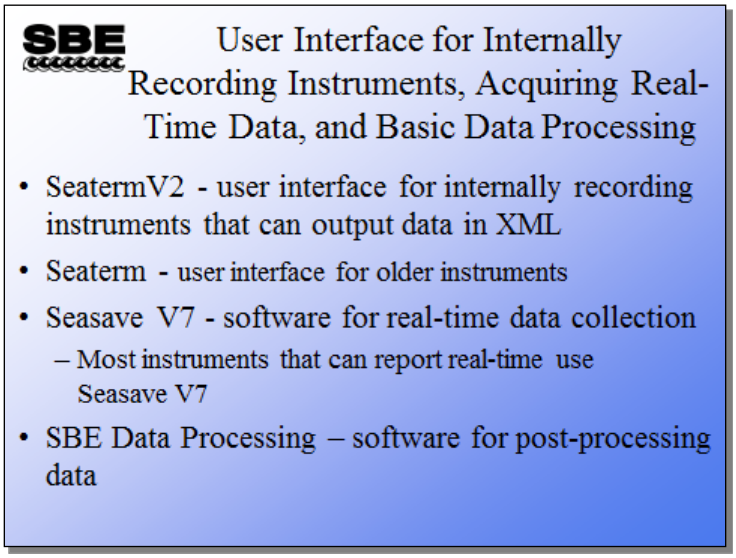
Module 2

Setup and Acquiring Data

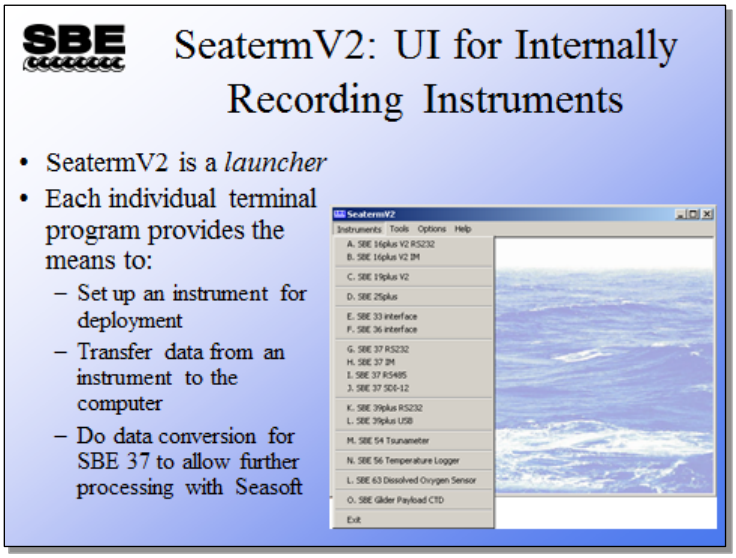
Overview



We are going to discuss SeatermV2, the user interface or terminal program for internally recording instruments that can output data in XML (instruments developed and/or redesigned since 2006). We will also discuss Seasave V7, an application that collects real-time data and saves it to a file. And, we'll provide a brief introduction to SBE Data Processing, for post-processing your data. By the end of this module you should be able to:

- Use SeatermV2 to prepare an internally recording instrument for deployment.
- Use SeatermV2 to transfer data stored in an internally recording instrument to your computer.
- Set up Seasave V7 to collect data in the manner that best suits your application.
- Use Seasave V7 to manipulate your configuration (.con or .xmlcon) file as appropriate for your instrument and auxiliary sensors.
- Use Seasave V7's capability for making file header annotations.
- Use Seasave V7's capability for marking points of interest in the real-time data and saving marked data into a file.
- Use SBE Data Processing to convert data to engineering units and plot data.

SeatermV2: User Interface for Internally Recording Instruments



SeatermV2 is a terminal program ***launcher*** for use with instruments developed or redesigned in 2006 and later. The common feature of this generation of instruments is the ability to output data in XML. SeatermV2 launches one of the following terminal programs, depending on the communication protocol required:

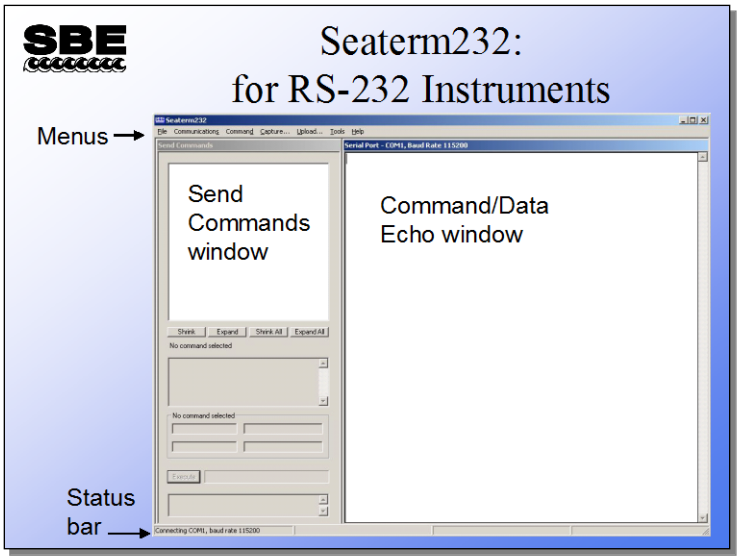
- Seaterm**232** – for communication via RS-**232** (standard serial communications)
- Seaterm**IM** – for communication via **I**nductive **M**odem telemetry (proprietary protocol that Sea-Bird developed for use in moorings; it supports instruments deployed in parallel, with each instrument assigned a unique address)
- Seaterm**485** – for communication via RS-**485** (4-wire serial communications, which allows instruments to be placed in parallel on the communications cable and each instrument to be addressed uniquely)
- Seaterm**USB** – for communication via **USB**

Currently, SeatermV2 supports the following instruments:

- SBE 16*plus* V2, 16*plus*-IM V2, 19*plus* V2 (all firmware version 2.0 and greater)
- SBE 25*plus*
- SBE 37-IM, IMP, SM, SMP, SI, SIP (all firmware version 3.0 and greater)
- SBE 37 IMP-IDO, SMP-IDO, SIP-IDO, IMP-ODO, SMP-ODO, SIP-ODO
- SBE 39*plus*
- SBE 54
- SBE 56
- SBE 63
- Glider Payload CTD

Note: SeatermV2 can also launch Seaterm (older terminal program) if you select the SBE 33 or 36 Deck Unit, providing easy access to Seaterm to set up a deck unit used with an SBE 19*plus* V2 or 25*plus*.

Seaterm232: Interface for RS-232 Instruments

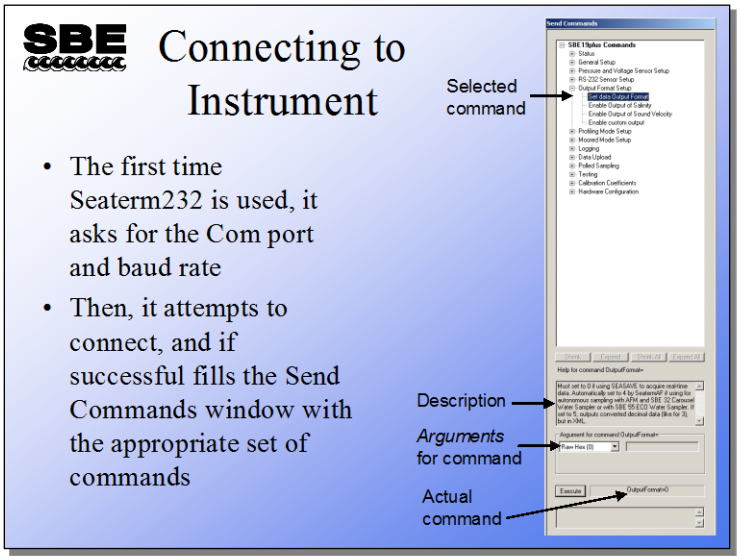


Seaterm232 opens if you select *SBE 19plus V2* in SeatermV2's Instruments menu. Seaterm232 is compatible with instruments with an RS-232 interface: 16*plus* V2, 19*plus* V2, 25*plus*, 37(-SM, SMP, SMP-IDO, SMP-ODO, SI, SIP, SIP-IDO, SIP-ODO), 54, 63, and Glider Payload CTD. Seaterm485 and SeatermIM have similar menus and functions.

Looking at Seaterm232:

- Menus – For tasks and frequently executed instrument commands.
- Send Commands window – Contains commands applicable to your instrument. The list appears after you connect to the instrument.
- Command/Data Echo window – Commands and instruments responses are echoed here. Title bar of this window shows the current Com port and baud rate.
- Status bar (at bottom) - Shows if Seaterm232 is connected, disconnected, capturing communications to a file, or uploading data from the instrument memory.

