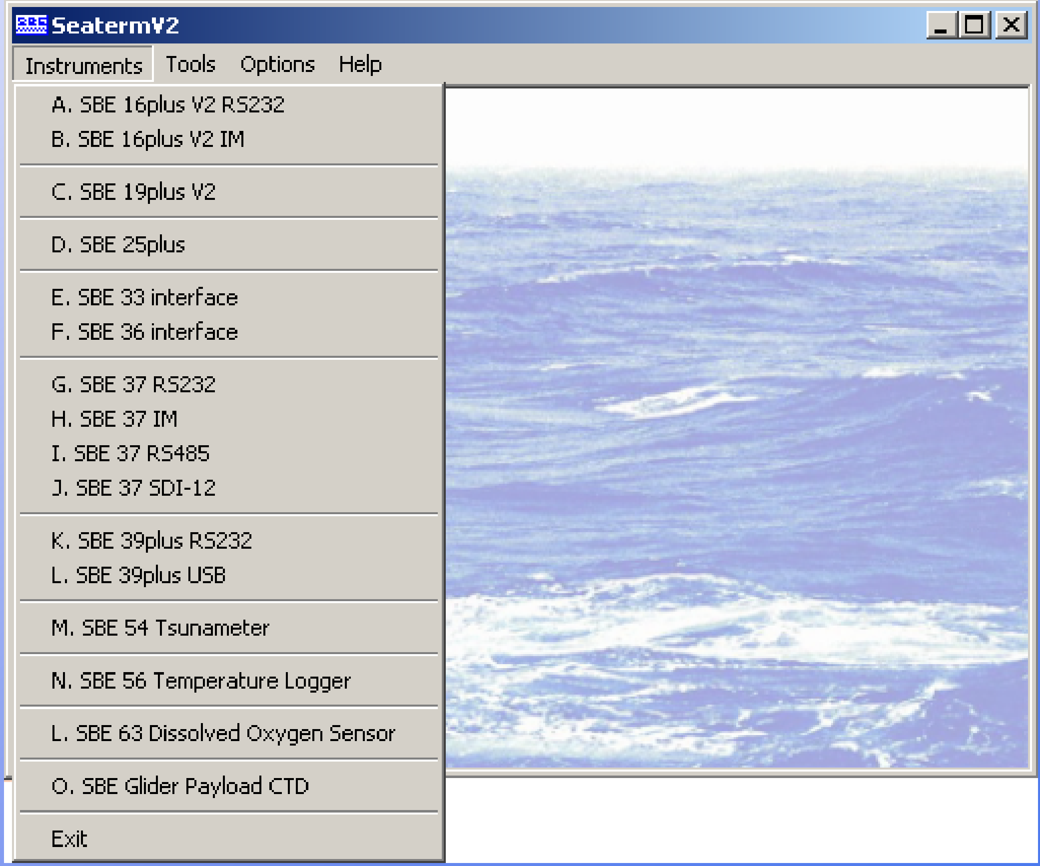
# Setup of Moored Instruments

- In this module we will discuss:
  - SeatermV2 and Seaterm, the user interface
  - Status reports, header listings, and data formats
  - Preparing for deployment
  - Conversion of data to a format used by SBE Data Processing

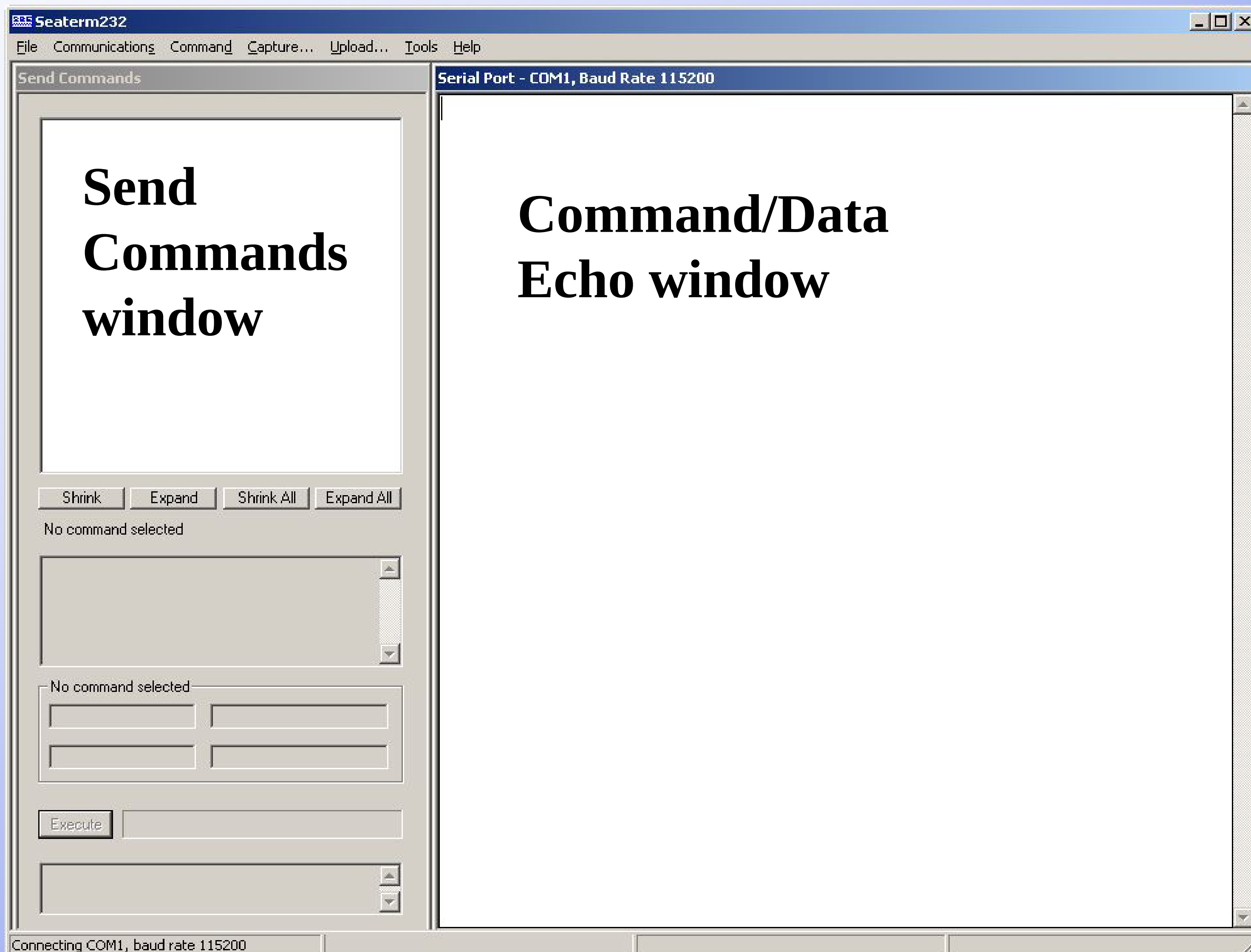
# Setting up Moored Instruments: SeatermV2 and Seaterm

- SeatermV2 and Seaterm
  - Set up an instrument for deployment
  - Transfer data from an instrument to user's computer
  - Do data conversion for SBE 37 and SBE 39 to allow further processing with Seasoft's data processing software (SBE Data Processing)



# Seaterm232:
# for RS-232 Instruments

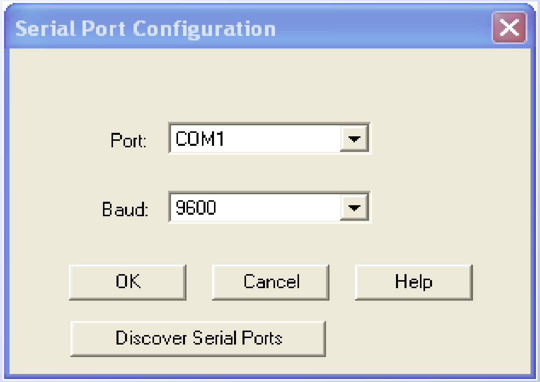
**Menus** →




**Status bar** →

# Connecting to Instrument

- The first time Seaterm232 is used, it asks for Com port and baud rate



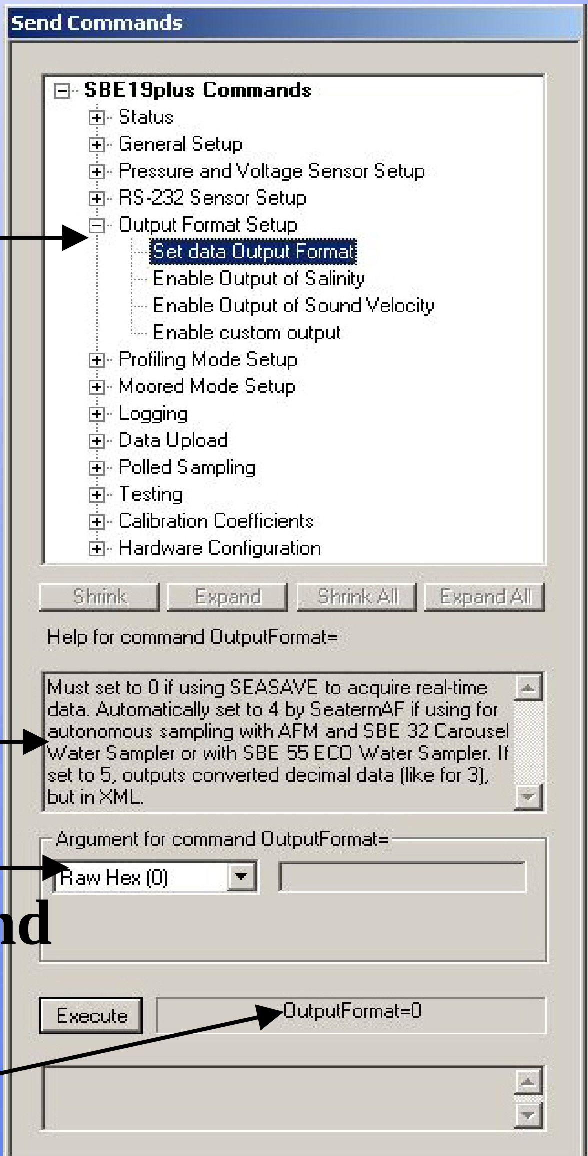

- Then, it attempts to connect, and if successful fills *Send Commands* window with appropriate set of commands

**Select command**

**Description**

***Arguments* for command**

**Actual command**



# Check Onboard Instrument Calibration Coefficients

Confirm calibration coefficients are programmed and are from most recent calibration

- Type command in Command Window: **DC** (DisplayCoefficients)
  **or**
- In Send Commands window, under Status, select *Display Calibration Coefficients* and click Execute button

In this example, coefficients have not been programmed into instrument, and must be entered.

