish.....Press **<CTRL>[F1]** together to clear graph screen
14. Check that there is a formatted floppy disk in drive a:\ **-Press any key**
15. Please wait while the programs DATCNV and BINAVG are running, when they are done a file will be written to the screen. The first two columns will be depth and temperature....scroll down **(keep hitting the space bar)** until you find the max depth

at which you were at....Write these (depth and temperature) on the logsheet in the BMAX and BTEMP columns.

16. **Press any key** to continue
17. Create, update, or skip header.dat **1** or **2** or **3** **<enter>**

Note: Except for the first cast – where you will press 1 to create- you will always press 2 for update.

18. Enter consecutive cast # **XXX <enter>**
19. Enter standard station # **XXX <enter>**
20. Enter month day hr min **XX XX XX XX <enter>**

    *Hour should be in GMT

21. Enter latitude and longitude **XXXX.X XXXX.X <enter>**
22. Enter depth in meters (No decimals) **XXX <enter>**
23. If done **999 <enter>**
24. **TERM19 <enter>**
25. Press **[F8]** to initialize logging
26. Press down arrow to highlight **YES <enter>**

YOU ARE NOW READY TO PROCEED WITH THE NEXT CAST

Appendix 9. Realtime Collection, Display, and Processing

From the directory C:\SCATXXXX (XXXX being the Profiler serial #)

Type the **Highlighted** commands

1. **SAVEDATA XXX <enter>** (XXX is the consecutive cast number, always 3 digits)
2. Turn on Profiler when instructed to do so, may be slight delay.
3. Wait for numbers to appear at the bottom of the screen, proceed with cast as usual.

   ***Note: If doing a water cast, take water sample 5 metres from bottom.....HIT <CTRL> [F5] when messenger is going down!**

4. Return profiler to surface, make sure magnetic switch is turned off
5. Press **<CTL> [F1]** together to clear graph screen.
6. **PRODATAR XXX <enter>** (XXX is the consecutive cast)
7. Check that you did enter the correct cast # - **press any key**
8. Check that there is a formatted floppy disk in drive a:\ - **Press any key**
9. Please wait while the programs DATCNV and BINAVG are running, when they are done a file will be written to the screen. The first two columns will be depth and temperature....scroll down **(keep hitting the space bar)** until you find the max depth at which you were at. Write these (depth and temperature) on the logsheet in the BMAX and BTEMP columns. **Press any key** to continue
10. Create, update, or skip header.dat **1** or **2** or **3** **<enter>**

    Note: Except for the first cast – where you will press 1 to create - you will always press 2 for update.

11. Enter consecutive cast # **XXX <enter>**
12. Enter standard station # **XXX <enter>**
13. Enter month day hr min **XX XX XX XX <enter>**

    *Hour should be in GMT

14. Enter latitude and longitude **XXXX.X XXXX.X <enter>**
15. Enter depth in meters (No decimals) **XXX <enter>**
16. The computer will now write to screen the information you just entered. Make sure it is correct. If yes press **Y**, if not press **N** and enter information again.
17. If done **999 <enter>**

You are now done and ready to proceed with the next cast.

Appendix 10. Sample Log Sheet

always consecutive

not always consecutive

24 hour clock. Add +4 for daylight savings, +5 rest of the year
(on the SCS display monitor the time is on the top - it's already adjusted +4/+5)

from Prodatar

CB 10.28.99

PROFILER LOG	Vessel:		Cruise:		Chief Sci:						Page	of		
Stations	Date			Time(GMT)		Latitude	Longitude	Depth	Sfc T	Salt		New batts	BMAX	BTEM	Initials	Inst. #
Cast#	Sta#	v/b/w	Mo	Day	Yr	Hr	Min	(deg,min)	(deg,min)	M	scs hull	Case	Btl #	Y/N	M	C		
001	001	b	8	23	00	16	12	4236.5	6455.4	59	17.1	-	-	Y	53	16.4	CB	1321
002	003	v	8	23	00	17	35	4232.1	6421.0	132	17.8	-	-	-	125	17.1	"	"
003	004	w	8	23	00	19	54	4228.7	6415.0	90	18.3	SS	1	-	86	18.0	"	"
004	005	b	8	23	00	21	42	4212.5	6354.2	280	18.1	-	-	-	201	17.9	"	"
005	005	v	8	23	00	21	58	4212.7	6354.2	281	18.1	-	-	-	274	17.7	"	"

v=vertical cast (nothing but CTD on wire)
b=bongo
w=water cast (Niskin bottle attached above CTD)

latitude,longitude, and depth from SCS display

from SCS display - Furuno sea temp

v/b/w: v=vertical (no bongo, no water bottle), b=bongo, w=water cast ; Time(GMT): During daylight savings time add 4hours, during regular time add 5 hours.

Comments: Please write any detailed comments in notebook.