Seaterm232: Connecting to Instrument



Seaterm232 attempts to automatically connect to the instrument through the user-selected Com port and baud rate. If not initially successful, it cycles through all other supported baud rates. When it succeeds, it queries the instrument with a **GetHD** (Get Hardware Data) command, to determine the instrument type and firmware version. XML command files, with each file containing a list of commands for each firmware version of a specific instrument, are installed automatically when you install SeatermV2, and are located in the same directory as SeatermV2. Seaterm232 fills the *Send Commands* window with the appropriate set of commands for the instrument, from the XML command file.

Below is a summary of the function of each of the menus:

File: Manually loads an XML command file if it does not load automatically (these files should be installed automatically when you install SeatermV2, and are located in the same directory).

Communications: Configures communications (baud rate and serial port); connects to the instrument; and disconnects from the instrument (releases the serial port so you can run another program, such as Seasave, without exiting Seaterm232).

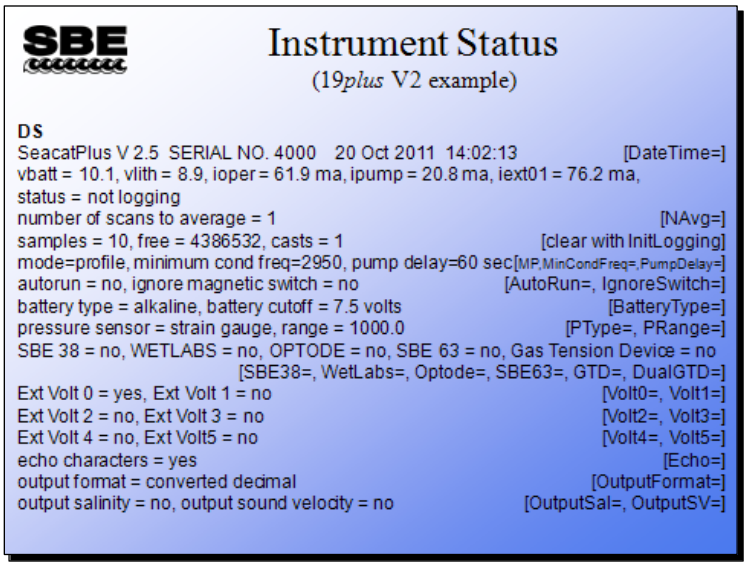
Command: Interrupts and stops instrument response to a command; sends a stop command to stop logging; sets date and time based on user-supplied software running on your computer; and sends a 5-second break (useful for instruments sampling in Serial Line Sync mode).

Capture: Causes Seaterm232 to write everything received from the instrument to a file (useful for some real-time operations and for diagnostics).

Upload: Starts the protocol for transferring data from the instrument's memory to your computer.

Tools: Starts a protocol for saving diagnostic information to a file that you can e-mail to Sea-Bird; converts data from an SBE 37 (so it can be processed with SBE Data Processing); and sends an XML script to the instrument (allowing automation of programming a number of instruments with the same setup).

Seaterm232: Instrument Status



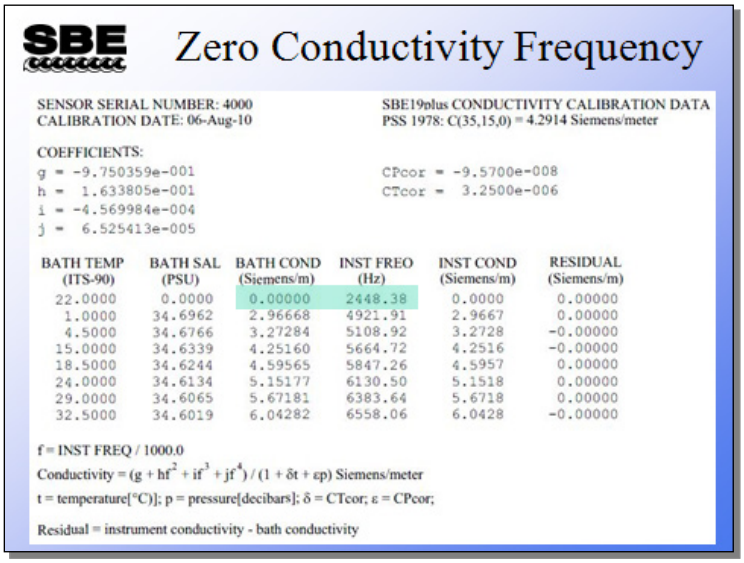
Instrument Status
(19*plus* V2 example)