**DC**

SBE37SM-RS232 v4.1  9077

temperature:  not set

TA0 = 0.000000e+00

TA1 = 0.000000e+00

TA2 = 0.000000e+00

TA3 = 0.000000e+00

conductivity:  not set

G = 0.000000e+00

H = 0.000000e+00

I = 0.000000e+00

J = 0.000000e+00

CPCOR = -9.570000e-08

CTCOR = 3.250000e-06

WBOTC = 0.000000e+00

pressure S/N 3537457, range = 508 psia  not set

Etc……………………………………………

# Checking Instrument Status

**Confirm status of your instrument -- show date/time, battery voltage, minimum pump delay, etc.**

- Type **DS** to display status in Command window.
  **Or**
- In Send Command window, click *Status*, click *Display Status and Configuration (or Setup) Parameters* and click Execute button at bottom of window

# Checking Instrument Status: SBE 16*plus* V2 Example

**DS**

SBE 16plus V 2.5 SERIAL NO. 6001 24 Feb 2012 14:11:48 [**DateTime=**]

vbatt = 10.3, vlith = 8.5, ioper = 62.5 ma, ipump = 21.6 ma, iext01 = 76.2 ma,

status = not logging

samples = 0, free = 3463060

sample interval=15 seconds, number of measurements per sample=1 [**SampleInterval=**,**NCycles=**]

pump=run pump during sample, delay before sampling=2.0 sec,
delay after sampling = 0.0 seconds [**PumpMode=**,**DelayBeforeSampling=, DelayAfterSampling=**]

transmit real-time = yes [**TxRealTime=**]

battery cutoff = 7.5 volts

pressure sensor = strain gauge, range = 1000.0 [**PType=**, **PRange=**]

SBE 38=no, SBE 50=yes, WETLABs = no, OPTODE = no, SBE63 = no,
Gas Tension Device=no [**SBE38=**,**SBE50=**, **WetLabs=,Optode=,SBE63=,GTD=**,**DualGTD=**]

Ext Volt 0 = yes, Ext Volt 1 = no [**Volt0=,Volt1=**]

Ext Volt 2 = no, Ext Volt 3 = no [**Volt2=**,**Volt3=**]

Ext Volt 4 = no, Ext Volt 5 = no [**Volt4=**,**Volt5=**]

echo characters = yes [**Echo=**]

output format = raw HEX [**OutputFormat=**]

serial sync mode disabled [**SyncMode=**]

# Checking Instrument Status: SBE 37-SM RS-232 Example

**ds**

SBE37SM-RS232 v4.1  SERIAL NO. 9077  15 May 2012 17:10:48

vMain = 13.37, vLith =  2.86

samplenumber = 9, free = 559231

not logging, stop command

sample interval = 15 seconds

data format = raw Decimal *This will output in frequency  (Output Format=0)*

output salinity

transmit real-time = yes *This will transmit data real-time to screen while running*

sync mode = no

pump installed = yes, minimum conductivity frequency = 3045.5 *This value is for higher salinity waters*

# Setting Date and Time in SeatermV2

To set the clock to Local time or UTC, click Command menu, and select your time preference

**OR**

In Command window: type **DateTime=mmddyyyyhhmmss**

(real-time clock month, day, year, hour, minute, second)

**OR**

In Send Commands Window: Click *General Setup*, click *Set Date and Time*, enter the date and time (mmddyyyyhhmmss), and click Execute button

# Pump Settings

In Command window, type: **MinCondFreq=x**

*where* x = minimum conductivity frequency (Hz)

**OR**

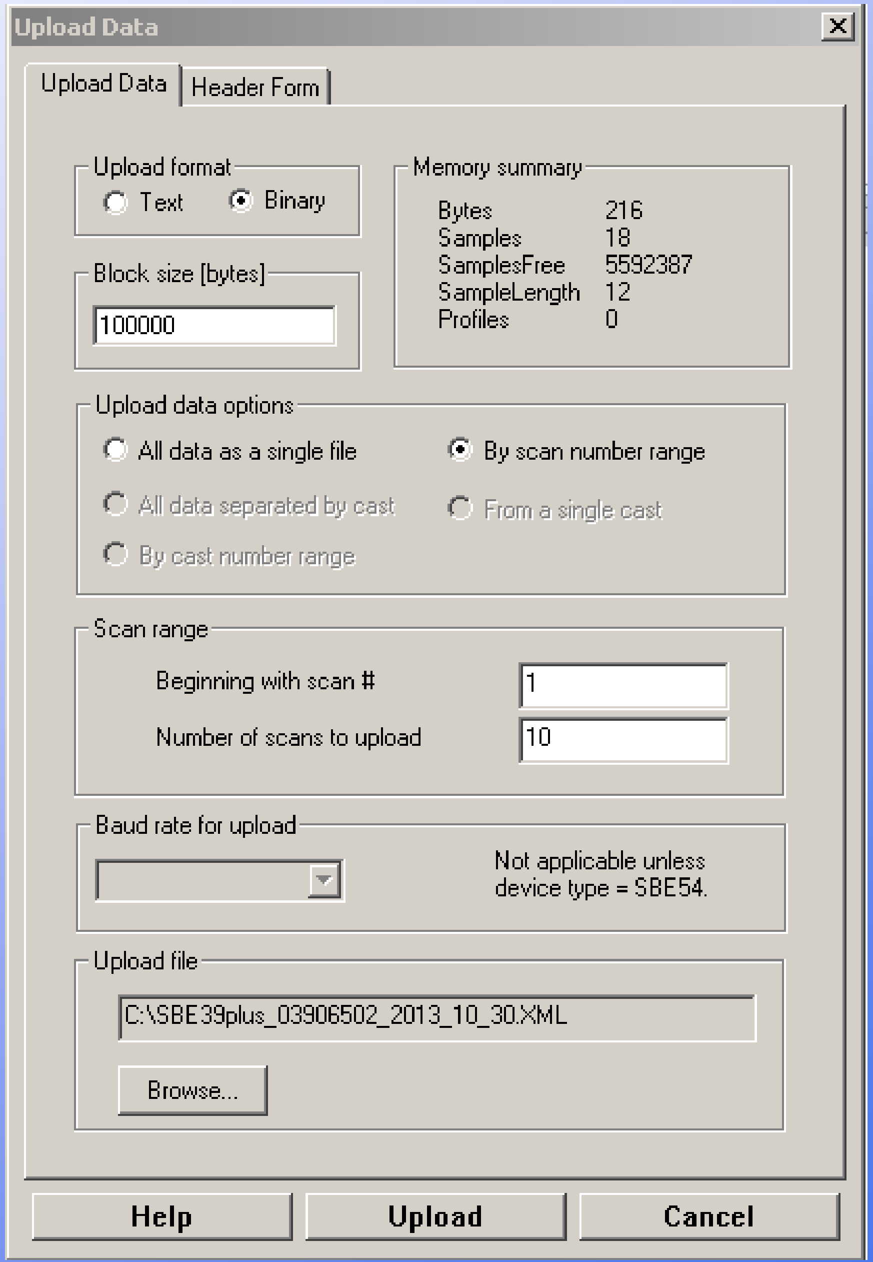
In Send Commands window, click *Pump Setup*, click *Set Minimum Conductivity Frequency (Hz) to Enable Pump*, enter frequency, and click Execute button.

# Files Created with Autonomous Moored CTDS

- Moored Instruments
  - Older versions of firmware upload data in format that can be directly converted in Seaterm
    - These do NOT require a *.con* or *.xmlcon* file (configuration file)
    - Use any configuration file…software uses internally stored coefficient data to compute engineering values
  - New Versions upload HEX Files that are then converted with SBE Data Processing
    - These DO require a *.xmlcon* (configuration file) to convert from Hexadecimal to Engineering

# Upload Types

- Moored instruments
  - All data as a single file: All scans
  - By scan number range: Enter beginning scan number and number of scans to upload
  - ALWAYS SAVE THE COMPLETE RAW XML FILE as a backup



# Activity: Setting up, Logging, and Uploading Data

- Use SeatermV2 to view status, then set up your SBE 37-SM MicroCAT, start and stop logging, and upload data; see notes for instructions

# Converting Sensor Output to Scientific Units

- SBE 16*plus* and 16*plus* V2 report data in scientific units or as frequencies and voltages
  - Data uploaded as .hex, use Data Conversion
- Older SBE 16 stores and reports data as frequencies and voltages
  - Data uploaded as .hex, use Data Conversion
- Newer SBE 37s – SeatermV2 uploads SBE 37 data to *.xml* file, converts to .hex file, and creates *.xmlcon* configuration file
  - Use Data Conversion to convert to engineering units using calibration data in .xmlcon file.
  - If you only have *.xml* data file, use *Convert .xml Data File* in SeatermV2 *Tools* menu to convert to *.hex* file
- SBE 39*plus* – SeatermV2 uploads SBE 39*plus* data to *.xml* file, converts to .asc file (for plotting in Plot39)
  - You can also convert to .cnv file

# Converting SBE 39 and Older SBE 37 Data

- For SBE 39 and older SBE 37 MicroCATs, use older terminal program Seaterm
  - Click *Upload* button
  - Upload in engineering units in ASCII (*.asc*) format
  - Click *Convert* button to convert *.asc* file to *.cnv* file

# SBE 16*plus* V2 Headers

DH1,2

hdr 1 30 Oct 2007 09:12:07 samples 1 to 34, int = 60, stop = stop cmd

hdr 2 30 Oct 2007 12:30:33 samples 35 to 87, int = 60, stop = stop cmd

Displays:

- Header number
- Date and time for when header was written
- First and last sample for header
- Interval between samples
- Reason logging was halted

Note: GetHeaders:1,2 is the equivalent of DH1,2

# SBE 16 Data Format

- Data is in hexadecimal format, T and C only
- Adding auxiliary sensors adds bytes to the scan

```
S>dd31,10
8A7503DB
8A7D03DB
8A9203DB
8A8D03DB
8ABB03DB
8AD803DB
8AE103DB
8AF603DC
8B0503DC
8B0603DB
S>
```

# SBE 16*plus* Data Formats

- Raw data in hexadecimal
  0442F20A8A7309B04A4D2C28730D24
  04429D0A8A6F09B0494D4828730D42
  0442210A8A6C09B04A4D3A28730D60
- Converted data in hexadecimal
  32505C0F51F601867A28730D24
  3253760F51EA01867A28730D42
  3257F70F51E101867A28730D60
- Raw data in decimal
  279282, 2698.449, 634954, 1.5073, 03 Jul 2001, 11:57:24
  279197, 2698.434, 634953, 1.5094, 03 Jul 2001, 11:57:54
  279073, 2698.422, 634954, 1.5084, 03 Jul 2001, 11:58:24
- Converted data in decimal
  22.9737, 0.00402, -0.037, 03 Jul 2001, 11:57:24
  22.9817, 0.00401, -0.038, 03 Jul 2001, 11:57:54
  22.9932, 0.00400, -0.038, 03 Jul 2001, 11:58:24

# SBE 16*plus* V2 Data Formats

- Raw data in hexadecimal

  0442F20A8A7309B04A4D2C28730D24
  04429D0A8A6F09B0494D4828730D42
- Converted data in hexadecimal

  32505C0F51F601867A28730D24
  3253760F51EA01867A28730D42
- Raw data in decimal

  279282, 2698.449, 634954, 1.5073, 03 Jul 2001, 11:57:24
  279197, 2698.434, 634953, 1.5094, 03 Jul 2001, 11:57:54
- Converted data in decimal

  22.9737, 0.00402, -0.037, 03 Jul 2001, 11:57:24
  22.9817, 0.00401, -0.038, 03 Jul 2001, 11:57:54
- Converted data in XML

<?xml?><datapacket><hdr><mfg>Sea-Bird</mfg><model>16plus</model>
<sn>1606001</sn></hdr><data><t1> 22.9737 </t1><c1> 0.00402 </c1>
<p1> -0.037 </p1<dt>2007-11-07T07:34:35</dt></data></datapacket>

# SBE 37 Data Formats

- **Firmware version < 3.0** (SM, SMP, SI, SIP)

  Format=1: 23.0161, 0.00002, 0.076, 08 Mar 2008, 17:10:23

  Format=2: 23.0161, 0.00002, 0.076, 03-08-2008, 17:10:23

- **Firmware version ≥ 3.0** (SM, SMP, SI, SIP, IM, IMP)

  OutputFormat=1:
  23.0161, 0.00002, 0.076, 08 Mar 2008, 17:10:23

  OutputFormat=2 (SM, SMP, SI, SIP) or 4 (IM, IMP):
  <?xml version="1.0"?><datapacket><hdr><mfg>Sea-Bird</mfg>
  <model>37SM</model><sn>03709999</sn></hdr>
  <data><t1> 23.0161</t1><c1> 0.00002</c1><p1> 0.076</p1>
  <dt>2008-03-08T 17:10:23</dt></data></datapacket>

# SBE 39 Data Format

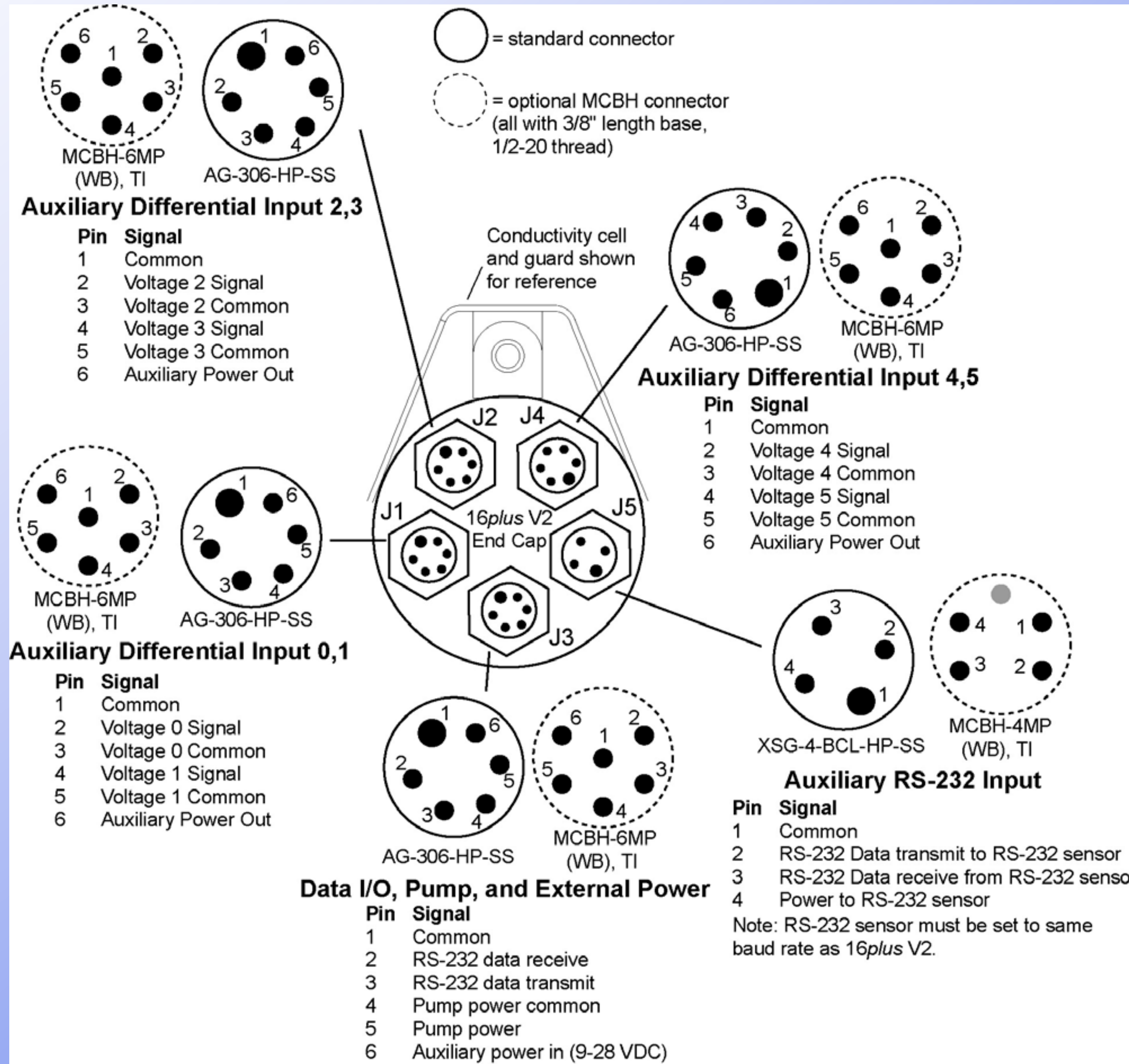
```
S>
S>dd1,8
start time =  03 Oct 2001  14:41:12
sample interval = 5 seconds
start sample number = 1

 25.4562,   -0.031, 03 Oct 2001, 14:41:12
 25.4581,   -0.031, 03 Oct 2001, 14:41:17
 25.4625,   -0.029, 03 Oct 2001, 14:41:22
 25.4642,   -0.029, 03 Oct 2001, 14:41:27
 25.4682,   -0.029, 03 Oct 2001, 14:41:32
 25.4715,   -0.029, 03 Oct 2001, 14:41:37
 25.4750,   -0.029, 03 Oct 2001, 14:41:42
 25.4704,   -0.029, 03 Oct 2001, 14:41:47
S>
```

# Activity: Converting and Plotting Time Series Data

- Use Seaterm (**not** SeatermV2) to convert data from an older SBE 37, and then use Derive and Sea Plot to calculate and plot salinity and density; see notes for instructions

# Auxiliary Sensors

- CTD status response **(DS)** in SeatermV2 indicated if auxiliary sensor channels are enabled or disabled
  - If channel is not enabled, CTD will not supply power to sensor or acquire data from sensor



# Auxiliary Sensors: *WET Labs ECO-FL Example*

- ECO-FL can be used for profiling or moorings
  - Profiling – Open bio-wiper when power applied, keep it open, and sample and transmit data continuously
  - Moored – Open bio-wiper when power applied, sample and transmit data, close bio-wiper; repeat
- Set up ECO for moored mode in WET Labs ECOView software or a terminal program
  - !!!!! (access sensor command set)
  - $set 1 (note space between command and number)
  - $pkt 1 (note space between command and number)
  - $sto (store settings in memory)

# Auxiliary Sensors:

## *WET Labs Example (ASV Setting Examples)*

**ECO Chlorophyll Fluorometer**

| ASV Value | Scale Factor | Range | Resolution |
|---|---|---|---|
| 4 | 26 | 0-125 ug Chl/l | 0.03 ug Chl/l |
| 2 | 13 | 0-60 ug Chl/l | 0.015 ug Chl/l |
| 1 | 6 | 0-30 ug Chl/l | 0.007 ug Chl/l |

Send following commands to set ASV setting:

```
!!!!!!
$asv 1, 2, or 4
```

# Auxiliary Sensors:
## *WET Labs ECO-FL Example*

- Plug ECO into voltage channel 0 (can be any channel) on 16*plus* V2; connect CTD to computer
- Run SeatermV2; send commands to 16*plus* V2
  - **Biowiper=y** (provide enough time for bio-wiper to close after sending a status command)
  - **MM** (moored mode)
  - **Volt0=y** (enable voltage channel 0)
  - **SetVoltType0=ECOFL** (sensor type on voltage channel 0)
  - **SetVoltSN0=12345** (serial number of sensor on voltage channel 0)
  - (continued on next slide)

