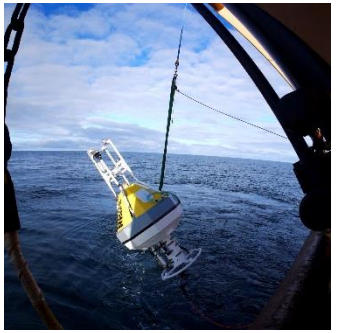
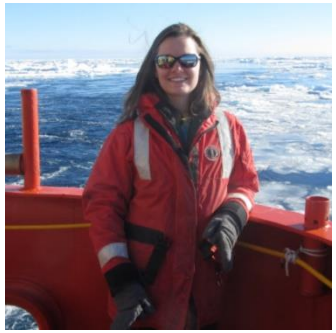
SEA-BIRD SCIENTIFIC



SEA-BIRD UNIVERSITY 2020

Greg Ikeda
Kim Martini
Natalie Zielinski



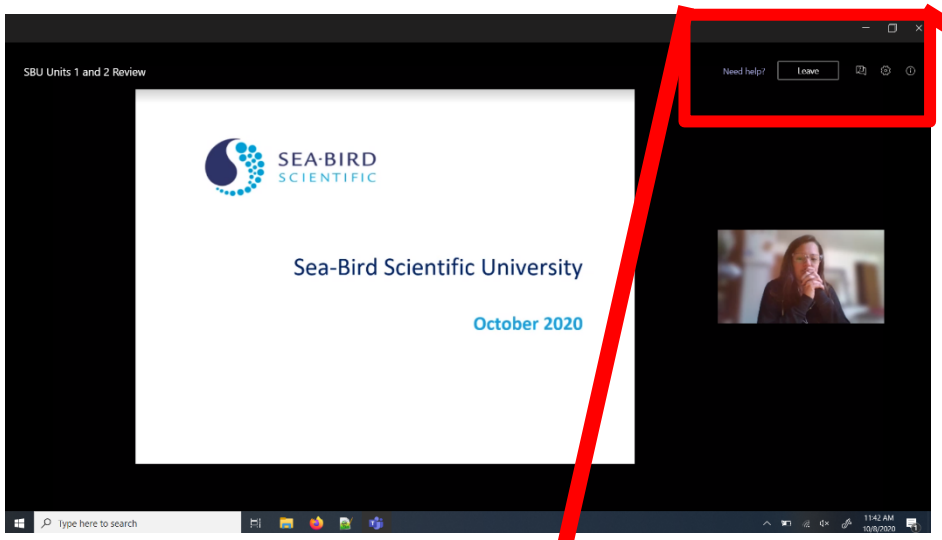
Virtual SBU Basics

- We are using Teams Live
  - You can see us, but we can't see you!
  - The SBU team is working from home, so there may be guest appearances by cats, dogs and kids.

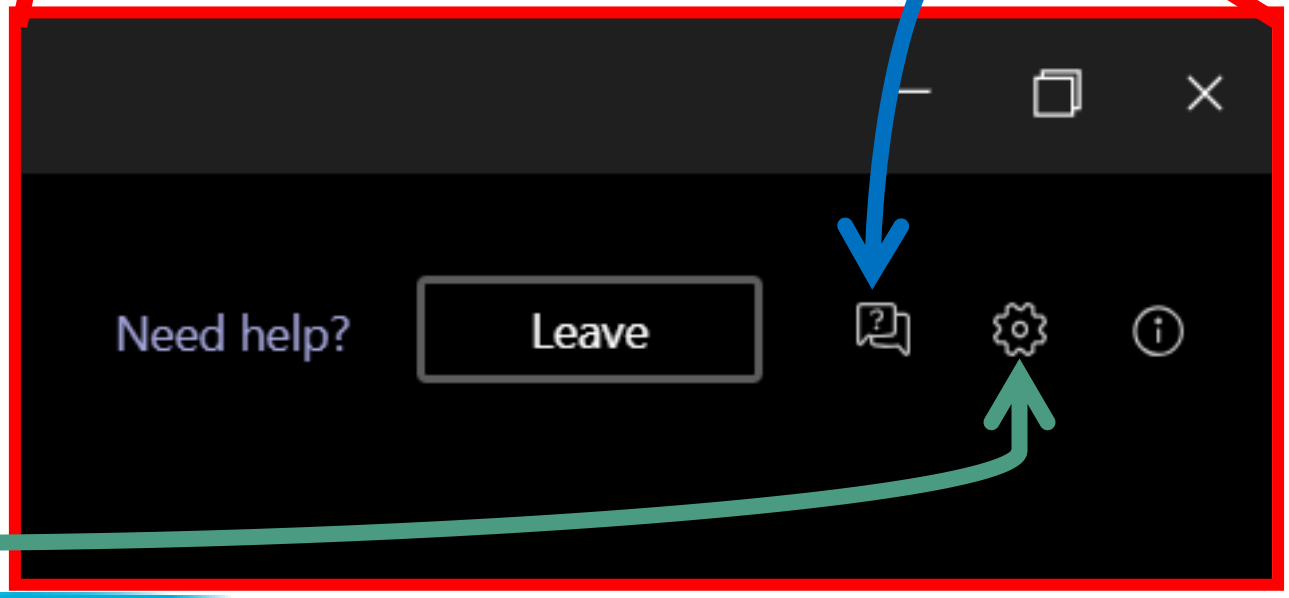
- Have questions?
  - Ask in the chat!

- Need closed captioning?
  - Turn them on in the settings.

Some important Teams Live settings



Click here to ask questions!



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Sea-Bird University Schedule

Week 1

Tuesday October 13th, 11:00 am ET / 8:00 am PT

Unit 1: Setup and Acquiring Data with Profiling Systems

Learn how to prepare and deploy a Sea-Bird Scientific Profiling CTD with Natalie Zielinski.

Thursday, October 15th, 11:00 am ET / 8:00 am PT

Unit 2: Setup and Acquiring Data with Moored Instruments

Learn how prepare a moored CTD for long-term deployment with Kim Martini.

Week 2

Tuesday, October 20th, 11:00 am ET / 8:00 am PT

Unit 3: Introduction to SBE Data Processing for Profiling and Moored Systems

Learn how to convert raw CTD data to a usable form in SBE Data Processing with Kim Martini.

Thursday, October 22nd, 11:00 am ET / 8:00 am PT

Unit 4: Advanced Data Processing for Profiling CTDs

Learn how to optimize profiling CTD data with SBE Data Processing with Kim Martini

Week 3

Tuesday, October 27th , 11:00 am ET / 8:00 am PT

Unit 5: The Cruise: Setup, Maintenance and Service

Learn the necessary steps before, during, and after a successful cruise with Greg Ikeda.

Tuesday, October 29th , 11:00 am ET / 8:00 am PT

Unit 6: Troubleshooting in the field

Learn how to spot, diagnose, and address common problems when they occur with Greg Ikeda.

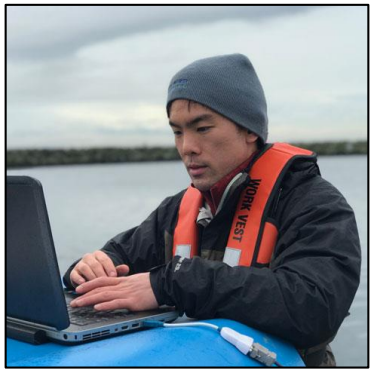
Virtual SBU Class Format

- How long is the class?
  - 1 hour + 30 minutes for Q&A + review
- Can I ask questions during class?
  - Please do! Two other instructors will be monitoring the chat.
- Want to practice your new skills?
  - We will be giving a take home exercise to complete after class.
- Want to go over the HW or have additional questions?
  - Join us for office hours tomorrow at 11:00 am ET / 8:00 am PT.
  - Microsoft Teams Link at the end of the presentation.
- Oops I missed something. Can I watch this again later?
  - Yes! We will post the recorded sessions at the end of October.

Meet the Instructors

- Dr. Kim Martini –
  - 4+ years with SBS, 16+ years SBS user, 100+ days at sea
  - Oceanographer
  - What aspect of the ocean scares you the most?
    - Horseshoe Crabs

- Greg Ikeda –
  - 5+ years with SBS, 10+ years SBS user, 150+ days at sea
  - Senior Content Development Manager
  - What aspect of the ocean scares you the most?
    - Big waves



- Natalie Zielinski –
  - 3+ years with SBS, 10+ years SBS user, 70+ days at sea
  - Product Manager (CTDs, pH, phosphate, oxygen)
  - What aspect of the ocean scares you the most?
    - Fearless

SEA-BIRD SCIENTIFIC

Setup and Acquiring Data with Profiling Systems

Sea-Bird Scientific University – October 13, 2020

Natalie Zielinski

Setup and Acquiring Data with Profiled Instruments: Hardware and Software

This module covers the following:

- Brief intro to profiled instruments
- Preparing hardware for deployment
  - Water sampling equipment
  - Spare hardware checklist
- Set Up and Functionality
  - CTD end caps
  - Integrating sensors
  - Configuration files (XMLCON)
  - Troubleshoot modular sensor connections
- Deploy Instrument
  - Software
  - Configuration file
  - Instrument set up
  - Software set up

What is do we mean by ‘Profiling’?

- A Profiling CTD rapidly measures water parameters as it travels through the water.

- A profile is often termed a ‘cast’
  - A cast is one down-and-up cycle of the CTD. Each cast consists of a downcast and upcast. Because of the way the CTD and other equipment are configured on the package, the data from the downcast is usually more accurate.

- CTDs are not one-size-fits-all instruments; the type of vehicle and characteristics of its use dictates the CTD design that will provide the best data.
  - Questions to ask when choosing the CTD for your experiment:
    - How deep do we need to go?
    - What parameters on top of C, T and D are needed?
    - What vessel will we deploy from?
    - Do we have access to real-time data streaming on that vessel?
    - Are water samples required?

CTDs and Modular Sensors

CTDs

SBE 9*plus*

SBE 25*plus*

SBE 49

SBE 19*plus* V2

SBE 11*plus* Deck Unit

SBE 33 Carousel Deck Unit

Modular

SBE 43
dissolved oxygen

ECO
backscatter,
fluorometer,
FDOM

C-Star
transmissometer

SBE 18
pH

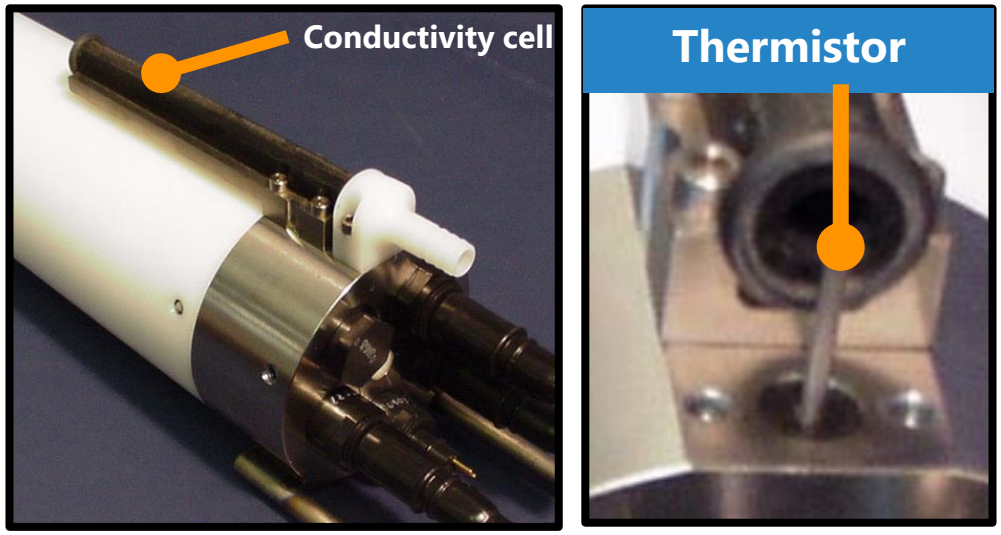
SBE 63
Optical
dissolved
oxygen
(moored)