DS
SeacatPlus V 2.5 SERIAL NO. 4000 20 Oct 2011 14:02:13 [DateTime=]
vbatt = 10.1, vlith = 8.9, ioper = 61.9 ma, ipump = 20.8 ma, iext01 = 76.2 ma,
status = not logging
number of scans to average = 1 [NAvg=]
samples = 10, free = 4386532, casts = 1 [clear with InitLogging]
mode=profile, minimum cond freq=2950, pump delay=60 sec [MP,MinCondFreq=,PumpDelay=]
autorun = no, ignore magnetic switch = no [AutoRun=, IgnoreSwitch=]
battery type = alkaline, battery cutoff = 7.5 volts [BatteryType=]
pressure sensor = strain gauge, range = 1000.0 [PType=, PRange=]
SBE 38 = no, WETLABS = no, OPTODE = no, SBE 63 = no, Gas Tension Device = no
[SBE38=, 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 Volt5 = no [Volt4=, Volt5=]
echo characters = yes [Echo=]
output format = converted decimal [OutputFormat=]
output salinity = no, output sound velocity = no [OutputSal=, OutputSV=]

The instrument status report contains much valuable information:

- Instrument type, firmware revision, serial number, and date and time.
- Main battery voltage and back-up battery voltage. Operating current, pump current, and current to external voltage sensors provide an indication of the battery lifetime you can expect, as well as the health of the instrument in general.
- The status entry indicates whether the instrument is logging data or not.
- The number of scans to average sets the sample rate.
- Memory: scans collected, number of scans that can fit in the remaining memory, and the number of casts collected.
- The 19*plus* V2 can operate in profiling or moored mode. In profiling mode it is powered continuously, while in moored mode it powers down between samples. The 19*plus* V2 waits until the conductivity sensor's frequency rises, indicating that there is water in the cell, to turn on the pump. The threshold for the pump turn-on is the *minimum conductivity frequency* (see next page for more information). In addition, there is a time delay from when that frequency is reached to the pump turn-on, to allow air to leave the plumbing.
- If the 19*plus* V2 is set to autorun=yes, it starts logging automatically when external power is applied. If the 19*plus* V2 is set to ignore its magnetic switch, it can only be made to collect data via commands sent by a terminal program.
- Battery type can be Alkaline, NiMH, or Ni-Cad. Battery type influences the cutoff voltage, which is the power level that causes the instrument to shut itself off because it does not have sufficient power to sample.
- Pressure sensor type and range are entered at the factory.
- Which auxiliary sensor channels are enabled and logged with the CTD data.
- Whether to show entered commands on screen as you type.
- Output data format.

Seaterm232: Instrument Status (*continued*)



SBE

Zero Conductivity Frequency

SENSOR SERIAL NUMBER: 4000
CALIBRATION DATE: 06-Aug-10

SBE19plus CONDUCTIVITY CALIBRATION DATA
PSS 1978: C(35,15,0) = 4.2914 Siemens/meter

COEFFICIENTS:

g = -9.750359e-001
h = 1.633805e-001
i = -4.569984e-004
j = 6.525413e-005

CPcor = -9.5700e-008
CTcor = 3.2500e-006

BATH TEMP (ITS-90)	BATH SAL (PSU)	BATH COND (Siemens/m)	INST FREO (Hz)	INST COND (Siemens/m)	RESIDUAL (Siemens/m)
22.0000	0.0000	0.00000	2448.38	0.0000	0.00000
1.0000	34.6962	2.96668	4921.91	2.9667	0.00000
4.5000	34.6766	3.27284	5108.92	3.2728	-0.00000
15.0000	34.6339	4.25160	5664.72	4.2516	-0.00000
18.5000	34.6244	4.59565	5847.26	4.5957	0.00000
24.0000	34.6134	5.15177	6130.50	5.1518	0.00000
29.0000	34.6065	5.67181	6383.64	5.6718	0.00000
32.5000	34.6019	6.04282	6558.06	6.0428	-0.00000

f = INST FREQ / 1000.0

Conductivity = $(g + hf^2 + if^3 + jf^4) / (1 + \delta t + \varepsilon p)$ Siemens/meter

t = temperature[°C]; p = pressure[decibars]; δ = CTcor; ε = CPcor;