# Auxiliary Sensors:
## *WET Labs ECO-FL Example*

- More setup in SeatermV2
  - **DelayBeforeSampling=4** (provide enough time after applying power for ECO-FL bio-wiper to open before taking a sample)
    - *Note:* **DelayBeforeSampling=4** is sufficient if ECO-FL is set up to take a single measurement for each sample ($pkt 1); increase it if taking more measurements for each sample.
  - **DelayAfterSampling=4** (provide enough time for ECO-FL bio-wiper to close after taking a sample, before turning off power)
  - Send **DS** (verify setup)

# Auxiliary Sensors:
# *WET Labs ECO-FL Example*

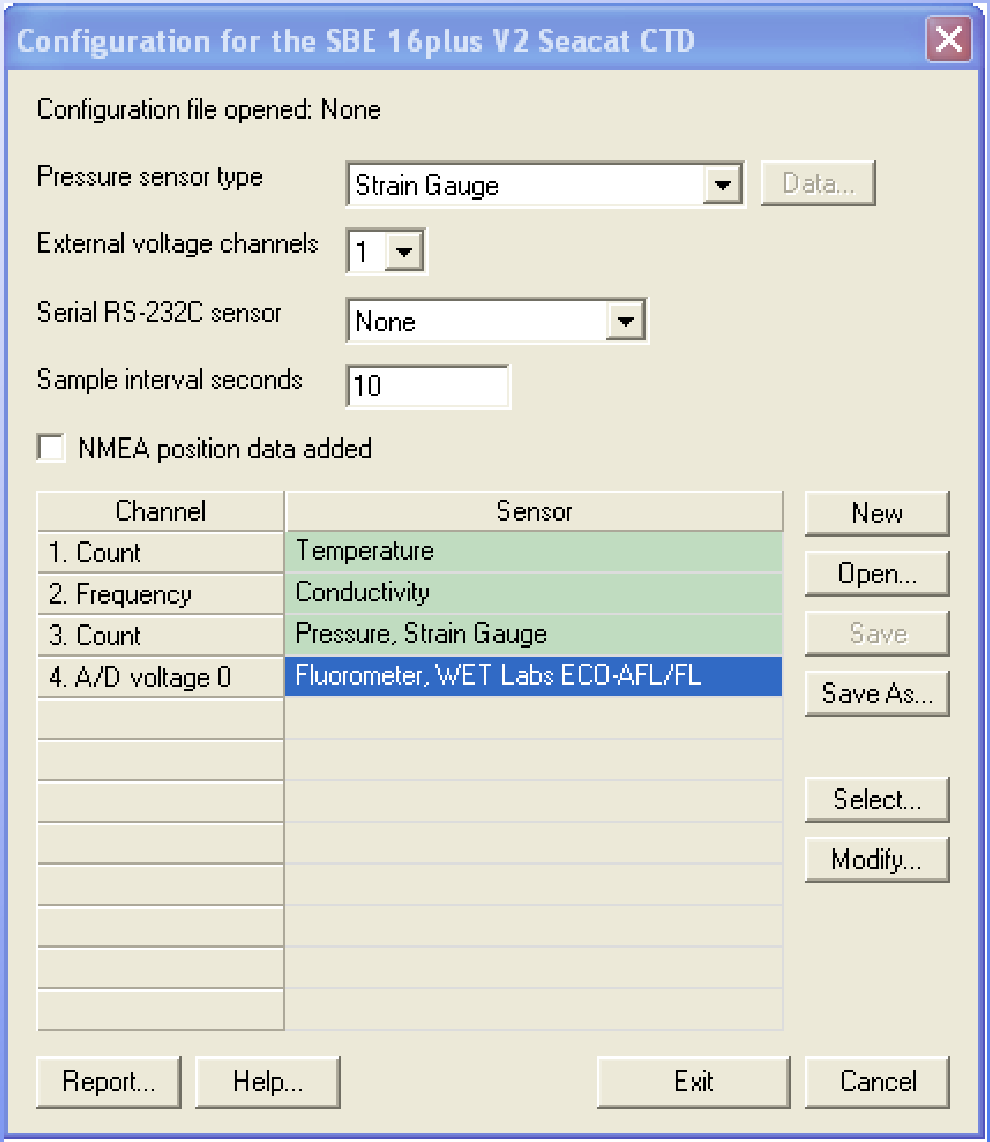
**When done with the setup, the status (DS) response should look like this (items not shown in bold may vary):**

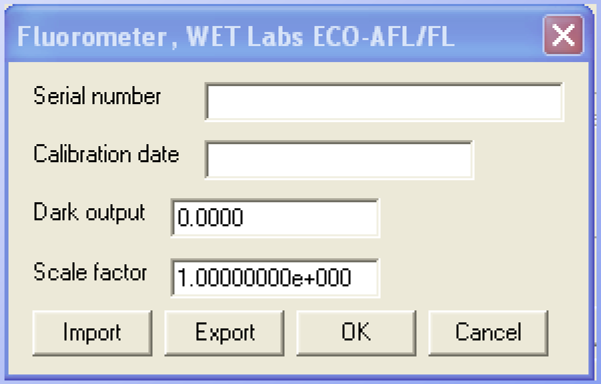
SBE 16plus V 2.5 SERIAL NO. 4000 24 Jan 2011 14:02:13
vbatt = 10.1, vlith = 8.9, ioper = 61.9 ma, ipump = 20.8 ma, iext01 = 76.2 ma,
status = not logging
samples = 0, free = 3463060
sample interval = 60 seconds, number of measurements per sample = 1
pump = run pump during sample, **delay before sampling = 4.0 seconds, delay after sampling = 4.0 seconds**
transmit real-time = yes
battery cutoff = 7.5 volts
pressure sensor = strain gauge, range = 1000.0
SBE 38=no, SBE50=no, WETLABS=no, OPTODE=no, SBE63=no, Gas Tension Device=no
**Ext Volt 0 = yes,** Ext Volt 1 = no
Ext Volt 2 = no, Ext Volt 3 = no
Ext Volt 4 = no, Ext Volt5 = no
echo characters = yes
output format = raw HEX
serial sync mode disabled

# Auxiliary Sensors:

## *WET Labs ECO-FL Example*

- Set up configuration (.xmlcon) file in Seasave or SBE Data Processing



# Auxiliary Sensors:

## *WET Labs ECO-FL Example (Calibration Sheet Example)*

### *ECO* Rhodamine Fluorometer Characterization Sheet

Date: 9/21/2010 S/N: FLRHRT-2040

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Rhodamine concentration expressed in ppb can be derived using the equation:

**Rhodamine (ppb) = Scale Factor * (Output - Dark Counts)**

| | Analog Range 1 | Analog Range 2 | Analog Range 4 (default) | Digital |
|---|---|---|---|---|
| **Dark Counts** | 0.076 | 0.045 | 0.030 V | 50 counts |
| **Scale Factor (SF)** | 12 | 23 | 47 ppb/V | 0.0141 ppb/count |
| **Maximum Output** | 4.92 | 4.92 | 4.92 V | 16380 counts |
| **Resolution** | 0.8 | 0.8 | 0.8 mV | 1.0 counts |

Ambient temperature during characterization 21.5 ℃

# Auxiliary Sensors:

## *WET Labs Example (Calibration Sheet Example)*

### FLNTU Characterization Sheet

Date: July 30, 2012 S/N: FLNTUS-2771

#### Chlorophyll Scale Factor

Chlorophyll concentration expressed in µg/l can be derived using the equation:

CHL (µg/l) = Scale Factor x (Output - Dark Counts)

| | Analog | | Digital | |
|---|---|---|---|---|
| **Dark Counts** | 0.072 | V | 43 | counts |
| **Scale Factor (SF)** | 10 | µg/l/V | 0.0118 | µg/l/count |
| **Maximum Output** | 4.98 | V | 4130 | counts |
| **Resolution** | 0.9 | mV | | |
| Ambient temperature during calibration | 22.3 | °C | | |

#### Nephelometric Turbidity Unit (NTU) Scale Factor

Turbidity units expressed in NTU can be derived using the equation:

NTU = Scale Factor x (Output - Dark Counts)

| | Analog | | Digital | |
|---|---|---|---|---|
| **Dark Counts** | 0.000 | V | 50 | counts |
| **NTU Solution Value** | 3.77 | V | 3100 | counts |
| **Scale Factor (SF)** | 5 | NTU/V | 0.0061 | NTU/count |
| **Maximum Output** | 4.98 | V | 4130 | counts |
| **Resolution** | 1.0 | mV | 1.0 | counts |
| Ambient temperature during calibration | 22.3 | °C | | |

# Auxiliary Sensors:

## *WET Labs ECO-FL Example*

- Mount ECO sensors with:
  - Clear path in front of optics face
    - Allow as much free space in front of sensor face as possible
    - Ensure cables are tied to CTD/frame so no cables/ties are able to float in front of sensor face
  - Detector pointed away from CTD body

**Downward Facing**

**Nothing In the Path**

# Auxiliary Sensors:

## *WET Labs ECO-FL Example (Testing ECO Functionality)*

- To test ECO functionality:
  - Begin with ECO pointed into open space
  - Place a fluorescent stick/hand 6-8” (15-20 cm) away, in front of sensor face
  - Slowly move stick/hand toward sensor
    - Voltage should increase as stick/hand gets closer to sensor face
  - Slowly move stick/hand away from sensor face
    - Voltage should decrease as distance increases



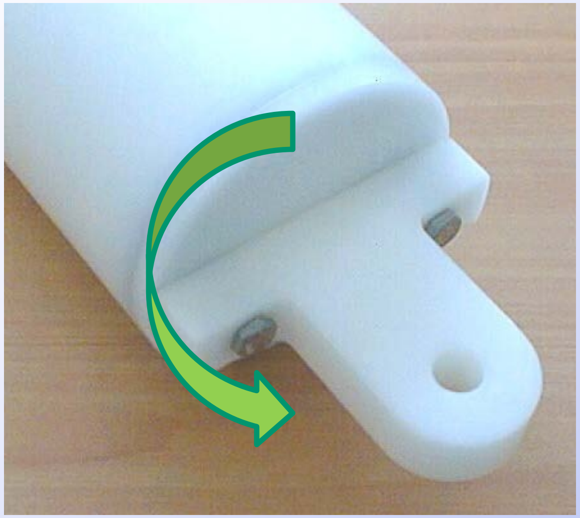

# Preparing for Deployment

- What about Anti-foulant paints?
- Install fresh batteries
- Check outputs from temperature and conductivity and other sensors
- Set internal clock
- Set ID for instruments using inductive modems or RS-485
- Check all cabling, and lubricate and reset underwater connections