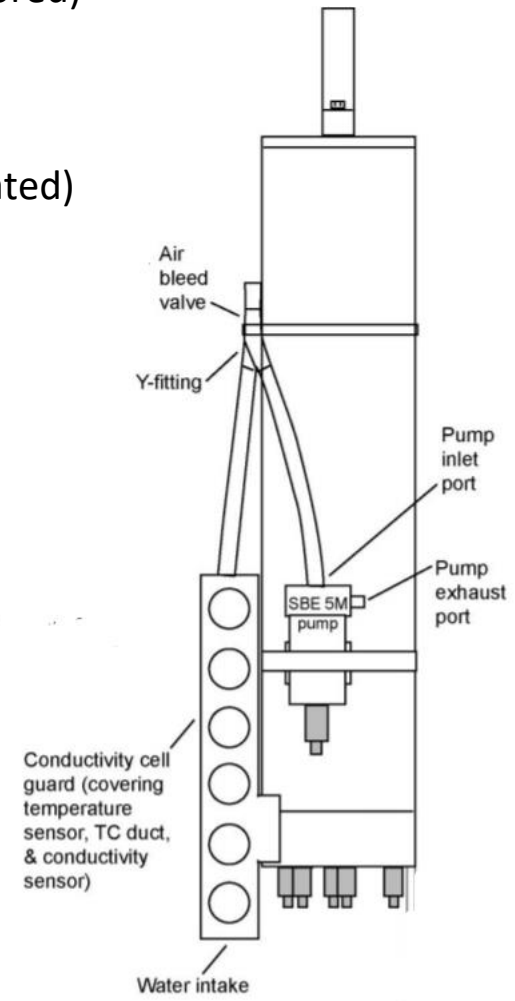
NOTE: Pictures not to scale

Integrated Sensors:
Conductivity, Temperature, and Depth (CTD)

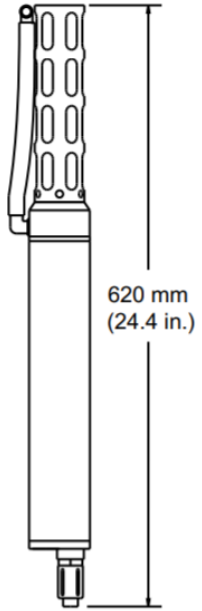
- Integral ducted conductivity cell and thermistor
  - SBE 19plus V2 and SBE 49; SBE 37 and SBE 16plus V2 (moored)
  - Salinity derived
- Internal pressure sensor
  - Depth is derived using the pressure sensor output (calculated)
- SBE 5 pump used for 19plusV2
- Integrated pump on 49

19*plus* V2 without guard





SBE 19plus V2



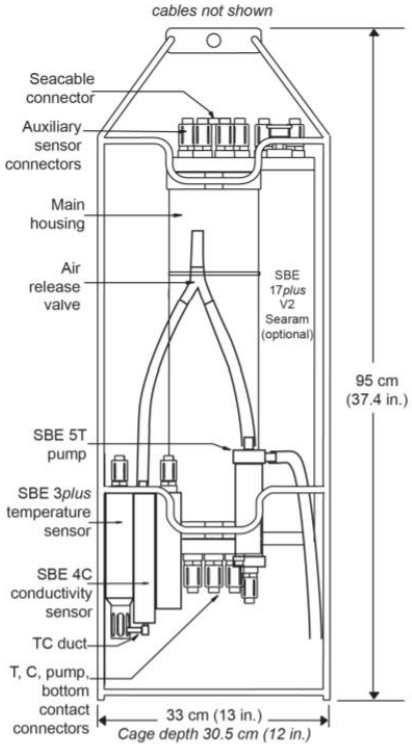
SBE 49

Modular Sensors:
Conductivity, Temperature

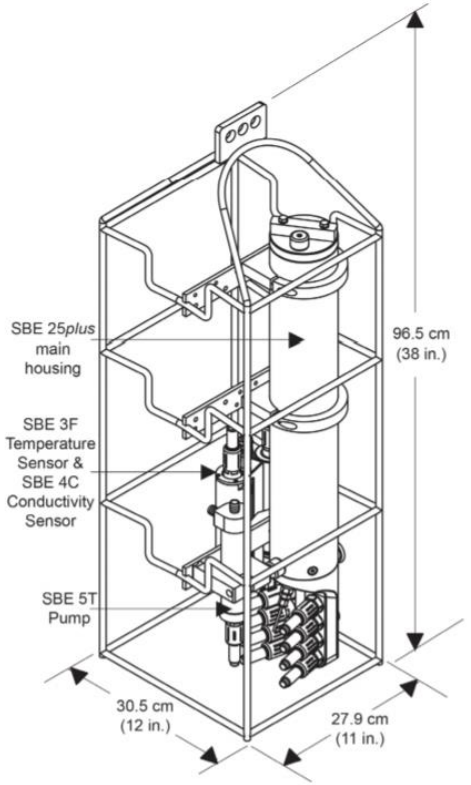
- Conductivity and temperature sensors may be mounted externally, ducted into pumped flow and cabled to the main CTD package
  - SBE 9plus and SBE 25plus
- Internal pressure sensor
  - Depth is derived from the pressure sensor output (calculated)
- SBE 5 pump from ducted flow

SBE 3 Temperature Sensor

SBE 4 Conductivity Sensor



SBE 9plus



SBE 25plus

Water Sampling Equipment

SBE 32 Carousel

Air Vent

Water Valve

OTE Sample Bottle

SBE 55 Carousel

Real-Time Profiling with a 9plus with *Water Sampling*

Third-Party Equipment

Sea-Bird Equipment

Winch & slip ring

SBE 11*plus* Deck Unit

Computer running Seasave

Single Conductor Sea Cable

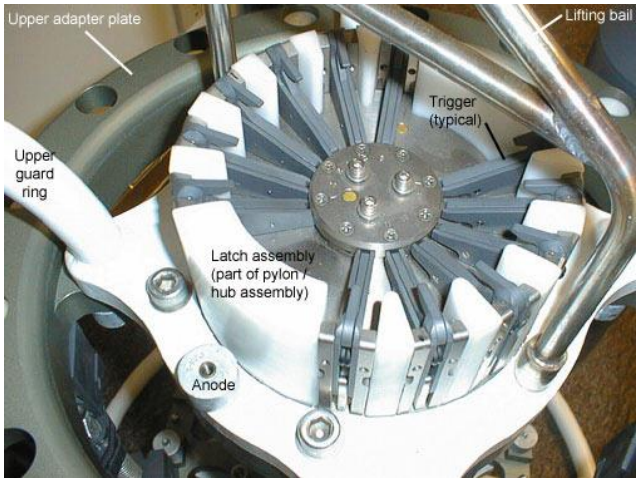
T

P

C

SBE 9*plus* (no memory)

SBE 32 Carousel with serial data integration option



SBE 32

Internal Logging with a 19plusV2

Non-conducting cable

T

P

C

SBE 19
SBE 19*plus*
SBE 19*plus* V2
SBE 25
SBE 25*plus*
(internal memory)

Data is viewed after it is collected

Real-Time Profiling with a 19plusV2 with *Water Sampling*

Third-Party Equipment

Sea-Bird Equipment

Winch & slip ring

SBE 33

Computer running Seasave

Single Conductor Sea Cable

T

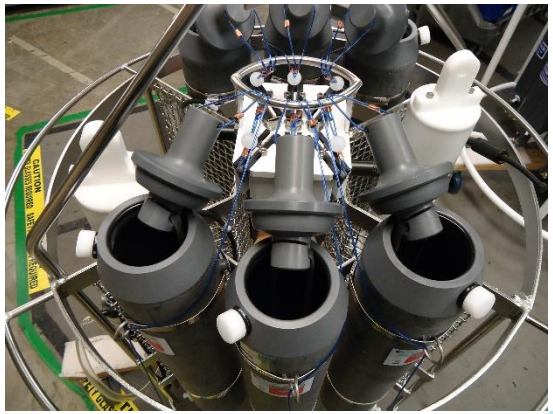
P

C

SBE 19, 19*plus*, 19*plus* V2, 25, or 25*plus* (internal memory)

SBE 32 Carousel with serial data integration option or SBE 55

SBE 55 with 19plusV2

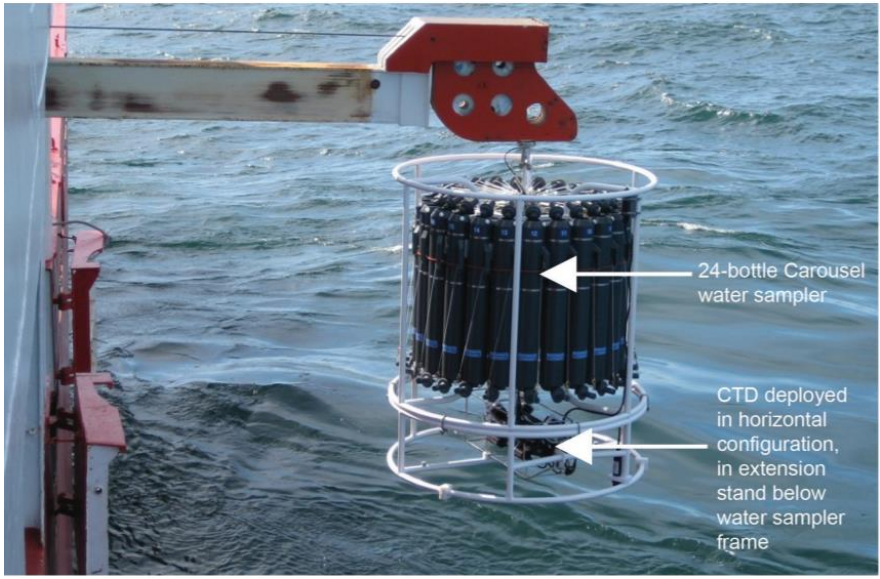


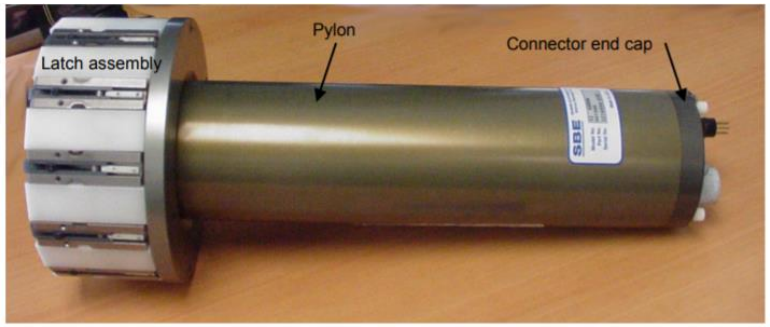
Hardware

- Preparing hardware for deployment
  - Water sampling equipment
  - Spare hardware checklist

Sampling Equipment

- Water sampling equipment usually consists of:
  - Water sample bottles with spring-loaded top and bottom end caps.
  - Trigger mechanism and electronics (SBE 32)
  - Lanyards that connect the bottle end caps to the trigger mechanism.
  - Frame that holds the bottles and trigger mechanism and electronics, also protects the package from collision with the side of the ship.