Residual = instrument conductivity - bath conductivity

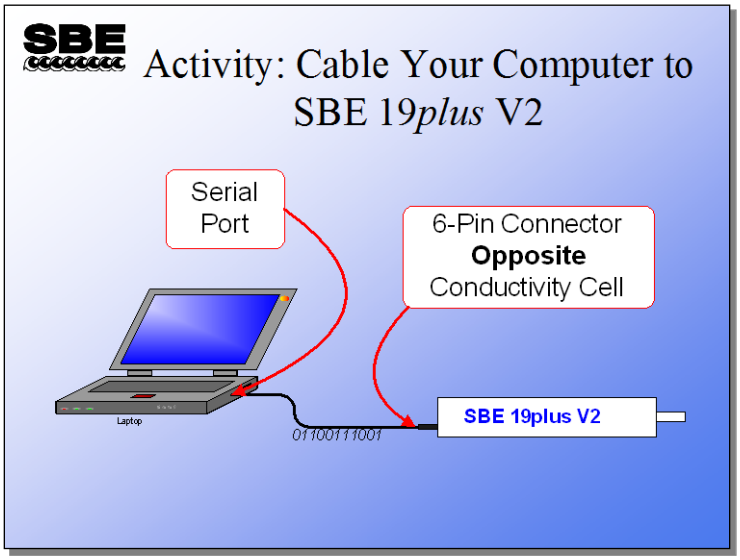
Some more discussion of the *minimum conductivity frequency*: The CTD's calibration sheet lists the uncorrected (raw) frequency output at 0 conductivity.

For salt water applications, the value for the *minimum conductivity frequency* is typically set at the factory to (0 conductivity frequency + 500 Hz).
For this instrument, a typical minimum conductivity frequency in salt water is (2448 + 500) = 2948 Hz; this was rounded up to 2950 Hz for the instrument discussed on the previous page (*minimum cond freq=2950* in **DS** response).

For fresh water applications, the value for the *minimum conductivity frequency* is typically set at the factory to (0 conductivity frequency + 5 Hz).
For this instrument, a typical minimum conductivity frequency in fresh water is (2448 + 5) = 2453 Hz

If the minimum conductivity frequency is too close to the *zero conductivity frequency*, the pump may turn on when the CTD is in air, as a result of small drifts in the electronics. Some experimentation may be required, and in some cases it may be necessary to rely only on the pump turn-on delay time to control the pump. If so, set a minimum conductivity frequency lower than the *zero conductivity frequency*.

Activity: Cable Computer to SBE 19*plus* V2



The 6-pin Data I/O - Pump connector is 180° from the conductivity cell. In class, we are connecting to this with a 6-pin to 4-pin adapter cable and a 4-pin to DB-9 data I/O cable. [The other connectors are for auxiliary voltage sensors (three 6-pin connectors) and an auxiliary RS-232 sensor (one 4-pin connector).]

Note: In a real deployment, a Y-cable connects to the 6-pin Data I/O – Pump connector. The 2-pin leg of the cable connects to the pump; the 4-pin leg of the cable connects to the computer or deck unit if obtaining real-time data.

If you are using a **USB to RS-232 converter, you need to know what COM port your computer has assigned to the connection**. Follow these directions (written for Windows XP Professional) to determine the COM port:

1. Select Start / Control Panel.
2. Select System.
3. Click the Hardware tab.
   A. Click *Device Manager.*
   B. Click *Ports.*
   C. Write down what COM port designation has been assigned to the USB port.

Activity: Set up SBE 19*plus* V2 and Collect Some Data

1. Click Start / Programs / Sea-Bird / Seaterm**V2** (**not** Seaterm!).

2. In SeatermV2: select *SBE 19plus V2* in Instruments menu. Seaterm232 appears.

3. In Seaterm232 (if this is the first time you using the software): Verify COM port matches computer connection and baud=9600, and click *OK*.
   - Seaterm232 should automatically connect and fill the Send Commands window.