# Anti-Foul Paint

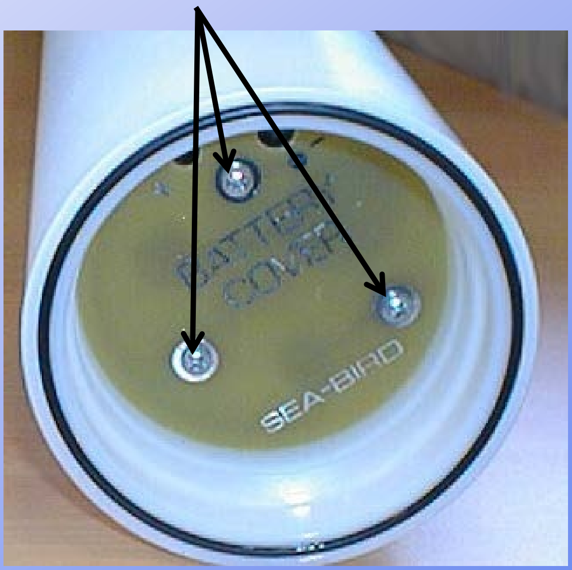
- Do **NOT** paint instruments with marine anti-fouling bottom paint, as paint will contaminate calibration bath
  - If instrument is painted, all paint must be removed from instrument prior to its return to SBE for re-calibration
  - 3M Tape or the more expensive 3M-Copper tape is an effective anti-foulant that can be used and removed for easy cleaning

# Changing Batteries in SBE 16*plus* V2



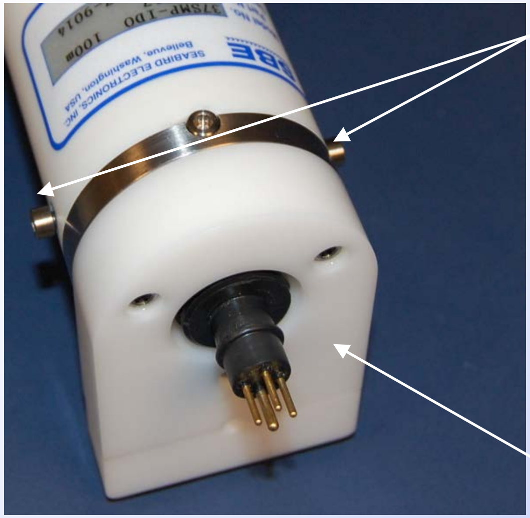
**Unthread cap by rotating counter-clockwise**

**Remove Phillips-head screws and washers**




**Install new batteries, with + terminals against flat battery contacts and - terminals against spring contacts.**

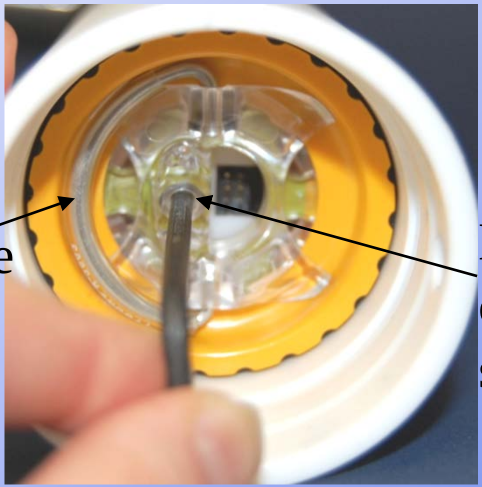
# Changing Batteries in SBE 37



2 screws securing connector end cap (screws shown partially removed)

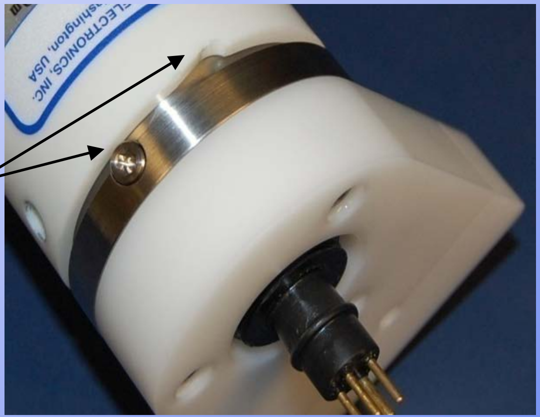
Cable mounting guide

Handle



Loosen captured screw

Twist end cap counter clockwise, twisting cap screw out of machined slot; end cap releases from housing



Molex connector

O-rings

# Check Connectors and Cables

- Check all the cabling
- Remove the cables from their bulkhead connectors
  - Inspect the bulkhead connectors and mating pieces
  - Clean and lubricate the bulkhead connectors
  - Burp all air out of the connectors when they are reseated

# Example: When connectors between a CTD and a sensor become a problem: Moored Oxygen SBE 43

**CLUES**

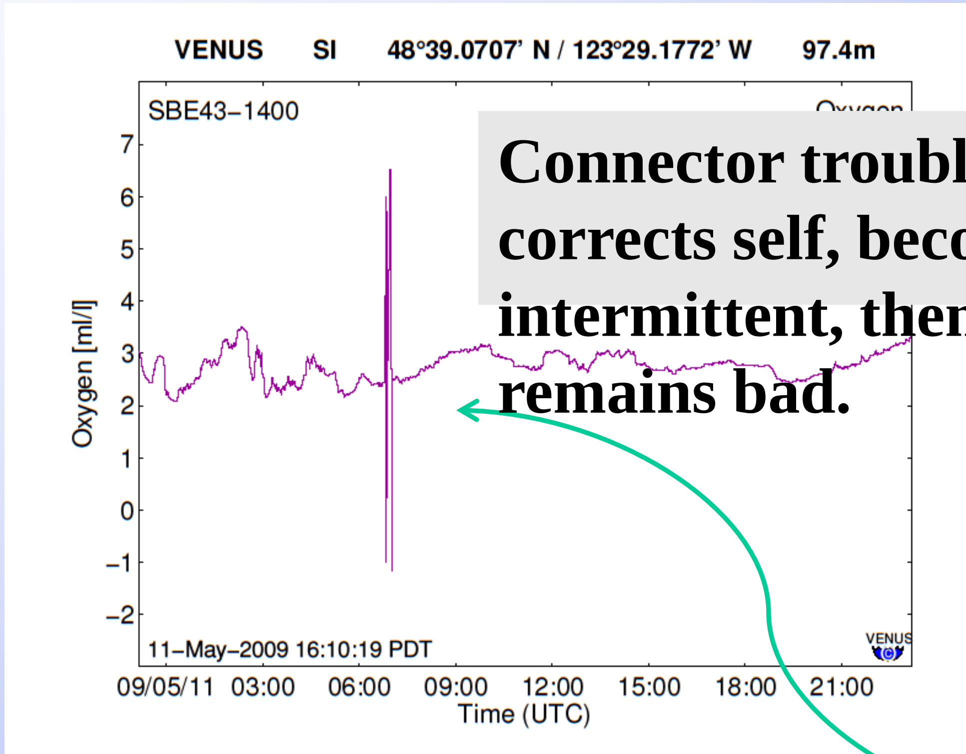
**Erratic Data**

**Intermittent (good, bad, then good)**

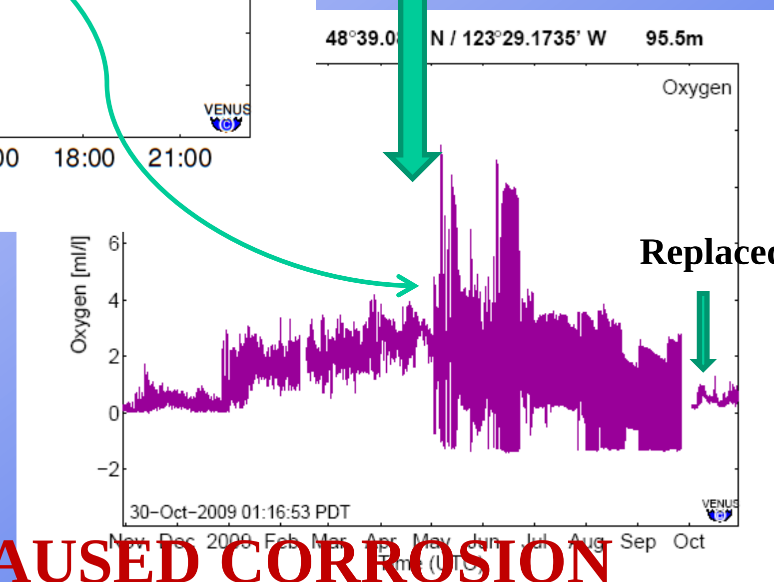
**Trending correct**

**Clog? Fouling?**

**Cables? Electrical?**

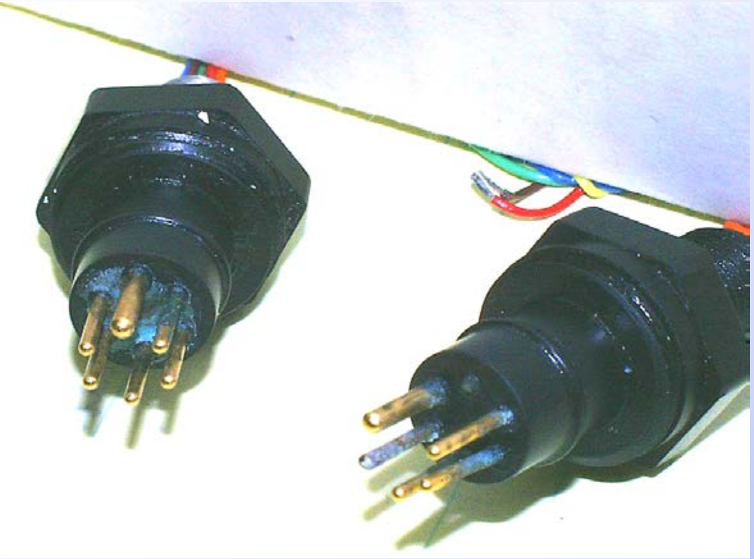



**Connector trouble starts, corrects self, becomes intermittent, then eventually remains bad.**




**POORLY SEATED CONNECTION CAUSED CORROSION ON CONNECTOR**

# When Underwater Connectors Go Bad



These were the connectors on recovery from the previous page DO plot showing Intermittent data.