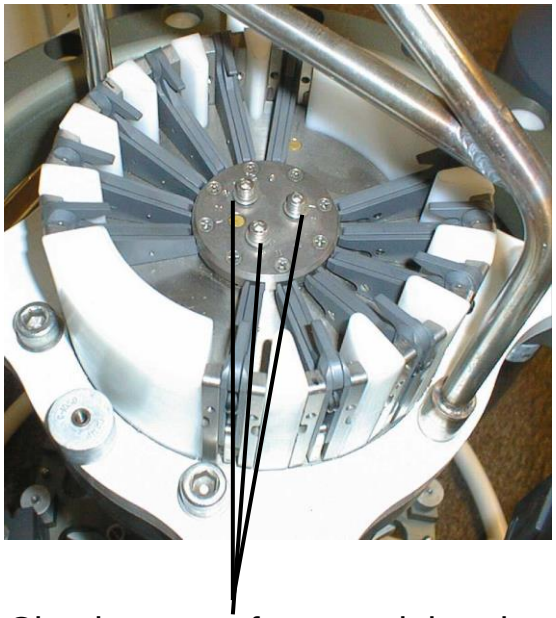




SBE 32 Latch Assembly and Hub

Check the Water Sampler: Water Sampler Triggers

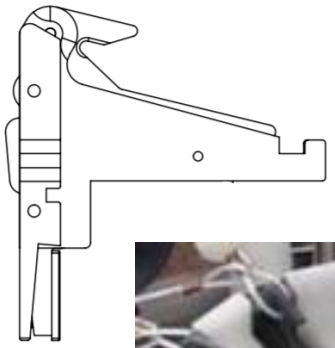
- Soak triggers in soap and water – Dishwasher friendly!
- **Never** lubricate triggers with oils or sprays
  - The coating is water lubricated
  - If trigger is sticking, look for scratches and/or adjust angle of lanyard.
- Check 3 screws holding trigger assembly to pylon for over-tightening, which causes distortion of trigger assembly
- Check the anodes to verify that they are securely fastened and have not eroded
- After Every Cast
  - Rinse the entire Carousel, including the frame, with fresh water after each cast.
- If More than 24 Hours Until the Next Cast – Prevent salt build up
  - Remove the 3 socket hex head screws holding the latch assembly to the pylon
  - Soak the whole latch assembly in a bucket of fresh water until the next cast.
  - With the latch assembly removed, thoroughly rinse the top of the pylon, including the magnets, with fresh water
- Salt deposits and corrosion that result from not rinsing with fresh water! →



Check screws for over-tightening

Check the Water Sampler: Lanyards and Bottles

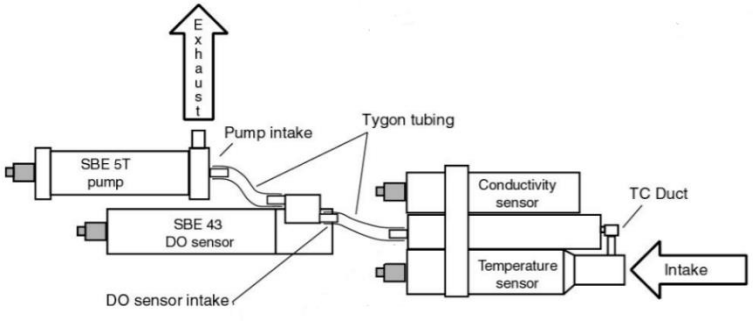
- Each bottle position has its own lanyard release latch controlled by a magnetic trigger
- Lanyards must run straight from the trigger to the water sampler.
- Rinse the inside and outside of each bottle with fresh water after every cast to prevent salt deposits on the tubing that closes each bottle
- Wrap white carousel frame in electrical tape when mounting equipment to prevent paint gouges

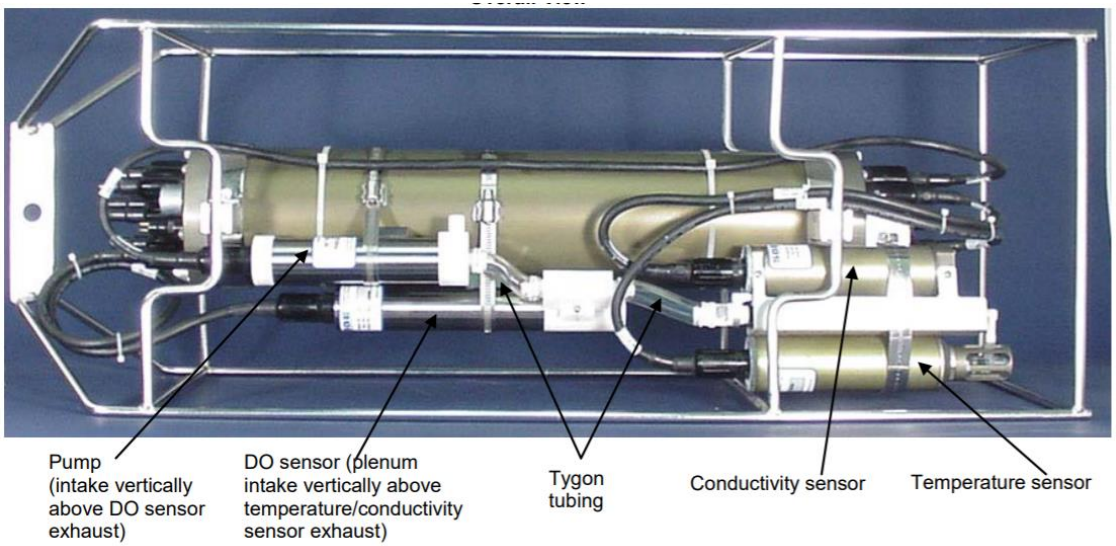


SBE 32 Detail (12-position latch assembly shown; 24- and 36-position similar)

9plus Sensor Flow Path

- TC duct:
  - All the water sensed by both the temperature and conductivity cell must pass through a single small (0.4 cm) diameter opening.
  - The electronically controlled pump forces the seawater to flow at a constant 30 cm^3 /second speed to ensure that the C - T time responses are constant.
- Mount SBE 9plus Horizontally when using SBE 32 frame system





Spare Hardware Checklist

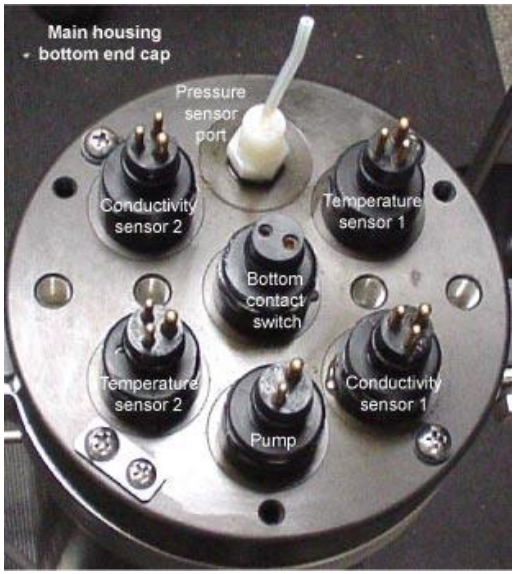
- ❑ Tygon tubing – various diameters
- ❑ Electrical tape – protect frame
- ❑ Zip ties – secure loose cables
- ❑ Dish soap and bucket – soak SBE 32 latch assembly
- ❑ Jackscrew kit
- ❑ Sea-Bird Spare Hardware Kits – instrument specific
- ❑ Spare latches
- ❑ Lanyard
- ❑ Anodes – Recommend to replace an anode when more than 50% of the material has eroded.
- ❑ Never-Seez Blue Moly – for screws exposed to seawater
- ❑ Dummy plugs
- ❑ Spare sensor cables
- ❑ Spare modular sensors
- ❑ Triton X-100 reagent for cleaning conductivity cells
- ❑ Sensor calibration sheets
- ❑ Manuals
- ❑ Kim wipes
- ❑ 100% silicon grease (NO WD-40)

Greg will talk more about this in units 5 and 6

Setup and Acquiring Data with Profiled Instruments: Hardware and Software

- Set Up and Functionality
  - CTD end caps
  - Integrating sensors
  - Configuration files (XMLCON)
  - Troubleshoot modular sensor connections

Integrating Sensors and Setting Up CTDs

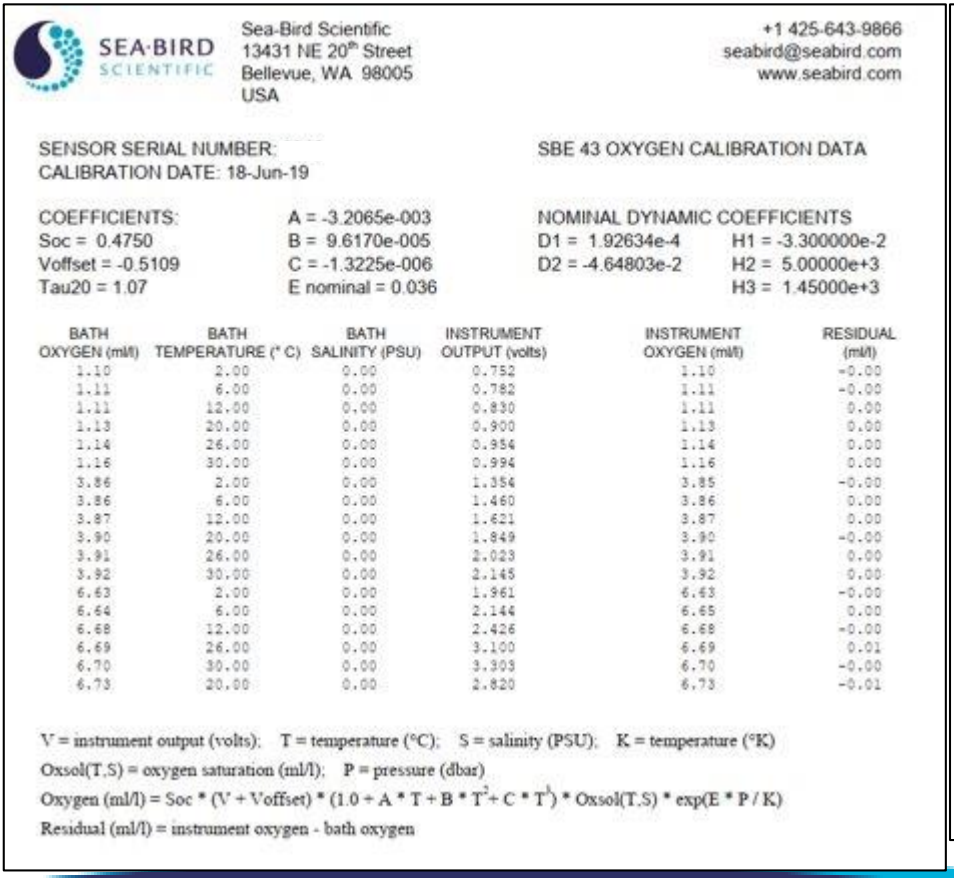


Integrating Modular Sensors

- The SBE 9plus, 19plusV2 and 25plus all have channels for modular sensors
  - Either voltage or RS-232
- Modular sensors are added to the system through cables to connectors on the CTD endcap and mounted externally
- Sea-Bird CTDs can be set up with common modular sensors (listed in xmlcon file settings) or third-party sensors (use User Polynomial)

Modular Sensor Calibration

- All SBS sensors and CTDs come with calibration files (PDF, .cal)
- The most recent calibration data must be loaded into the XMLCON file to view correct data in real-time as well as to process data accurately.



SEA-BIRD SCIENTIFIC

Sea-Bird Scientific
13431 NE 20th Street
Bellevue, WA 98005
USA

+1 425-643-9866
seabird@seabird.com
www.seabird.com

SENSOR SERIAL NUMBER:
CALIBRATION DATE: 18-Jun-19

SBE 43 OXYGEN CALIBRATION DATA

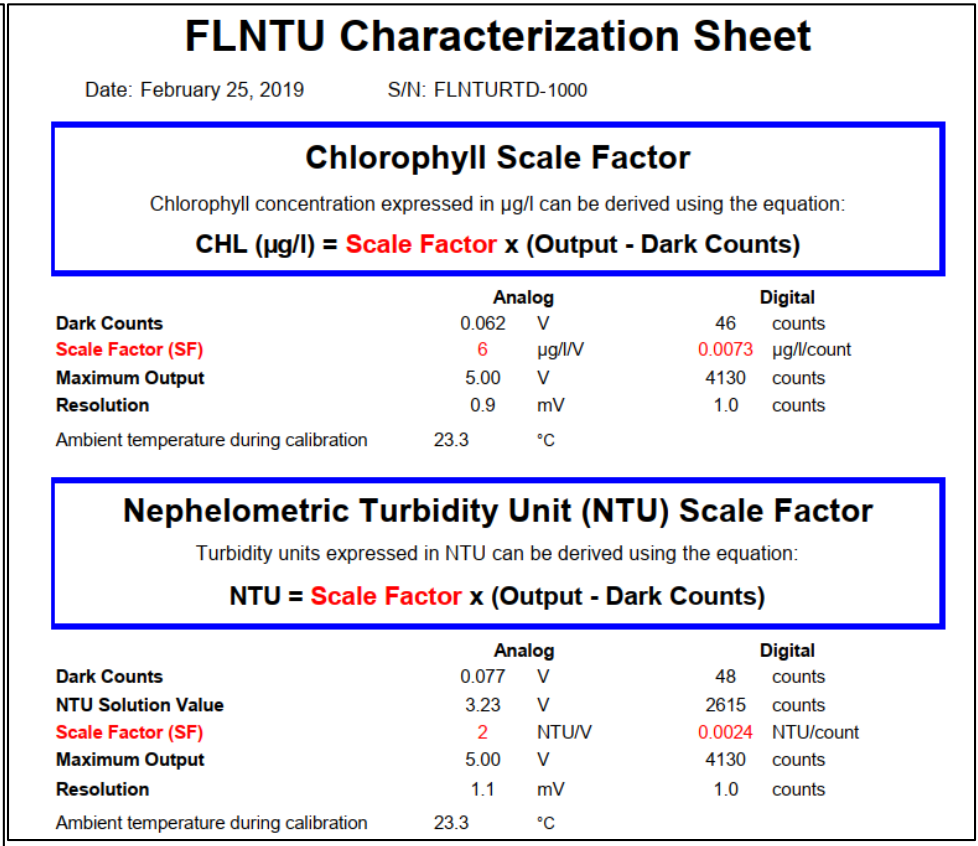
COEFFICIENTS:
Soc = 0.4750
Voffset = -0.5109
Tau20 = 1.07