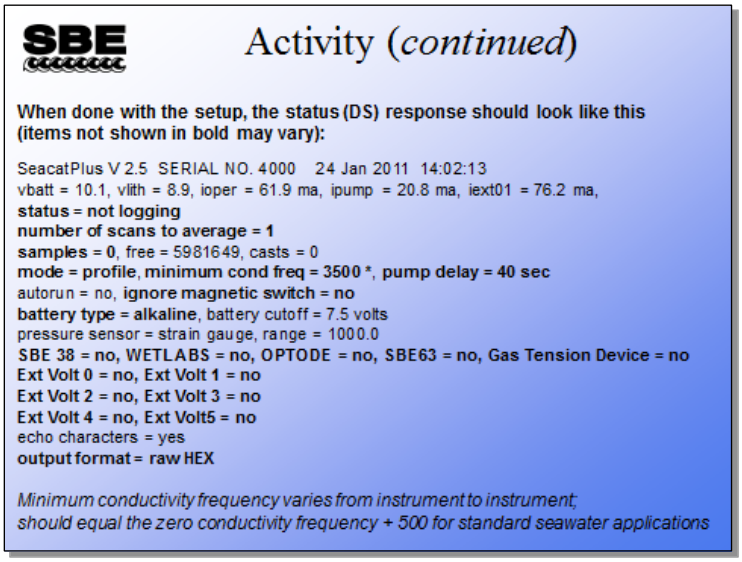
4. Type in the commands below (upper or lower case, it does not matter) or send commands using the Send Commands window. **The 19*plus* V2 prompts you to enter some commands twice.**

Send Commands **CATEGORY**	**COMMAND**	**DESCRIPTION**
General Setup	OutputExecutedTag=y **or** OutputExecutedTag=1	Enable output of executing and executed tags, making it easier to use the Send Commands window to transmit commands.
	BatteryType=alkaline	Alkaline batteries in housing.
	InitLogging	Reset memory, so data recording starts at beginning of memory.
Pressure & Voltage Setup	Volt0=N **or** Volt0=0	No auxiliary sensor 0 installed. Note: We disabled all other auxiliary sensors for you for this activity.
Output Format Setup	OutputFormat=2	Transmit raw data as decimal numbers; needed for next step.
Polled Sampling	TS	Request 1 scan of data. Conductivity frequency (Hz) is second number in output; this is the zero (dry cell) frequency. Use this frequency below when setting pump start frequency.
Profiling Mode Setup	MP	Set to profiling mode.
	NAvg=1	Set number of scans to average to 1, to record and transmit at 4 Hz.
	IgnoreSwitch=N **or** IgnoreSwitch=0	Enable magnetic switch to start and stop logging.
	MinCondFreq=CCCC	Set pump start frequency to: [zero conductivity frequency (from TS) + 500] (i.e., add 500 to zero conductivity frequency, and use that number in place of CCCC)
	PumpDelay=40	Set pump start delay to allow time for air to leave the plumbing.
Output Format Setup	OutputFormat=0	Transmit raw data as hexadecimal numbers; **needed for Seasave (later!).**
Status	DS	Verify setup.

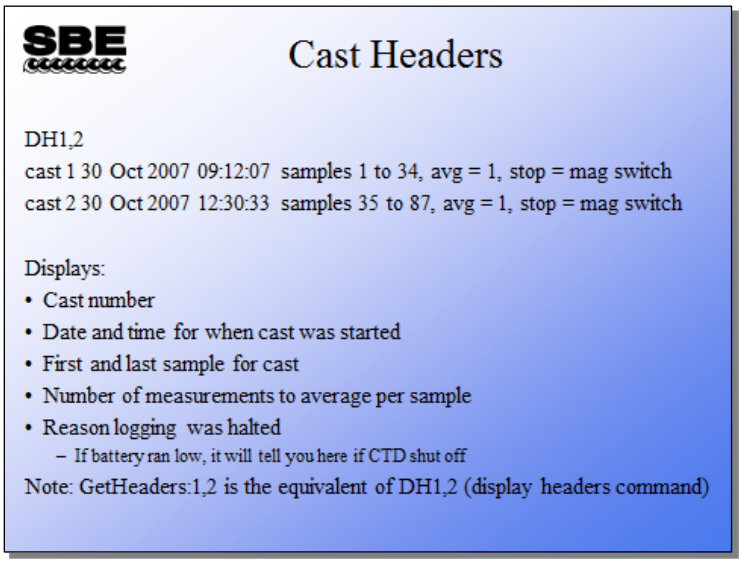
5. Move the magnetic switch to ON.