**Look for signs of corrosion before plugging in in sensor.**
**Be sure connectors are burped and seated.**
**Align the pins and do not use too much lubricant.**

# Re-Install Cables and Dummy Plugs

- Clean and re-lubricate connector boots, dummy plugs, and connectors
  - Clean with Kimwipes or other lint free cloth or wipe
  - SBE recommends Dow Corning® DC4 for lubrication
- Never use petroleum-based products


# Preparing for Deployment

- Check memory, clear if necessary
  - (not all SBE 37s have internal memory)
  - Provides back up to real-time system
  - old data will NOT be overwritten
- Set Start Logging Date and Time
- Set sampling interval
  - be sure to check your battery endurance!

# *Sample* QUICKSTART Checklist for SBE 37

SBE37 RS232 SN ______________________

Operator _______________________Date ______________ Checked by_______

Communications tab, Configure, Com Port __________, Baud 9600

DC (display coefficients) _____*check to make sure they are in there and correct*

DS (display status) ______ *look at what you want to change*

Set Date/Time ________________________________________(Local or UTC)

vMain ____________________________________________________

Sample Interval ____________________________________________

Data format _______________________________________________

Output Salinity (is it enabled?) _________ Mooring Depth Entered_______

Transmit realtime __________________________________________

Minimum Conductivity Frequency _____________________________

# Preparing for Deployment

- SBE 16*plus* series:
  - Check that you are getting outputs from all enabled sensors
- SBE 37 series:
  - Check that you are getting outputs from all sensors
- ALWAYS keep an archive copy of RAW, non-corrected data before initializing logging
  - This allows a return to original data for correction or reprocessing later on

# Verify Functionality

- Log data on instrument, then upload and review

**or**

- View data real-time using SeatermV2
  - Establish communications with instrument
- Verify you have most recent calibration coefficients
  - Check for both electronic and hard copies

# Pre-Deployment Sensor Check

- Use the **TS** command to check nominal functionality of all sensors
- Also use to check conductivity **zero frequency** against calibration sheet
  - Should be within a few Hz of the Zero Conductivity value
  - Be sure to do this on a dry conductivity cell (no water or droplets)

# Record Some Data

Log and check some data

A clean tub full of water is a good way to do this, but it can also be done in air

Verify recorded values seem reasonable

Compare to another instrument you know is good

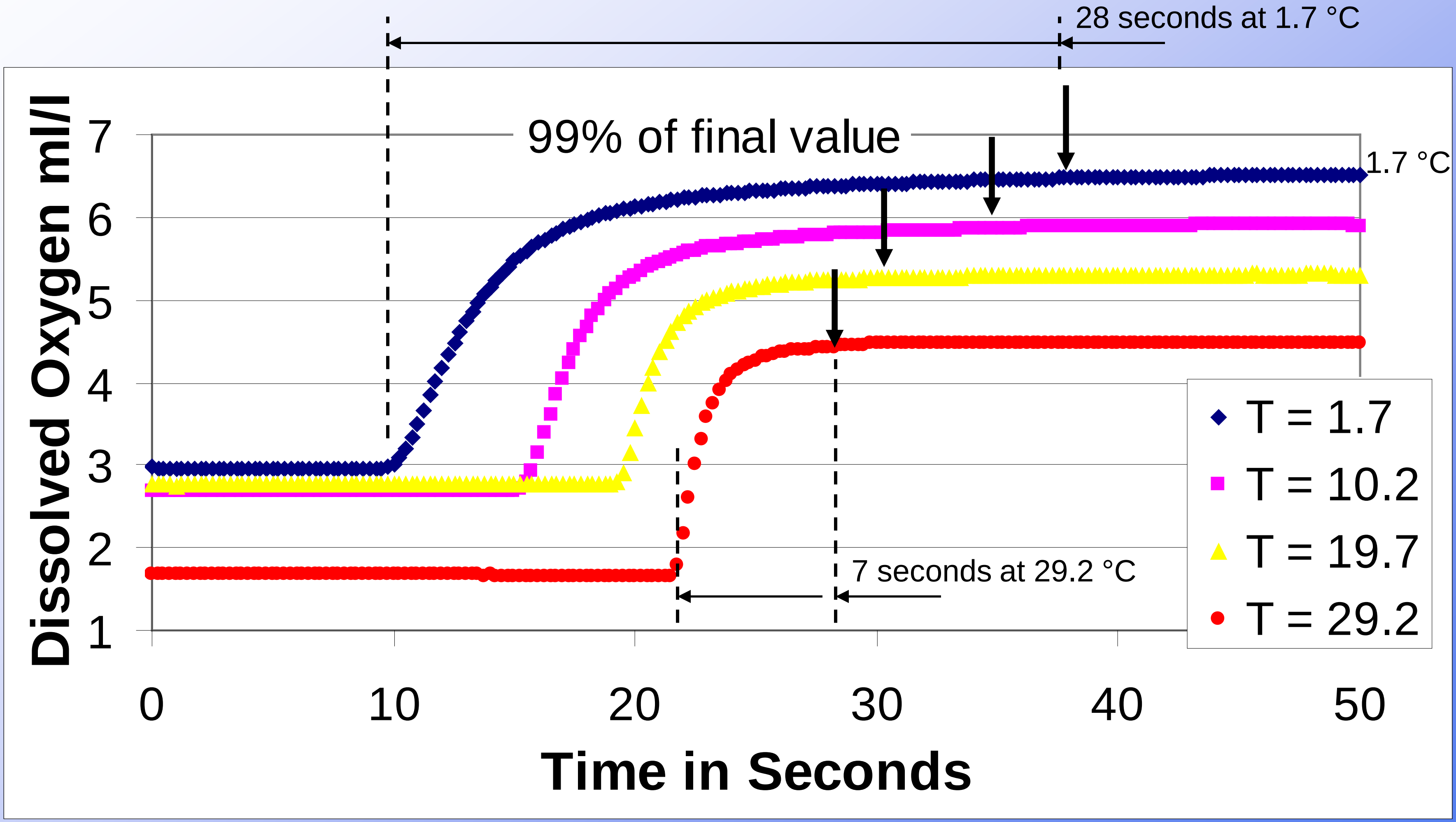
# Pump Mode Settings on Moored Instruments

- If moored in an area with large thermal gradients, pump for a longer period of time to eliminate cell thermal mass effects on conductivity measurement
- Time required for DO measurement equilibration is dependent on sensor's membrane thickness and on water temperature
  - See User's Manual for your instrument about pump option settings for DO

# Example: SBE 16*plus* and 16*plus* V2 Pump Modes

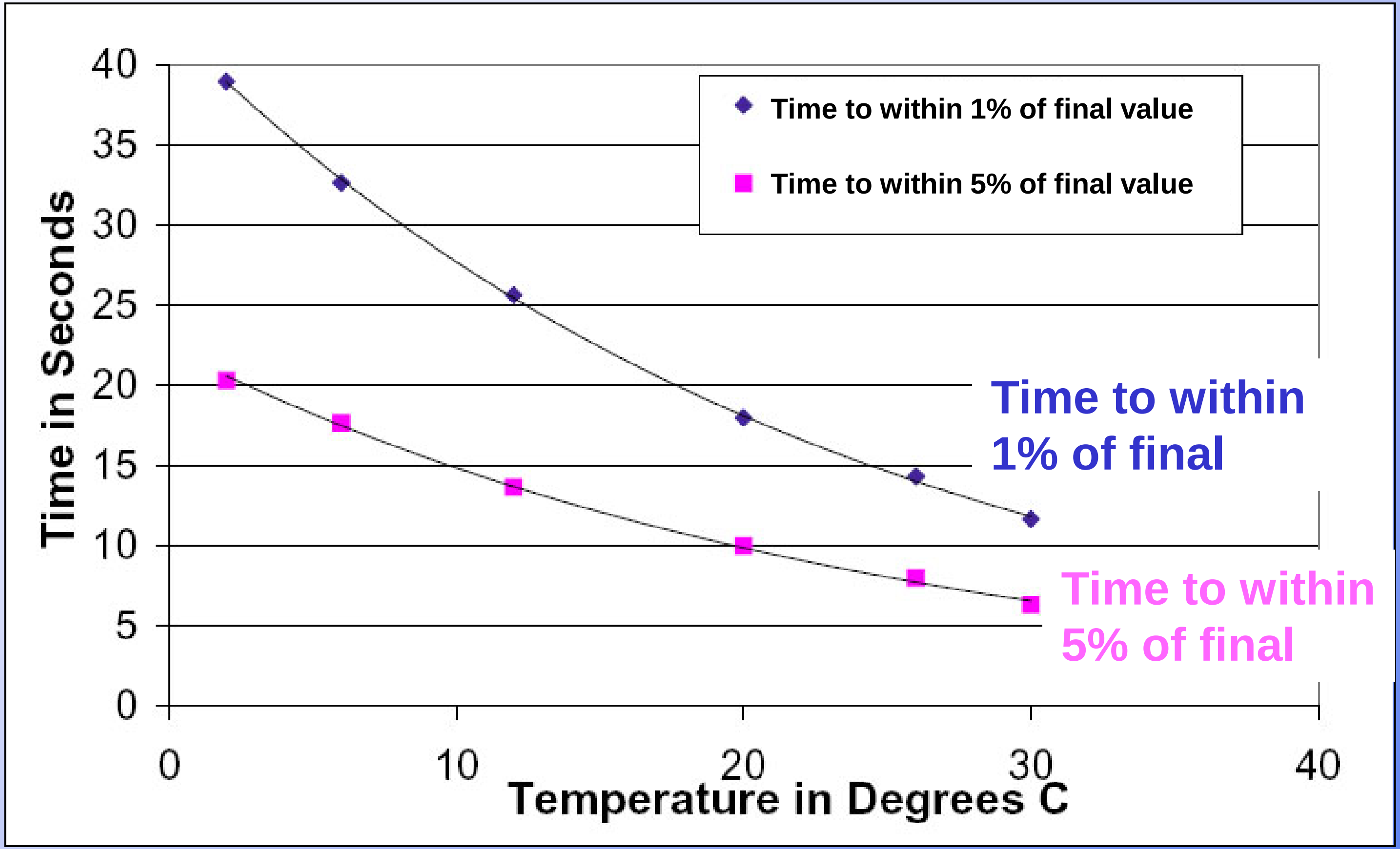
- No pump
  - No mystery here
- Pump for 0.5 seconds before sample
  - T & C only, ventilates the cell, saves power
- Pump on for entire sample period plus for some period prior to the sample
  - For auxiliary sensors with long time constants
    - Dissolved oxygen
    - Fluorometer