A = -3.2065e-003
B = 9.6170e-005
C = -1.3225e-006
E nominal = 0.036

NOMINAL DYNAMIC COEFFICIENTS
D1 = 1.92634e-4
D2 = -4.64803e-2
H1 = -3.300000e-2
H2 = 5.00000e+3
H3 = 1.45000e+3

BATH OXYGEN (ml/l)	BATH TEMPERATURE (° C)	BATH SALINITY (PSU)	INSTRUMENT OUTPUT (volts)	INSTRUMENT OXYGEN (ml/l)	RESIDUAL (ml/l)
1.10	2.00	0.00	0.752	1.10	-0.00
1.11	6.00	0.00	0.782	1.11	-0.00
1.11	12.00	0.00	0.830	1.11	0.00
1.13	20.00	0.00	0.900	1.13	0.00
1.14	26.00	0.00	0.954	1.14	0.00
1.16	30.00	0.00	0.994	1.16	0.00
3.86	2.00	0.00	1.354	3.85	-0.00
3.86	6.00	0.00	1.460	3.86	0.00
3.87	12.00	0.00	1.621	3.87	0.00
3.90	20.00	0.00	1.849	3.90	-0.00
3.91	26.00	0.00	2.023	3.91	0.00
3.92	30.00	0.00	2.145	3.92	0.00
6.63	2.00	0.00	1.961	6.63	-0.00
6.64	6.00	0.00	2.144	6.65	0.00
6.68	12.00	0.00	2.426	6.68	-0.00
6.69	26.00	0.00	3.100	6.69	0.01
6.70	30.00	0.00	3.303	6.70	-0.00
6.73	20.00	0.00	2.820	6.73	-0.01

V = instrument output (volts); T = temperature (°C); S = salinity (PSU); K = temperature (°K)
Oxsol(T,S) = oxygen saturation (ml/l); P = pressure (dbar)
Oxygen (ml/l) = Soc * (V + Voffset) * (1.0 + A * T + B * T^2 + C * T^3) * Oxsol(T,S) * exp(E * P / K)
Residual (ml/l) = instrument oxygen - bath oxygen



FLNTU Characterization Sheet

Date: February 25, 2019 S/N: FLNTURTD-1000

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	0.062	V	46	counts
Scale Factor (SF)	6	µg/l/V	0.0073	µg/l/count
Maximum Output	5.00	V	4130	counts
Resolution	0.9	mV	1.0	counts
Ambient temperature during calibration	23.3	°C		

Nephelometric Turbidity Unit (NTU) Scale Factor

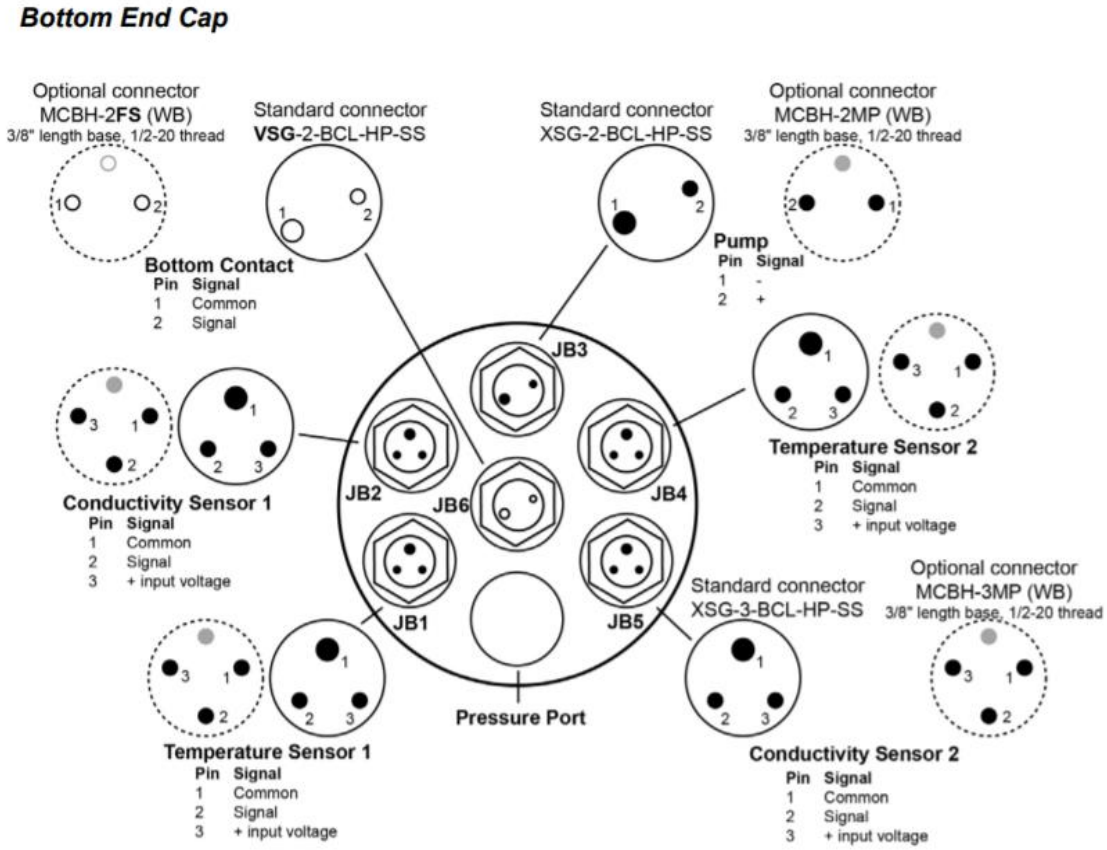
Turbidity units expressed in NTU can be derived using the equation:

NTU = Scale Factor x (Output - Dark Counts)

	Analog		Digital	
Dark Counts	0.077	V	48	counts
NTU Solution Value	3.23	V	2615	counts
Scale Factor (SF)	2	NTU/V	0.0024	NTU/count
Maximum Output	5.00	V	4130	counts
Resolution	1.1	mV	1.0	counts
Ambient temperature during calibration	23.3	°C		

Bottom End Cap for 9plus

- **Bottom** end cap reserved for primary and secondary T and C and associated pump power
- Connectors on the bottom endcap are identified with a B
  - J**B**1, J**B**2, etc.
- The primary and secondary T and C sensors are plumbed individually with their own pumps

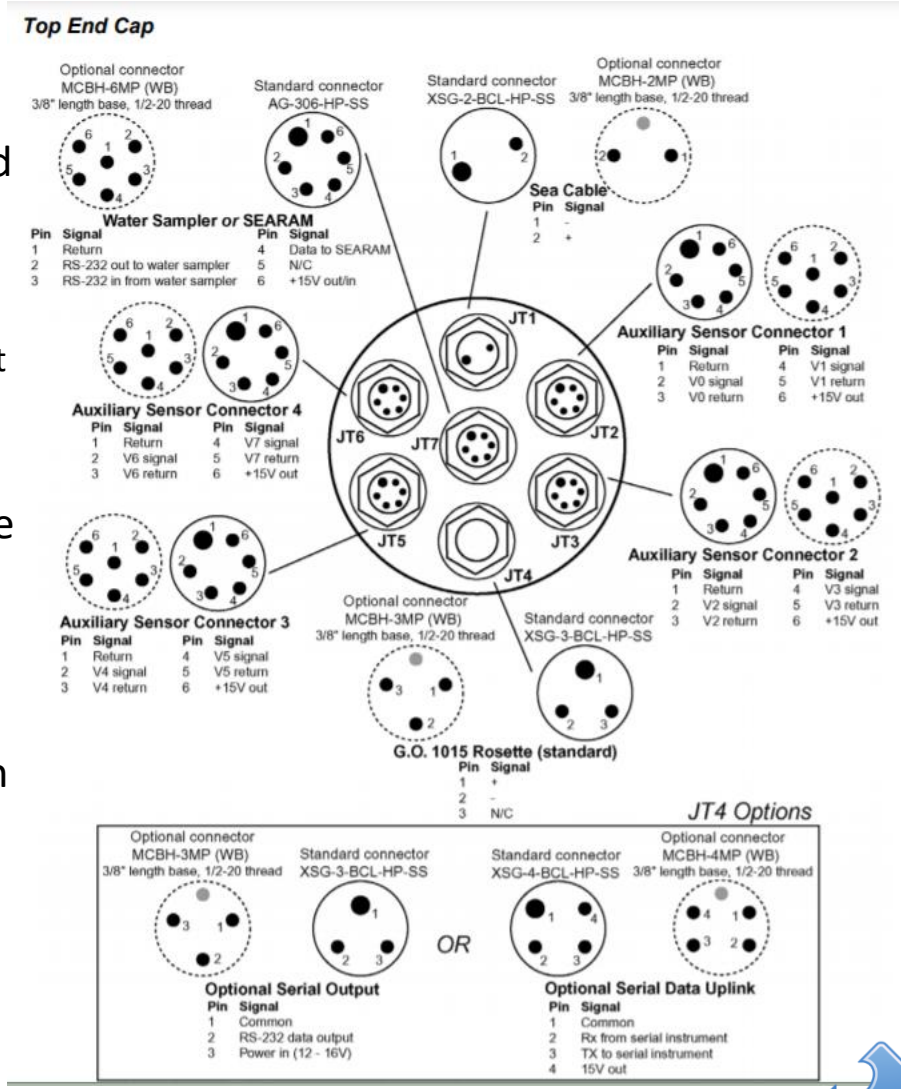


Note: An SBE 9*plus* with dual temperature and conductivity sensors is supplied with two pumps, one for each TC pair. JB3 connects to both pumps with a Y-cable.