6. When you get bored, move the magnetic switch to OFF.

Activity (*continued*)

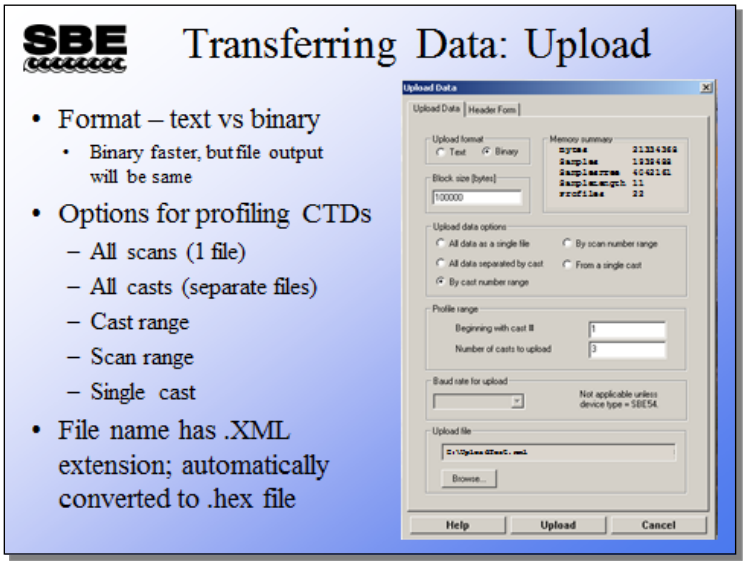


Stored Cast Headers



Each cast header lists the start date and time, number of scans in the cast, number of samples averaged per scan, and reason the cast ended for each cast.

Transferring Stored Data



When you click the Upload menu in Seaterm232, you start a process that produces an upload file that is compatible with our data processing software (SBE Data Processing).

Upload Format: Seaterm232 can upload in text or binary. Binary is approximately twice as fast; the resulting output file is the same, regardless of which upload method you use.

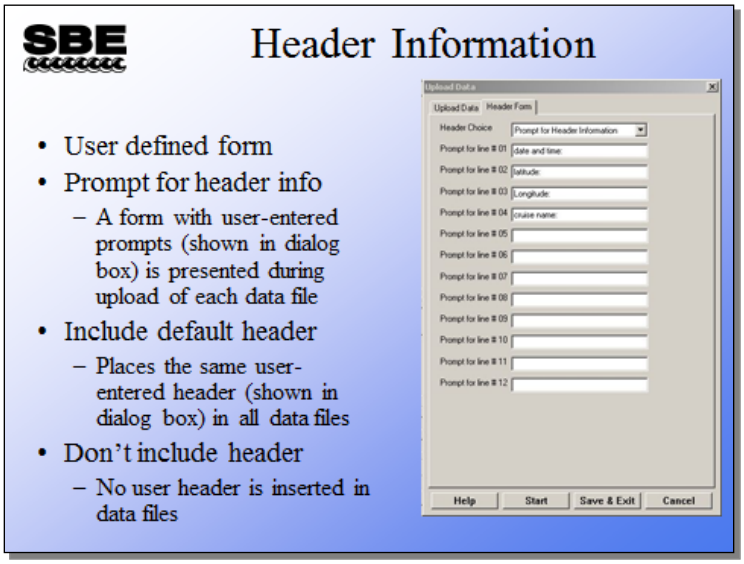
Upload Data Options: Data from an internally recording profiling instrument can be transferred to your computer in one of the following ways:

- **All scans:** All scans in instrument are uploaded into 1 file.
- **All casts:** All casts stored in instrument are uploaded; each cast is in a separate file identified by a 3-digit cast number appended to uploaded file name. If user header information is to be added, Seaterm232 prompts for it before uploading each cast.
- **By cast range:** Enter range. If user header information is to be added, Seaterm232 prompts for it before uploading each cast.
- **By scan range:** Enter range. Useful when data is not arranged in casts or only part of a cast is desired.
- **Single cast:** Enter cast number.

Upload file: After Seaterm232 completes the upload to the .XML file, it automatically converts to a .hex file, which is compatible with Seasave and SBE Data Processing.
(XML is a *language* that is both human- and computer-readable. Software can recognize data fields more easily in XML. For example, the 19*plus* V2 **GetCD** status command outputs '`<PumpDelay>40</PumpDelay>`' to define the pump delay; there is an opening and closing tag, so there is no ambiguity on the value, and the line location in the response does not affect data readability. In contrast, the **DS** command outputs '`pump delay = 40 sec`' on a line with other information; if Sea-Bird changes the location of that line within the response, any software *reading* the response would have to be updated to find the new location.)

Note on Calibration Coefficients: The .XML file and .hex file contain *raw* data – frequencies and voltages from the sensors. Calibration coefficients are applied in post-processing, using the instrument configuration (.con or .xmlcon) file, to convert the output to engineering units (°C, S/m, etc.). The 19*plus* V2 can also output real-time data in engineering units, using the calibration coefficients programmed into the instrument; these do not affect the raw data that is uploaded from memory.