# Stabilization of Moored Dissolved Oxygen (DO) Sensors




For a **0.5-mil** Membrane

# Stabilization Time Versus Temperature of Moored DO Sensors




For a **1.0-mil** Membrane

# Pump Functionality and Problems

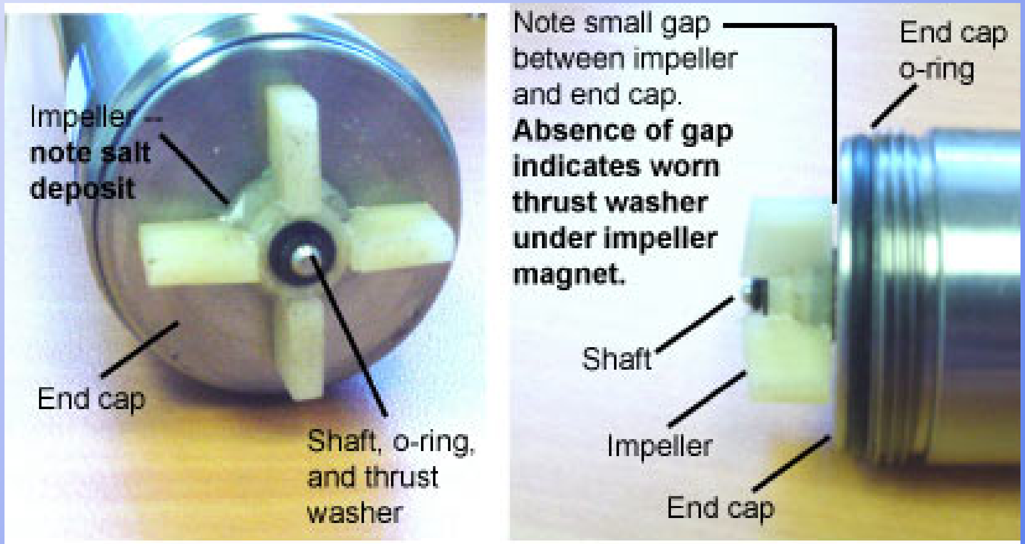
- Could be pump itself
  - Hook pump up directly to a 12 VDC power supply, and verify pump impeller is spinning
  - Swap pump out if a spare is available
  - Inspect pump
- Could be cable
  - Install a spare cable if possible
  - Wiggle cable to check for intermittent connection

# Pump Testing

- Test pump (standard pump circuitry)
  - With instrument connect to your compute, run Seaterm V2, use the PUMP ON command to see if the pump turns on
  - Verify pump impeller is spinning
    - Listen for pump to turn on
    - Look for disturbance at exhaust of pump if in the water
    - Put your finger at the intake or exhaust to feel if there is water movement

# What if Pump Is Not Running?

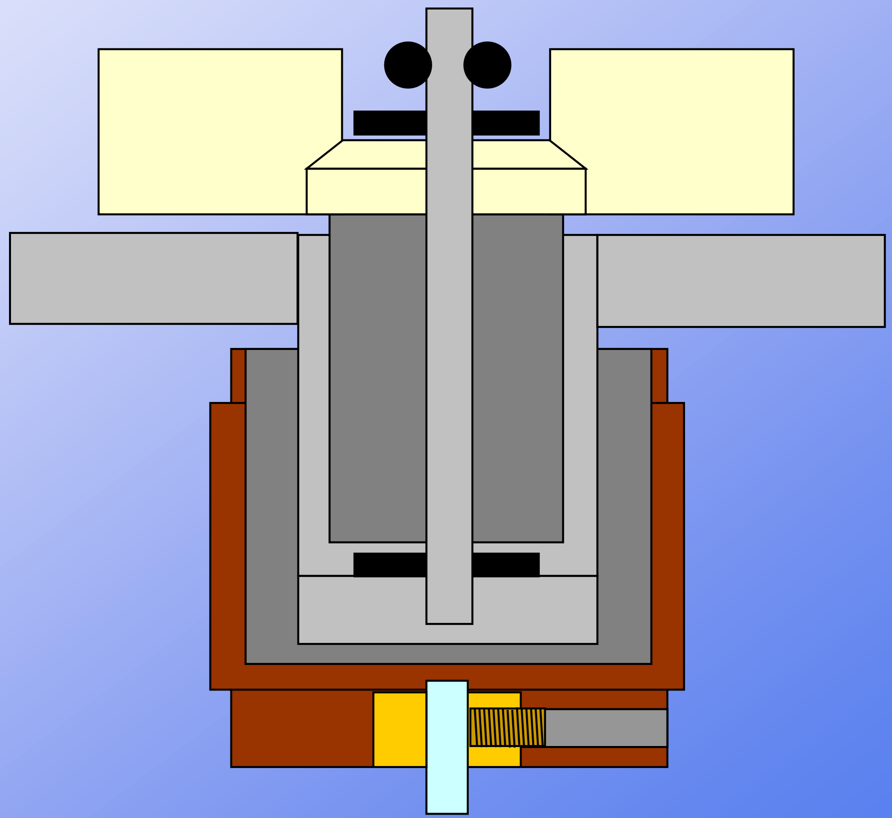
- If pump is not running, remove pump head and inspect impeller and thrust washers to determine if a clogged impeller is problem
- Pump impeller can become stopped by sand, sediment, and salt crystals




*SBE 5T with Pump Head Removed*

# Pump Impeller

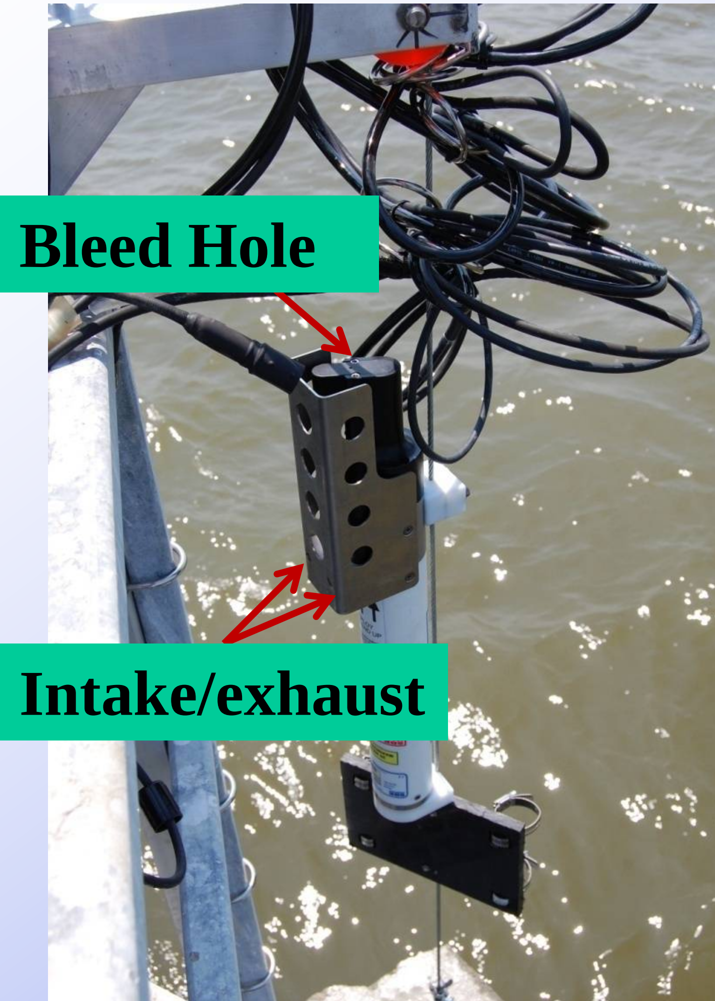
- Periodically inspect impeller thrust washers and pump impeller housing
- Replace thrust washers and impeller retaining O-ring annually or as required
  - Kits available from SBE



# Configure Sensors and CTD Hardware for Clean Data Collection

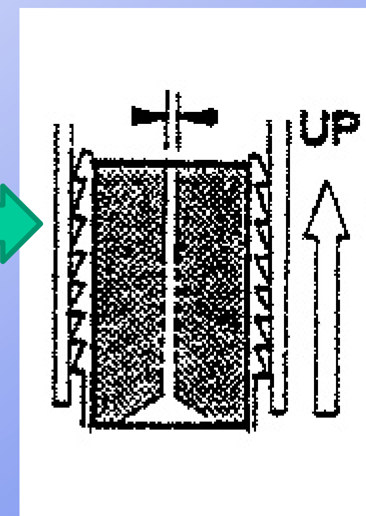
- Ensure that sensors sample same water
  - Plumbing
  - Place T, C sensors together and duct
- CTD deployment orientations
  - (vertical vs. horizontal)
- Ensure that sensors sample undisturbed water
  - No flow blockage/distortion on frame
  - No foreign thermal mass or wakes