M2

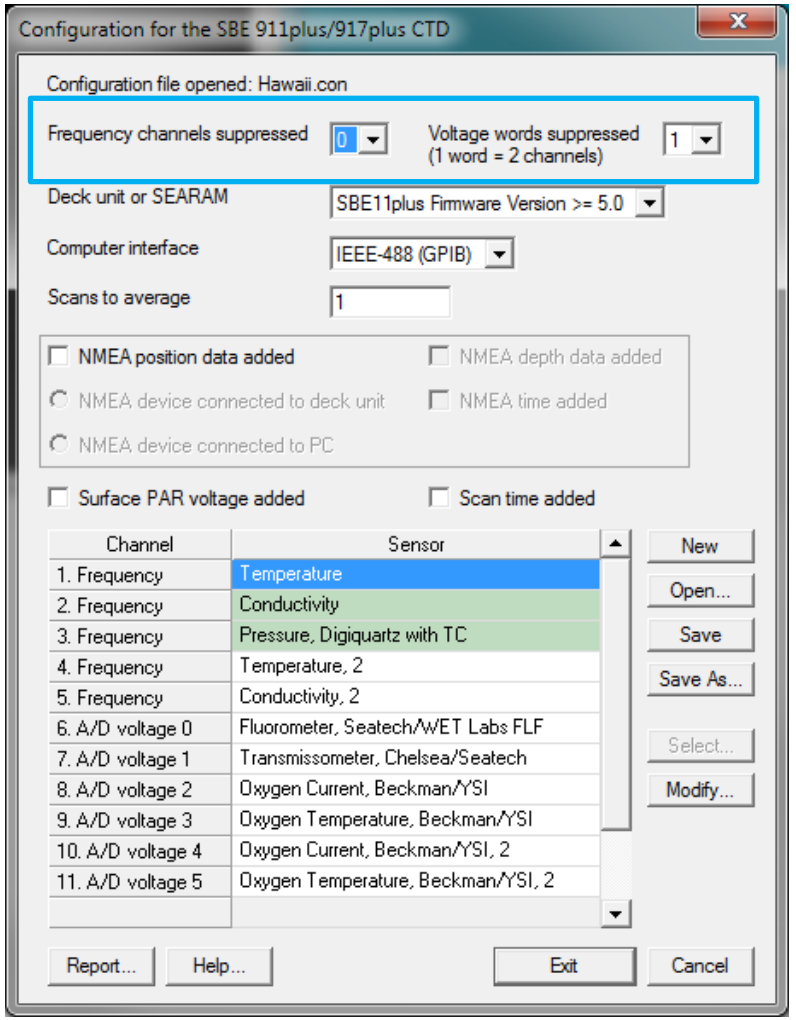
Top End Cap for 9plus

- **Top** end cap is for user-selected, modular sensor connection
- Connectors on the top endcap are identified by a T
  - JT1, JT2, etc.
- Sea Cable (power) connector on the top (not to be confused with the pump connector on the bottom)
- Connect modular sensors to the appropriate channel.
- Auxiliary sensors can be plumbed into the primary and secondary flow paths
- With a Y-cable, each auxiliary connector can support two sensor data streams (6-pin connectors)
- All modular sensor connectors are always powered on a 9plus
  - Dummy off unused connectors



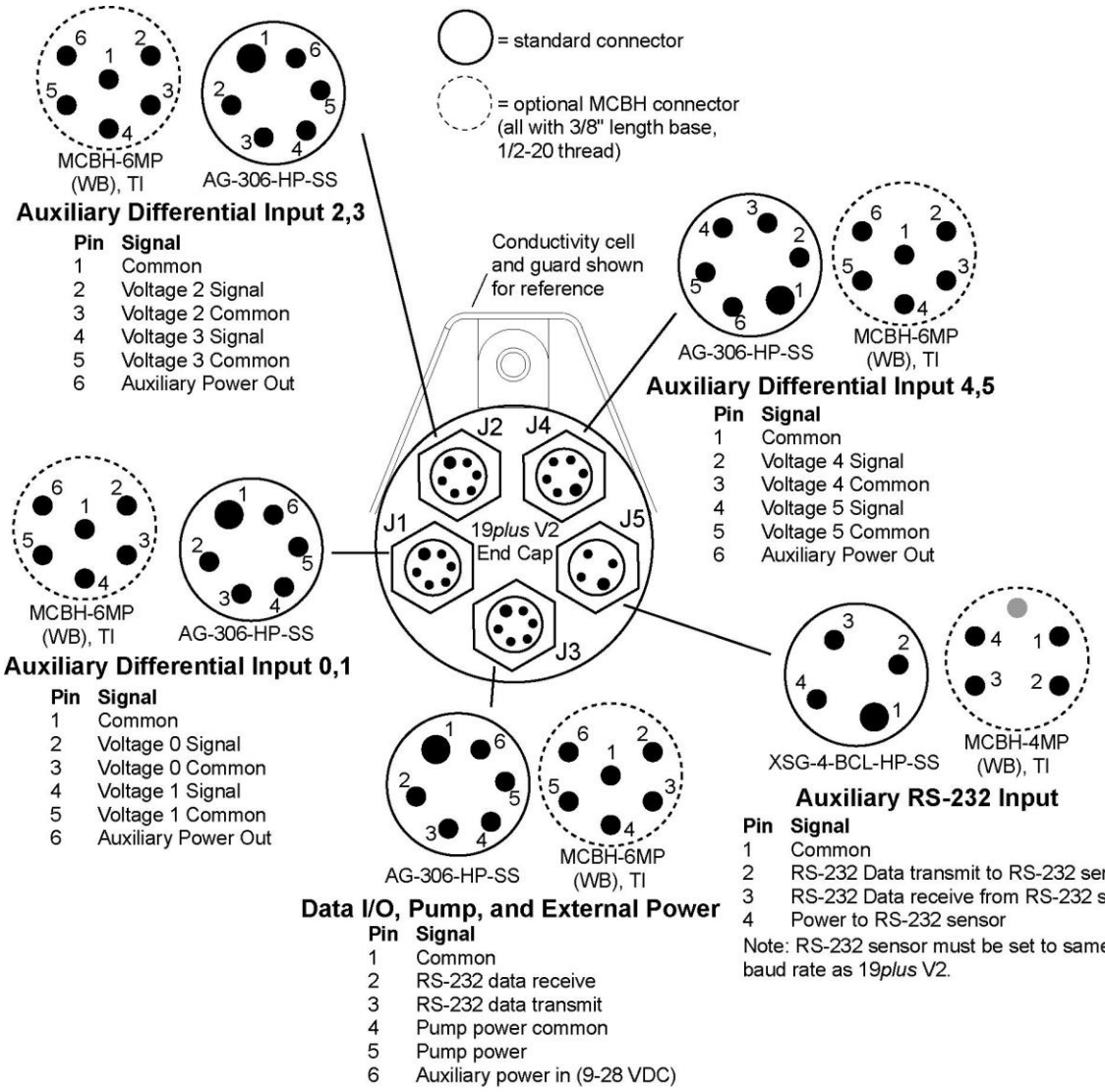
9plus Configuration File

- There are 8 available voltage channels.
  - Suppress those not in use.
  - Define or import the calibration data for each sensor
- If the Voltage Word is suppressed in the .xmlcon file, power will still be supplied, but SeaSave will not record that data to the computer!
  - Recall, SBE 9plus does not have internal memory
  - XMLCON loaded in Seasave controls real-time graphs and Seasave data file
  - Voltage suppression starts at the JT6 connector.
- Check options for NMEA stream
- If the .xmlcon or .con file does not match the instrument configuration, the software will not interpret or process raw data correctly
  - Sometimes you will get an error from the software. Sometimes the data stream is 'readable' but incorrect
  - Always document what sensor model and SN are connected to each connector



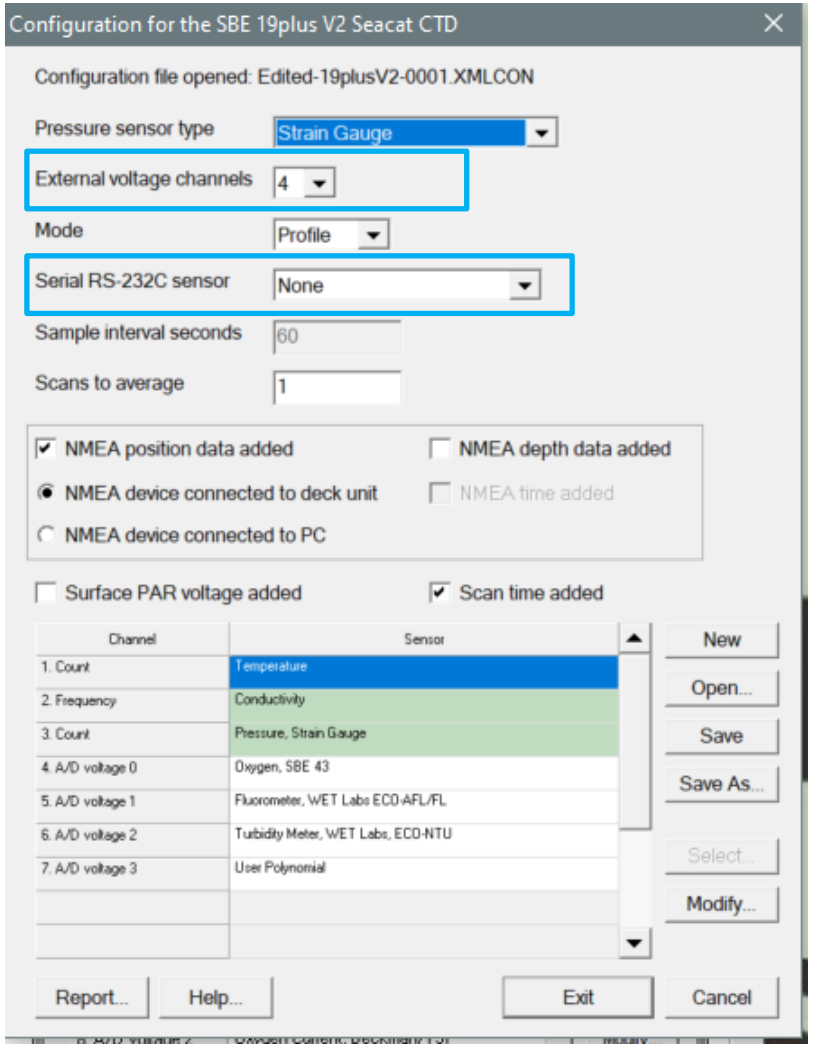
19plusV2 End Cap

- One connector endcap
- Connect the sensor to the appropriate voltage channel.
- With a Y-cable, each auxiliary connector can support 2 sensors
- CTD status response **(DS)** in SeatermV2 indicates if sensor channels are enabled or disabled
- If the channel is not enabled, CTD will NOT supply power to NOR acquire data from sensor
- Dummy off unused connectors
- Output data string order defined by CTD channel settings



19plusV2 Configuration File

- There are 6 available voltage channels.
  - Must be enabled to supply power
  - Define or import the calibration data for each sensor
- Set the number of channels and confirm use of RS-232 sensor
- Check options for NMEA stream
- If the .xmlcon or .con file does not match the instrument configuration, the software will not interpret or process raw data correctly
  - Sometimes you will get an error from the software. Sometimes the data stream is 'readable' but incorrect
  - Always document what sensor model and SN are connected to each connector



Troubleshoot modular sensor connections

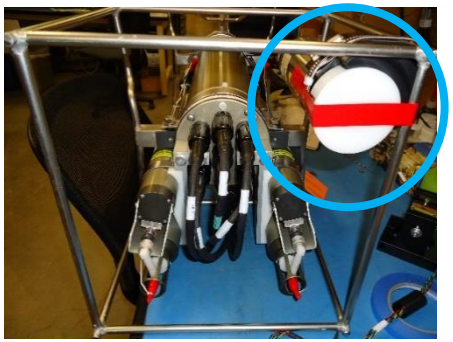
- Common communication issues
  - Connector and/or cable corrosion
  - Loose mating of connectors and cables
  - Holes or slashes in cables
  - Incorrect XLMCON/channel set up

Corroded pins on bulkhead connectors - Connector on right has a missing pin

- Common data issues
  - Pump issues
    - Incorrect minimum conductivity frequency
    - Clogged
    - Check TC duct
    - Magnet decoupling – especially if pump started in air
  - Fouling
    - Fouled conductivity tends to look fresh to reality

Troubleshoot modular sensor connections

- Keep track of troubleshooting steps and order
- General:
  - Swap sensor – Does the issue follow the sensor?
  - Swap cables – Does the issue follow the cable?
  - Clean flow path
  - Check calibration in XMLCON file – used to convert data from raw frequency/voltage to scientific units
- Sensor specific:
  - ECO – Check dark count, confirm no interference in sensing path
  - SBE 43 – Check membrane
  - SBE 18 – Re-calibrate



Good installation of ECO

Torn SBE 43 membrane

Software and XMLCON Set Up

- Deployment Instrument
  - Software
  - Configuration file
  - Instrument set up
  - Software set up

Sea-Bird software for recording and processing data

There are 3 software programs that Sea-Bird has developed for interfacing with CTD instruments and processing data.