Appendix 11. Helpful Tips and Reminders

- Remove the Tygon tubing from the conductivity cell prior to deployment and plug the pump hose to the base of the conductivity cell.
- Put the Tygon tubing, filled with water, back on the conductivity cell after each cast.
- Do not fill the Tygon tubing with water if there is a possibility of freezing temperatures.
- Rinse the CTD with fresh water after each cast
- Remove the CTD from the wire if rough weather occurs
- Change batteries when voltage approaches 6.5 volts.
- Dump archived data after each cast. Casts #'s stored in memory begin with zero.
- The CTD must be turned off for archived communication.
- Clear memory (F8) after dumping data and changing batteries.
- Do NOT change batteries out on deck.
- Do not put "used" batteries in the supply bin. They may be mistaken for new.
- Do not overwrite files if repeating a cast. Instead, increment the cast number but keep the station number the same.
- Use three digits when specifying cast numbers (ex. Savedata 001, Prodatar 001)
- In realtime mode, the CTD should be turned on AFTER the software prompts you to do so.
- In realtime mode, the computer data display should not be cleared (<ctrl-F1>) until AFTER the CTD has been turned off.
- Periodically check the magnetic on/off switch on the CTD. Make sure that the screws are sufficiently tight so that the switch will not slide to "off" during deployment or to "on" during storage.

Appendix 11. Helpful Tips and Reminders (Cont.)

- Make sure you are in the proper instrument directory prior to data collection. The calibration file "cfigxxxx.con" (xxxx=CTD serial number) must be in the directory where you are running "Savedata yyy" (yyy=consecutive cast number)

- If you switch instruments, you must switch directories (cd\scatxxxx where xxxx represents the CTD serial number).

- Report problems in detail.

- If you are not doing a bongo haul, the CTD may be lowered as fast as you and the winch operator feel comfortable with. During the summer or when you expect to sample in temperature or salinity gradients, the deployment rate should be slowed down in order to adequately sample the water column structure.

- If you are not doing a bongo, soak the CTD at the surface for at least 1 minute prior to lowering.

- Make sure that there are no other software applications running in Windows prior to running "Savedata yyy" (yyy=consecutive cast number).

- If you forget to record "bmax" or "btemp" while running "Prodata(a/r) yyy", run "Prodata(a/r) yyy" again. Or, if you are comfortable with any editor (DOS, Notepad etc.), you can view the file c:\scatxxxx\avgdata\sbeyyy.asc where xxxx= CTD serial number and yyy=consecutive cast number.

- "Create" the header file after the first cast, "Update" for all other casts.

- If you forget to "mark" a salinity sample with <ctrl> F5, make a note on the logsheet or in the notebook where you took the sample (if not at bmax).

- Keep the Chief Scientist or Watch Chief informed of any problems that you might be experiencing. They may be able to help and are ultimately responsible for all operations out at sea.

Appendix 12. Common Problems with Easy Solutions

- *Garbage data during the cast*: Are you in the correct directory for the instrument being used?
- *Salinity data does not show up on graph*: Was the Tygon tubing taken off? Are you sampling near the coast where the salinity may be lower than what the graph is scaled for?
- *When running Savedata, you get a graph but no numbers*: Was it turned on before you were prompted to do so? Was <ctrl-F1> hit before the CTD was turned off on the last cast? In these cases, turn the CTD off, exit seasave.exe (hit <esc>) and start over. (Yes, you can overwrite the file in this case)
- *CTD stops recording after it is in the water*: Is it time to change the batteries? Remember that the pump does not turn on until it is in the water for 45 seconds. Is the on/off switch loose so that it slides to "off " as it is lowered in the water?
- *Can't establish communication with Term19*.exe: Is the CTD off? Is the test cable plugged into a comm port? Are the batteries completely dead? Is the baud rate correct? Instrument baud rates are found on the "configuration page" (usually the first page) of the SBE, Inc manuals.
- *Prodatar gives "file not found" error message*: Was the correct cast number entered? Did you forget the cast number when running either Savedata or Prodatar? If you ran Savedata without a cast number, it created a file called "sbe.hex". This should be renamed to "sbexxx.hex" and Prodatar xxx should be run again.
- *Prodatar not backing data up*: The disk is full. Change it.
- *Noisy salinity data during downcast*: This is probably normal. The bongo nets generate a lot of turbulence during the descent causing poor flushing of the conductivity cell. However, the upcast should look noticeably better.
- *Data spikes occasionally, but data otherwise good*: Check all connections in the computer lab and out on the sea cable. This just may be a bad seal out at the sea cable, but it may also be a sign of more trouble to come (i.e. termination, or slip rings bad). Note that when there are pressure spikes, the SBE, Inc. routine "binavg.exe" will NOT give the correct "bmax" and "btemp". Pressure spikes are usually caused by a single bad scan (out of approximately 1000) that can easily be edited out of the data file. This data will be processed and cleaned back onshore by the Oceanography Branch. However, users may clean the data out at sea if they wish (NOT a requirement) by doing the following:

    1. Run datcnv.exe interactively (rather than in batch) and edit the output sbexxx.cnv file.
    2. Remove the record(s) containing the pressure spike(s)
    3. Run the remaining SBE,Inc routines (filter.exe, alignctd, binavg, derive, and asciiout) interactively
    4. Edit or type out the ascii file (sbexxx.asc) to find your bmax and btemp
    5. If you haven't already entered the header information, you can edit "header.dat" and enter the station information.

Appendix 12. Common Problems with Easy Solutions (cont.)

- *Data spikes everywhere, CTD may stop recording*: The BEST trouble shooting technique that you can use is to download this cast data stored in the CTD memory (use the archived instructions). If the archived data are clean, you know that the problem is NOT with the CTD but lies somewhere in the sea cable or slip rings. It is time to ask the Electronics Technician for help. If the data in memory also show the spikes, there is a CTD problem. In this case, switch to the backup instrument.
- *Can't find the information you are looking for:* Consult the SBE, Inc. manuals.