# Plumbing for Vertical Deployment




**SBE 37**

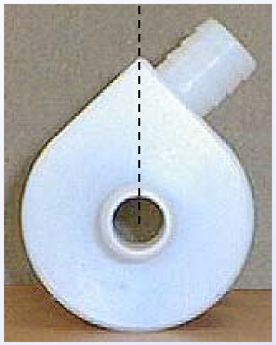
**Y-Fitting with bleed hole**
**Detail for SBE 16*plus***

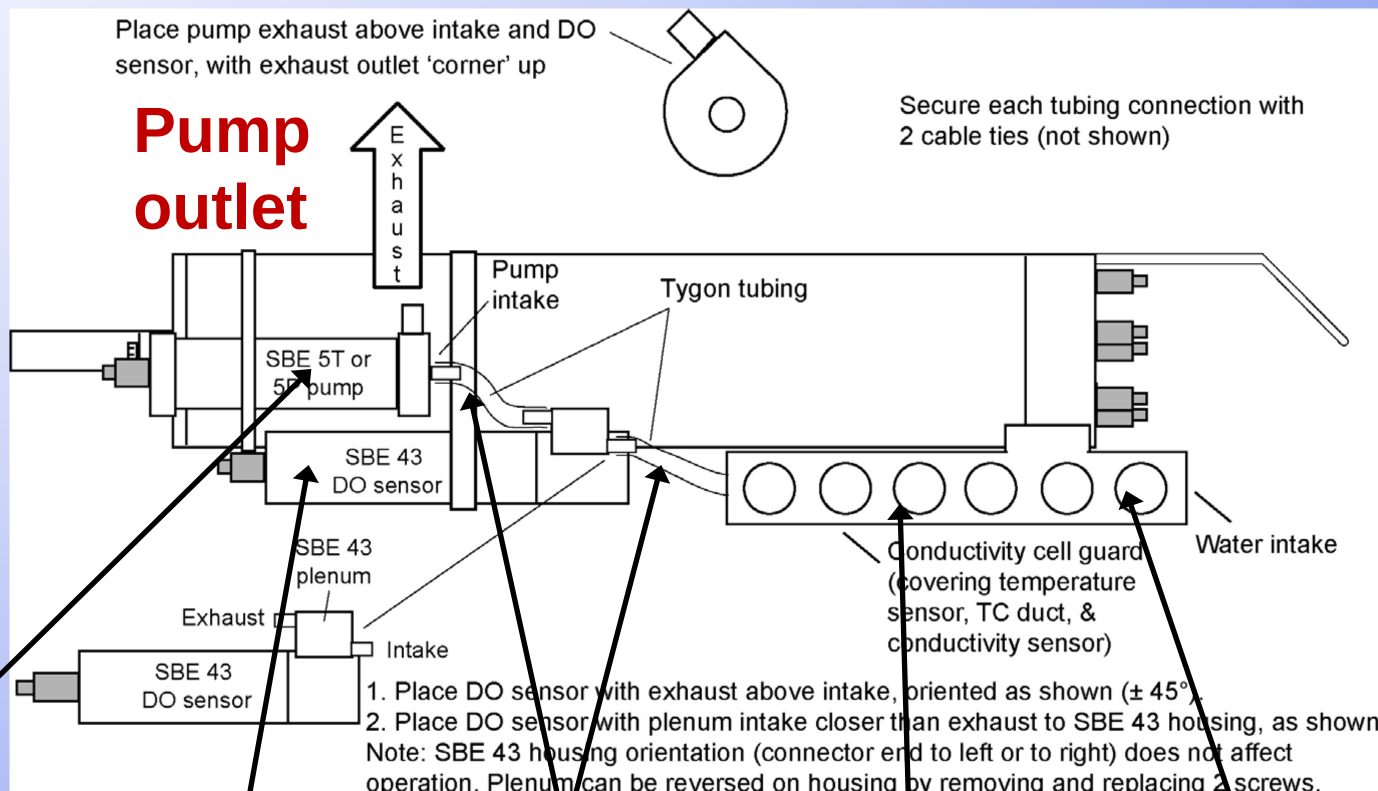



**Hole allows**
**air out of plumbing at**
**Highest point in**
**plumbing.**
**Keep tube above**
**full of water!!!**

# Horizontal Deployment Applications

vertical






**Pump (vertically above DO)**

**DO sensor**

**Vinyl tubing**

**Conductivity sensor**

**Temperature sensor**

SBE

# Make a Neat Underwater Package

- Tie or tape all loose cabling to frame of package
  - Loose cables can move as package rises or drops
    - Results in wire fatigue
- Make sure no cables are in path of inlet to temperature sensors
- Instrument with aluminum housing: check zinc anodes occasionally
  - Grounding problems can cause zinc anodes to disappear

# Removing Air from Plumbing

- On deployment or in test bath, try to expel air from plumbing
  - Moorings deeper than 10 m will expel air
  - For shallow moorings < 10 m, fill plumbing with DI water prior to deployment
- Observe bubbles coming out of bleed-hole or pump exhaust
  - Move instrument under water to “shake” air out
  - Pre-fill with water at deployment if no chance of freezing

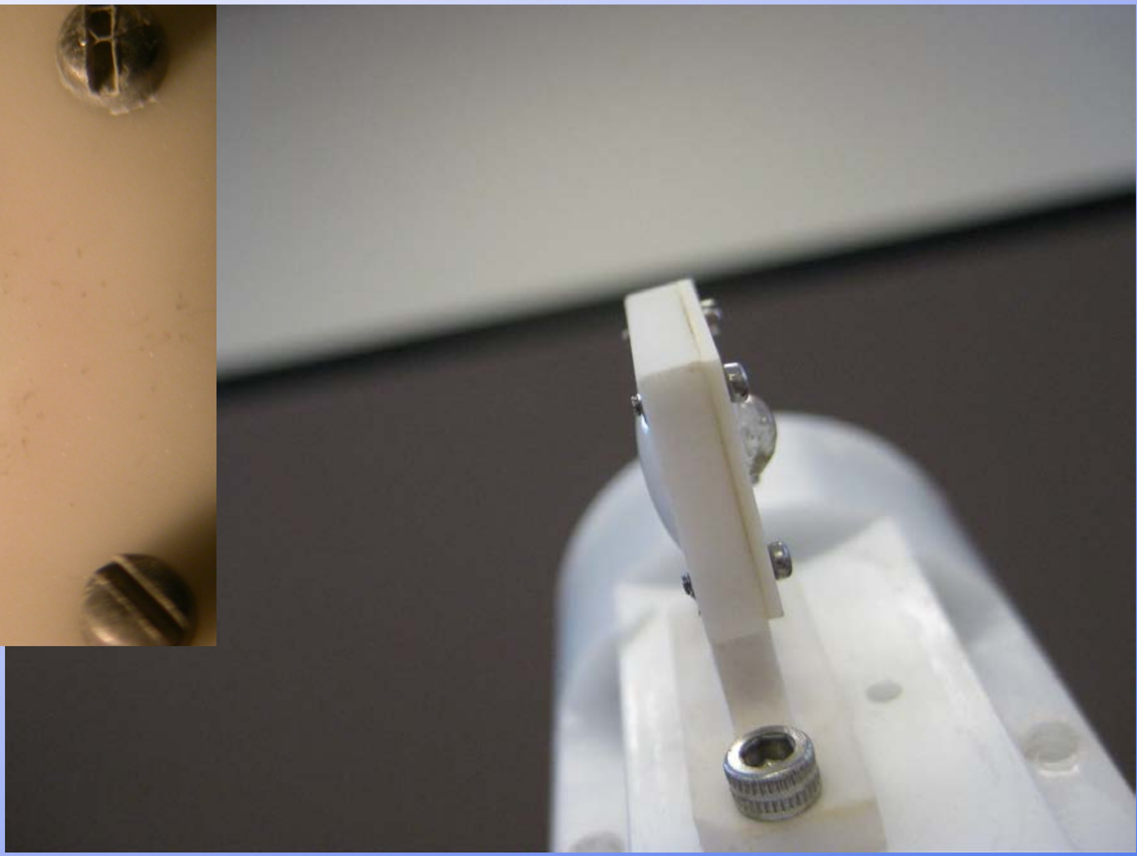
# Deploying in Very Cold Places

- Glass conductivity cell is subject to breakage due to water freezing in cell
- Remove all water from conductivity cell
  - Repeated ice formation (film or droplets) on electrodes can degrade calibration at 0.001 - 0.020 PSU level
- Make a solution of 1% triton in sterile seawater
  - Use 0.5 micron filtered seawater or boiled seawater
- Never use anti-freezes like glycol or alcohol
- SBE 43 Oxygen Sensor – prevent freezing by keeping indoors or in area above freezing

# Frozen SBE 43 Oxygen Sensor

Electrolyte will freeze ~-4 deg C

**Split Open Membrane Caused by Freezing**



**Bloated membrane – Impact, freezing**

# Log Data Now or Later?

- Use the **StartNow** command to begin logging data immediately
- To begin logging later:
  1. Use the **Startmmddyy=** command to enter a date to start logging, and then use the **Starthhmmss=** command to enter a start time on that date
     - Or -
     Use the **StartDateTime=** command to enter a date and time to start logging

  2. Use the **StartLater** command to begin logging on the date and time entered above

# Inductive Modem IDs

- Valid range for ID numbers is 00 – 99
- There must be only one instrument on the loop when setting IDs
- IM receiver is very sensitive; instruments not on the loop, but near the loop, will receive the ID change

# Getting Data to the Surface and the Shore

- You are responsible for the communications link between the surface buoy and the shore
  - Satellite
  - Cell phone
  - Radio modem
- You are responsible for a buoy computer that requests data from the moored instruments

# Requesting Data from Moored Instruments

- **PwrOn** causes the buoy modem to send a wake-up tone down the inductive link
- **GData** tells the moored instruments to prepare a data scan for transmission
- **Dataii** requests the instrument with the ID **ii** to transmit the scan
- **PwrOff** causes all instruments on the mooring to go to sleep

# Inductive Telemetry Troubleshooting

- Inductive communication is one way at a time (half duplex)
- Instruments with the same ID will compete for the link
- If request for data occurs during data acquisition, the request will be ignored