- **SeatermV2 -** user interface for internally recording instruments that can output data in XML and deck boxes
  - Terminal program with some preloaded commands
  - **Seaterm -** user interface for older instruments
- **Seasave V7** - software for real-time data collection
  - Uses XMLCON configuration file with loaded calibration coefficients
- **SBE Data Processing** – software for post-processing data

Note: We're developing new software! Want to be a beta tester? Sign up with the link in the chat

Commands

- SBS Commands are your friend!
  - You can:
    - See if the CTD is Logging vs not logging
    - See the # of samples stored
    - See the # of casts stored
    - See which voltage channels are on vs off
    - See if the RS-232 channel is on vs off
    - Start logging
    - Run the sensor continuously
    - Check minimum conductivity setting
  - GetHD, DS, GetSD, GetEC, GetCC (not case sensitive)

- This applies to the 19plusV2 and 25plus.
  - Why not the 9plus?

- Deck units have their own set of commands for configuration

Integrating Modular Sensors

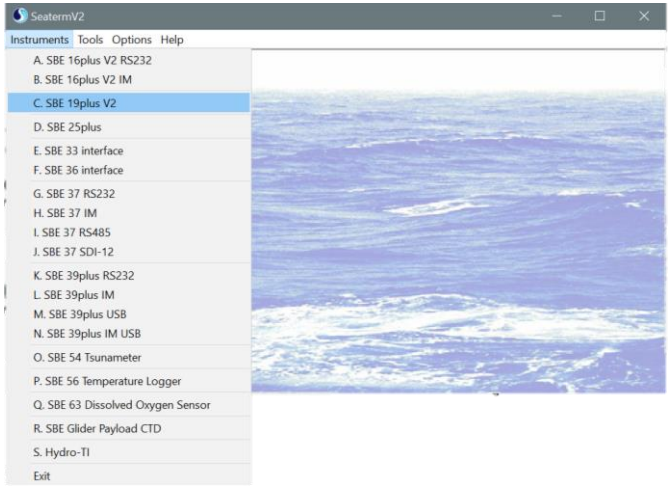
- In **internally recording CTDs** (19plusV2), the channel that the sensor is connected to must be *enabled* in the CTD (*volt0=y*)
  - If the channel is not enabled, the CTD will not supply power to the sensor nor acquire data from the sensor
    - Exception: SBE 25plus – Sensors always powered

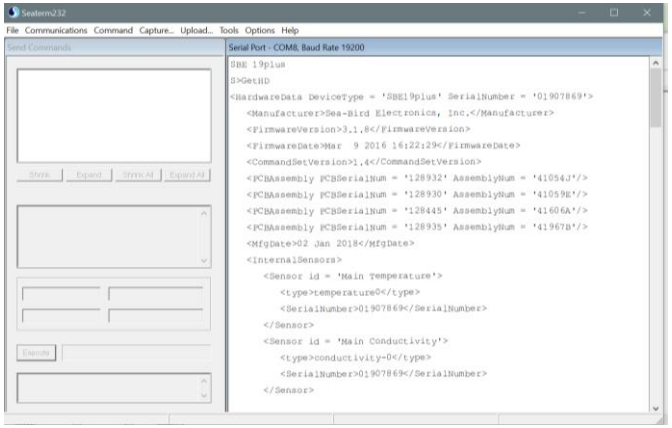
- For **all CTDs**, the configuration file (XMLCON) for our real-time data acquisition software (Seasave) and post-processing software (SBE Data Processing) must *designate* ***where the sensor's raw data falls within the data stream***, and the sensor's calibration coefficients
  - Where the data falls within the data stream is defined by the connector each sensor is connected too for the 9plus
  - Where the data falls within the data stream is defined by the connector location as well as the number of channels enabled for the 19plusV2

- Sea-Bird handles this if you purchase the sensor(s) integrated with the CTD
  - **If you make changes, you must do this yourself!**

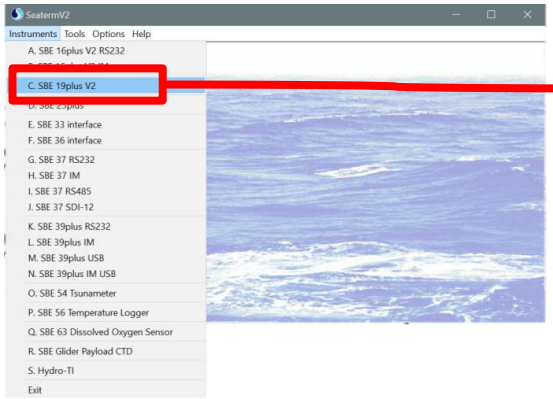
Connecting to a 19plusV2 – Live Demo

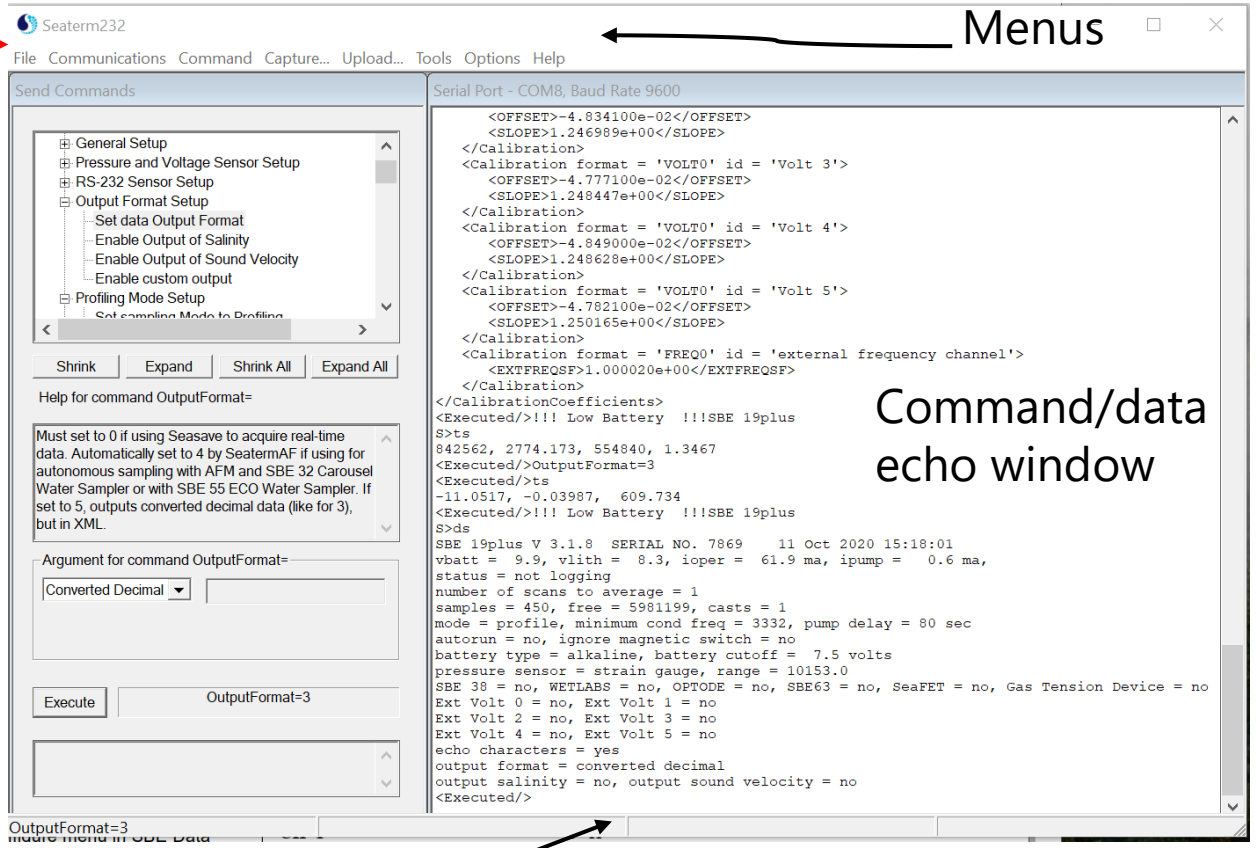
1. Install Seasoft software package
   - Includes SeatermV2, SeasaveV7, SBE Data Processing
2. Install internal batteries or connect to external power
3. Connect Data I/O cable to 19plusV2 and computer
4. Start SeatermV2
5. Go to Instruments -> C. 19plusV2
6. First time connection:
   1. Go to Communications -> Configure
   2. Set Port connection and Baud
      - If you don't know the Port, use the Windows Device Manager!
      - If you don't know the Baud, default usually 9600 or 19200.
7. When connected, SeatermV2 sends GetHD to the instrument and you will see the output in the terminal window
8. Select Capture to have a record of what you did
9. Send commands to change and confirm 19plusV2 setup
10. When complete, hit Capture again to stop and save file





Seaterm232: Instrument Status and Set up





- The first time Seaterm232 is used, it asks for the Com port and baud rate
- Then, it attempts to connect, and if successful fills the Send Commands window with the appropriate set of commands
  - Commands auto-sent and loaded are dependent on the instrument selected from the File Menu

Example DS output: Setting Up a SBE 19*plus* V2

19plusV2 DS Command:

SBE 19plus V 3.1.8 SERIAL NO. 7951 28 Jun 2019 07:11:07
vbatt = 14.2, vlith = 8.4, ioper = 62.1 ma, ipump = 55.8 ma,
iext01 = 4.2 ma, iext2345 = 25.6 ma
status = not logging
number of scans to average = 1
samples = 0, free = 3870479, casts = 0
mode = profile, **minimum cond freq** = 3338, pump delay = 60 sec
autorun = no, ignore magnetic switch = no
battery type = alkaline, battery cutoff = 7.5 volts
pressure sensor = strain gauge, range = 10153.0
SBE 38 = no, WETLABS = no, OPTODE = no, SBE63 = no, SeaFET = no, Gas Tension Device = no
Ext Volt 0 = yes, Ext Volt 1 = no
Ext Volt 2 = yes, Ext Volt 3 = yes
Ext Volt 4 = no, Ext Volt 5 = no
echo characters = yes
output format = raw HEX

- Minimum conductivity frequency varies from instrument to instrument – See conductivity Cal sheet
- In air should equal the zero conductivity frequency + 500 for standard seawater applications

- *The set up in the instrument must match the XMLCON file, otherwise you will get errors in Seasave and SBE Data Processing*
- *Enabling/Disabling voltage and serial channels changes the scan length – common error in Seasave!*

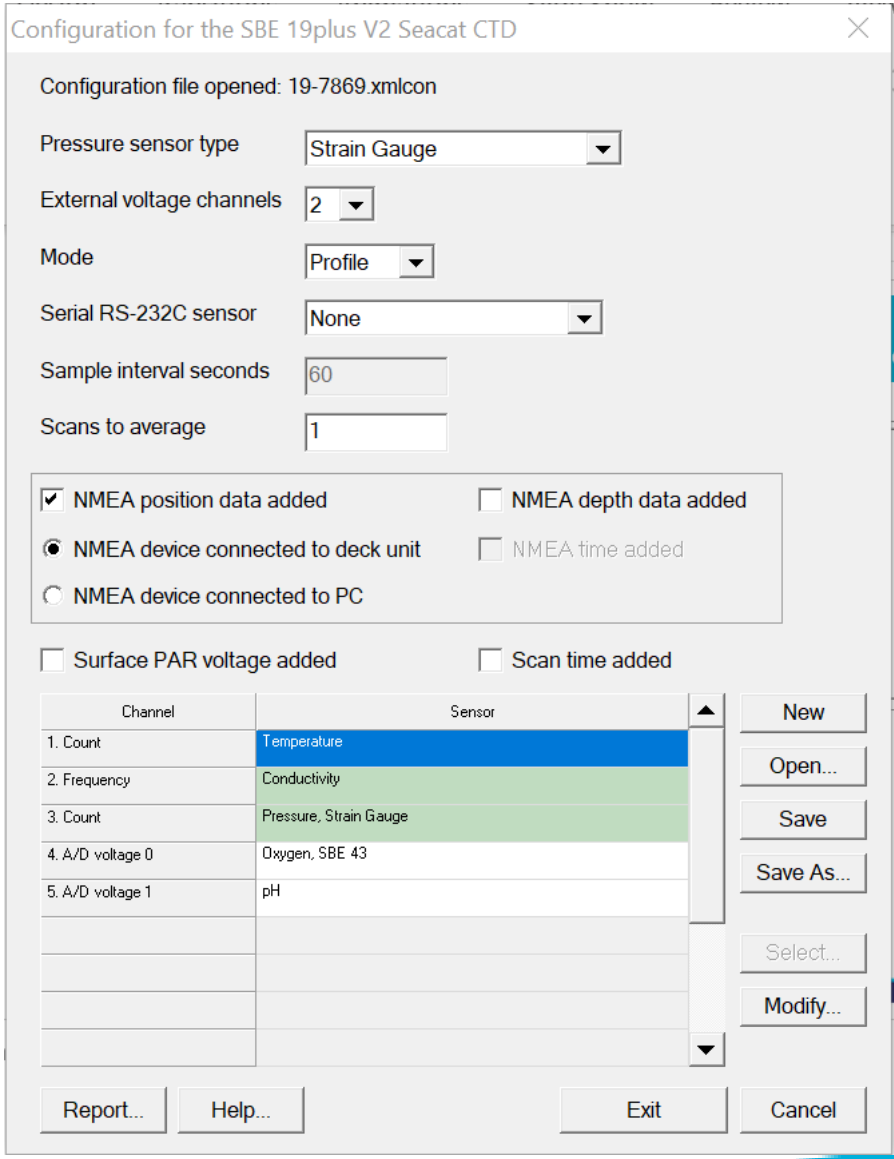
Example DS output: Setting Up a SBE 19*plus* V2

2 Channel Example

Example: Enable voltage sensors wired to channels 0 and 3 on end cap (user input in bold).

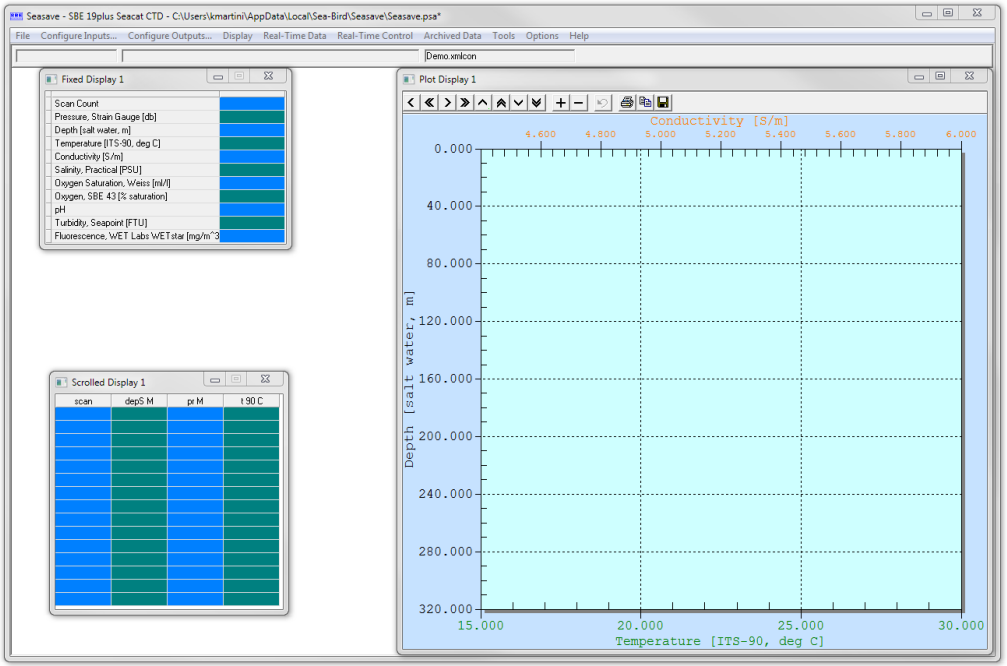
VOLT0=Y
VOLT1=N
VOLT2=N
VOLT3=Y
VOLT4=N
VOLT5=N

There will be 2 external sensor voltages in data stream. In .xmlcon or .con file (in SBE Data Processing or Seasave), indicate *2* external voltage channels. Voltage 0 corresponds to sensor wired to external voltage channel 0; voltage 1 corresponds to sensor wired to external voltage channel 3.



SeasaveV7
Configuration and Default Display

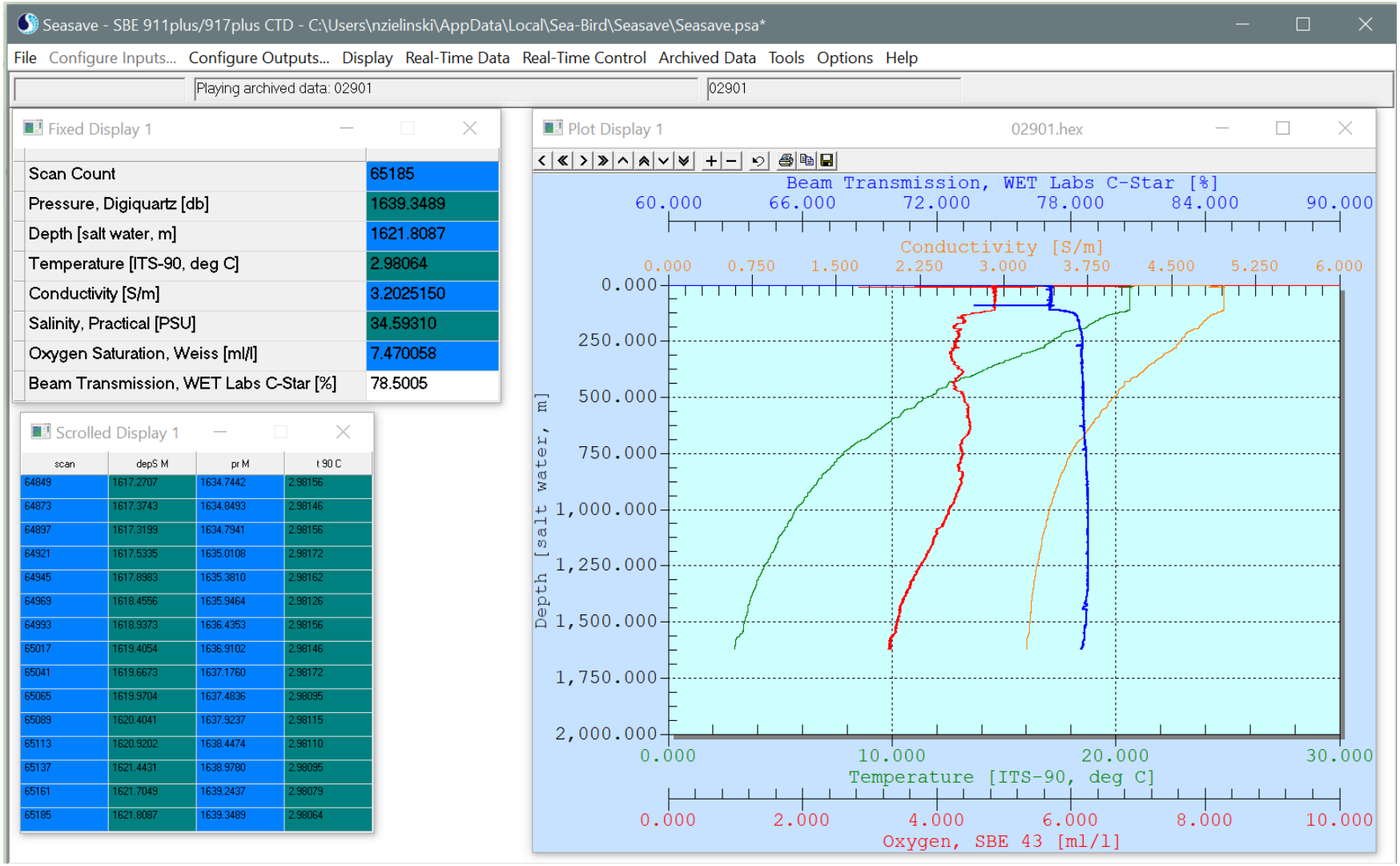
- **Seasave** requires instrument configuration
  - What kind of instrument being used
  - How many sensors are enabled
  - What type of sensors (e.g., DO, Fluorometer)
  - Communication paths
    - Which computer interface
    - What data transmission protocol



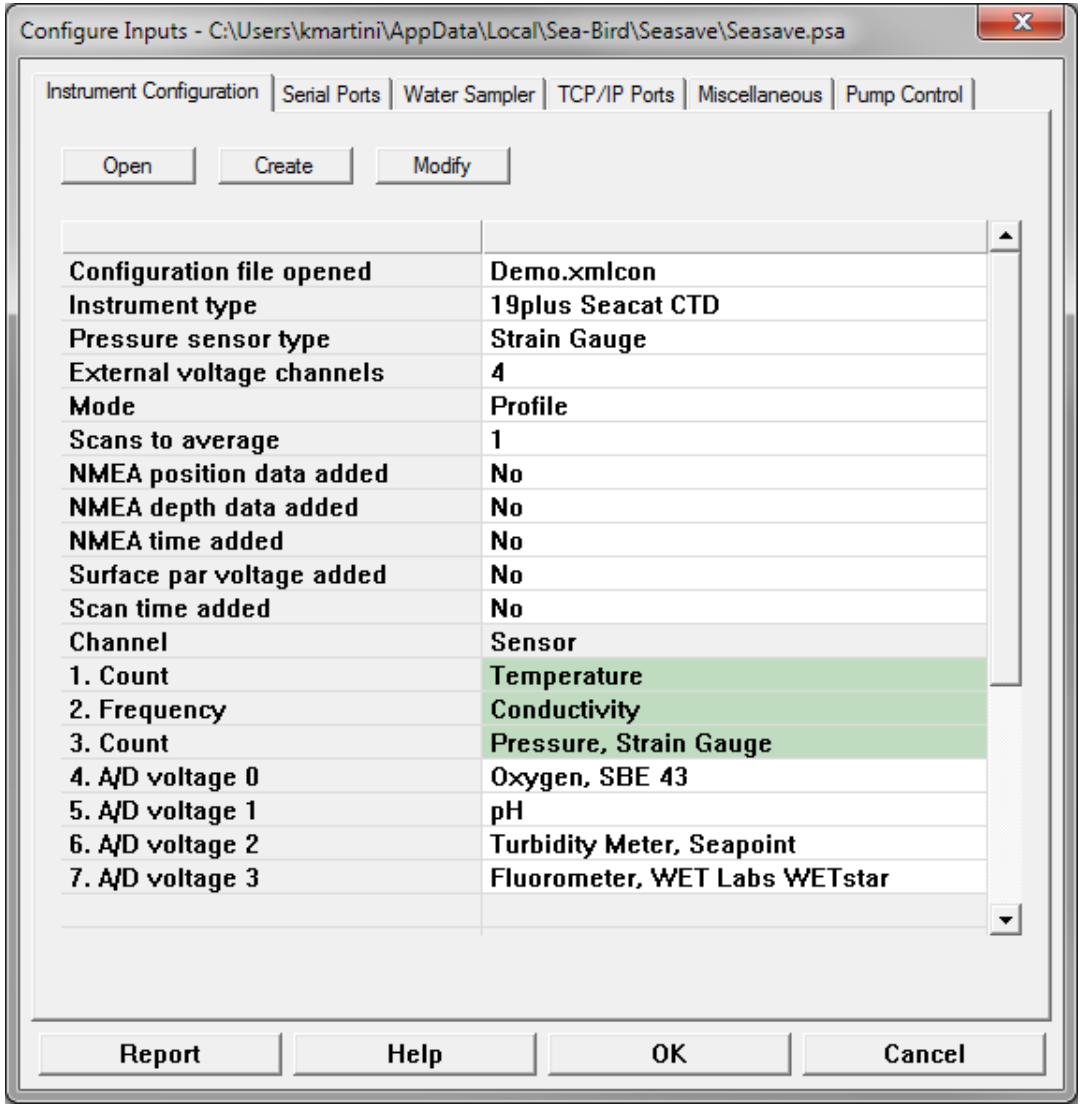
- How does **Seasave** know all this stuff?
  - XMLCON file

- You can also replay data with the XMLCON and HEX raw data file

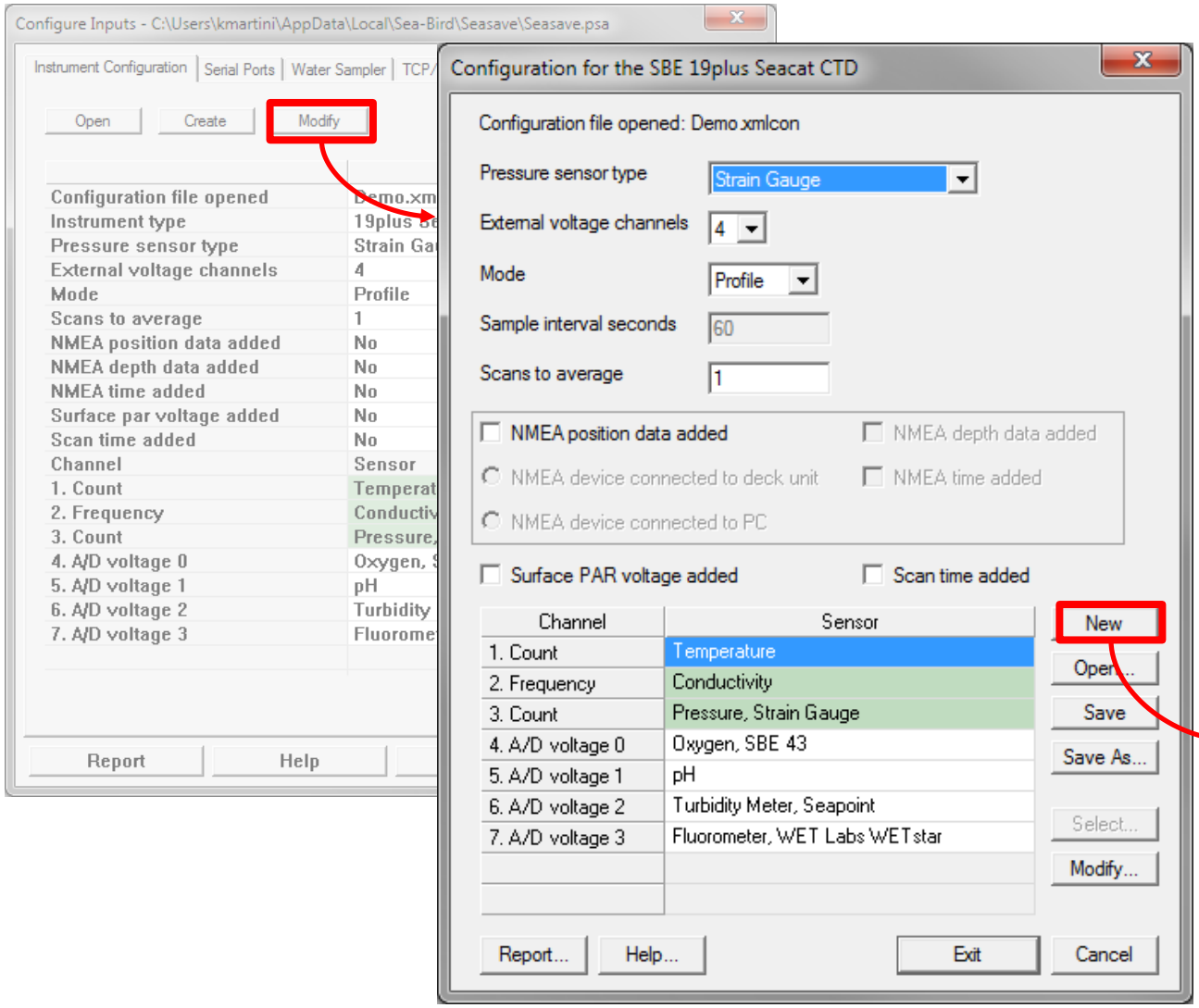
SeasaveV7 Demo



Seasave: Instrument Configuration Window



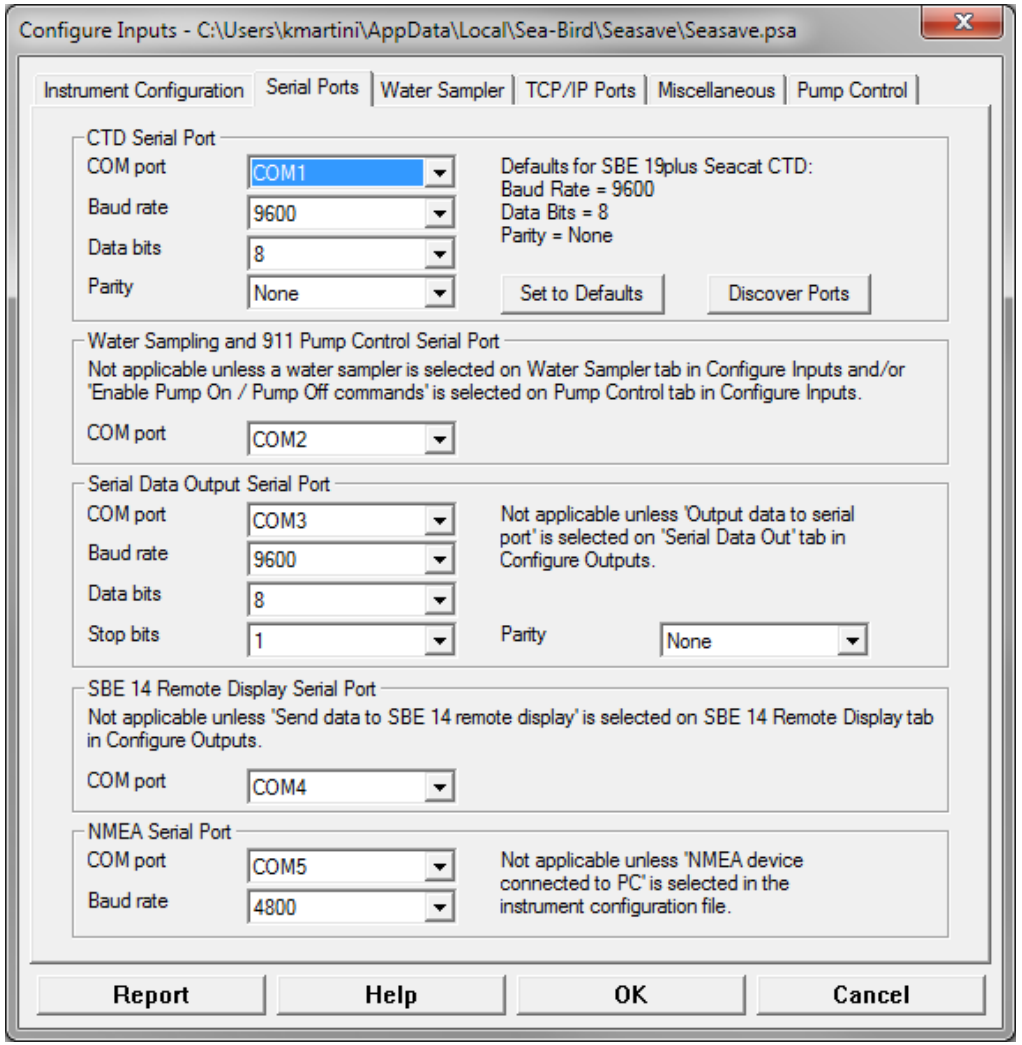
Seasave: Examining the Configuration File



You can also double click the file to open and edit

Configure Inputs: Serial Ports

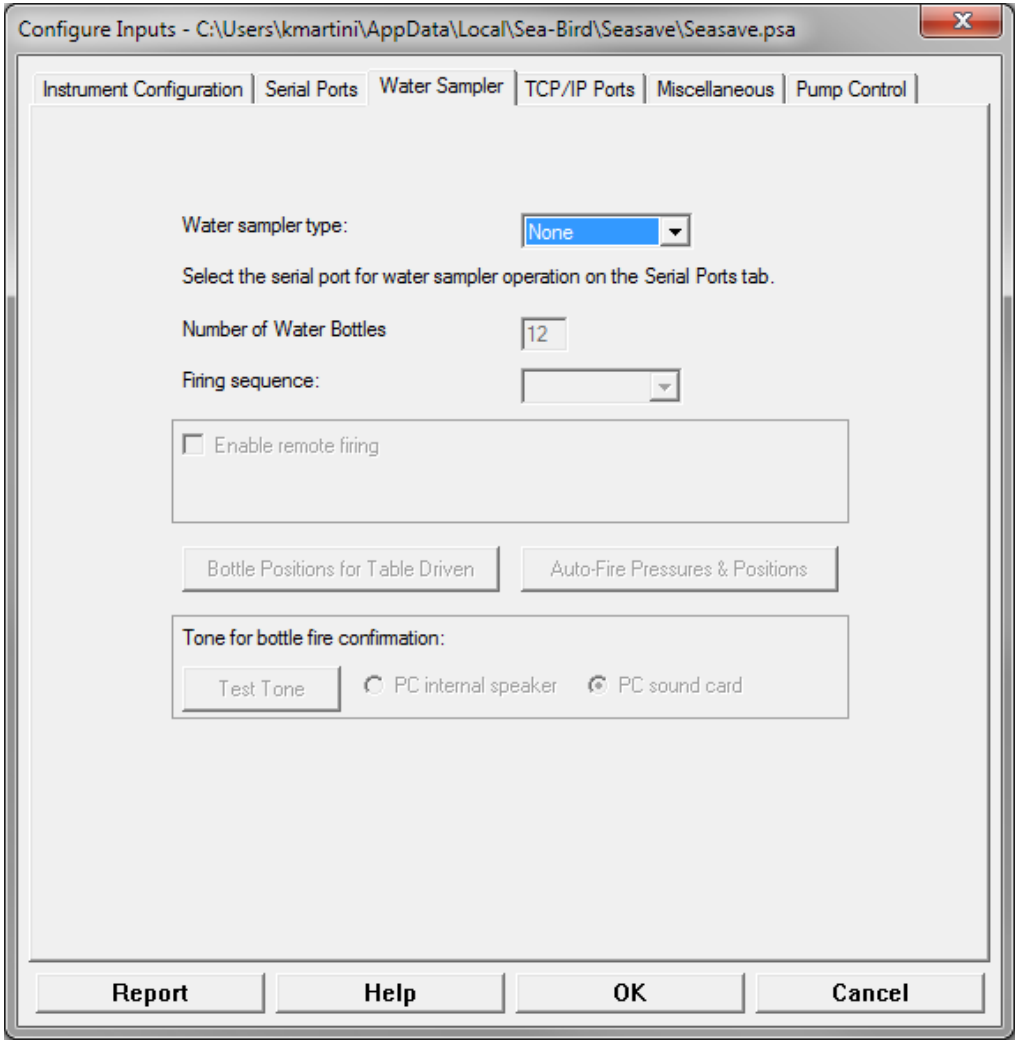
- Define up to 5 ports:
  - Communicate with CTD (required)
  - Communicate with water sampler and/or CTD for pump control (9*plus* must have pump control option)
  - Output data to serial port
  - Output data to SBE 14 Remote Display (obsolete)
  - Input data from NMEA device connected to PC
- Define in Configure Inputs or Configure Outputs



Configure Inputs: Real-Time Water Sampling

- Water sampler configuration

  Type:
  - SBE 32 Carousel
  - SBE 55 ECO
  - GO 1015, GO 1016
- Bottle closure protocol
  - Sequential
  - User Input
  - Table Driven
  - Auto Fire
- Firing bottles from a remote computer



What Files Does Seasave Create?

Uses

- Configuration file, *.con* or *.xmlcon*
  - instrument configuration for cast of matching file name

All these files have the same name as the .hex data file, but different extensions

Always Creates

- Data file, *.hex* (ASCII representation of binary)
- Header file, *.hdr*
  - *Lines beginning with stars (*) mean:*
    - ** have information from raw data file*
    - *** have user-input header information*
    - **END* flags end of header*

Depends on Setup

- Mark file, *.mrk*
  - Contains 1 data scan for each time Mark Scan button is clicked (variables set up on Mark Variables tab of Configure Outputs)
- Bottle file, *.bl*
  - Created when water sampling is enabled
  - Contains bottle fire sequence number and position, date and time, and beginning and ending scan number corresponding to 1.5-second duration for each bottle
  - Data written to .bl file each time confirm bit in data stream is set or when a confirmation is received from water sampler
- Navigation file, *.nav*