Data File Headers



Now we are looking at the Header Form tab from the dialog box shown in the previous slide. User headers may be placed in uploaded data files, to provide more details about the conditions of the cast.

- If *Prompt for Header Information* is selected, the prompts are used to guide the user's file entries as each cast is uploaded.
- If *Include default header* is selected, these are the only entries that will be added to each file's header; the default entries should reflect more complete information.

Activity: Transfer Data from CTD to Computer

1. Turn off the magnetic switch if you have not already done so. **You must stop logging data before you upload data**.

2. Click Start / Programs / Sea-Bird / Seaterm**V2** (**not** Seaterm!).

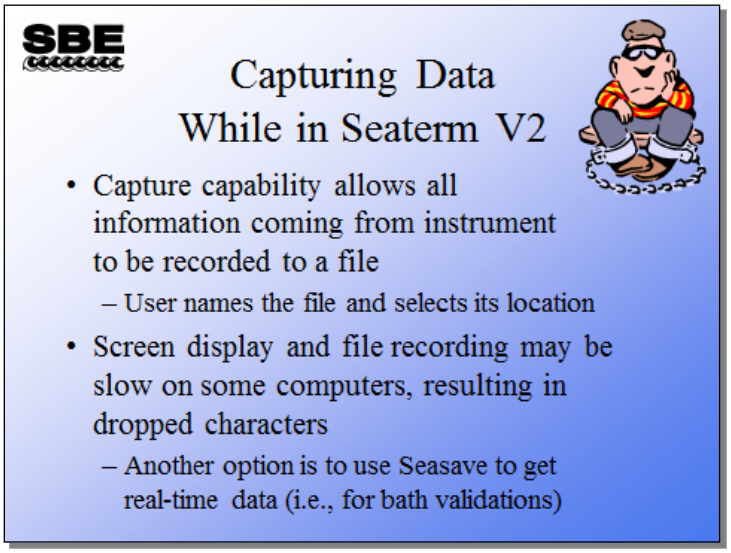
3. In SeatermV2: select *SBE 19plus V2* in Instruments menu. Seaterm232 appears.

4. In Seaterm232, click Upload menu.
   A. In Save As dialog box: save the data in your C:\Data folder with name *intrec* (i.e., C:\Data\intrec.xml), and click *Save*.
   B. In Upload Data dialog box: select *All data as a single file*, make other selections as desired, and click *Upload*.

5. Look in C:\Data. You should see 2 files: intrec.xml and intrec.hex. Seaterm232 automatically converted the uploaded data in intrec.xml into a .hex file, which is compatible with Seasave and SBE Data Processing.

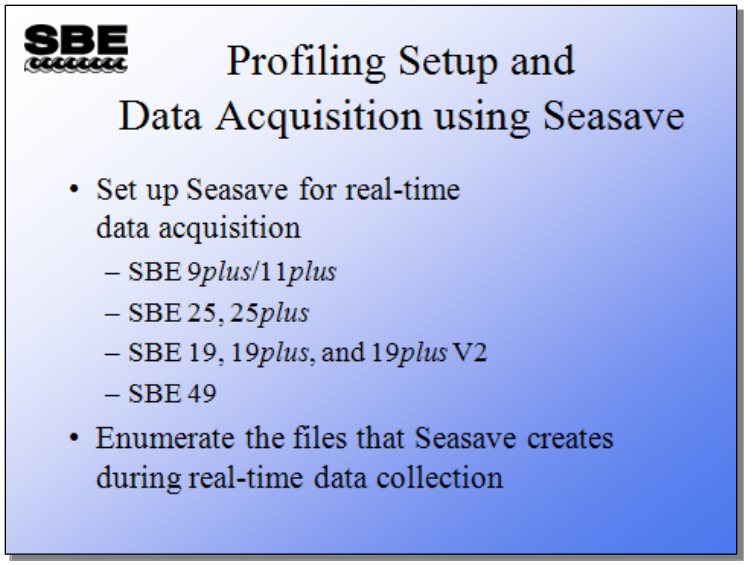
Note:
- Seaterm232 provides a default file name in the Save As dialog box, which includes the instrument type, instrument serial number, year, month, and day. In this activity, we are not using the default file name, but in a real deployment you may find it useful.

Seaterm232: Capturing ASCII Data



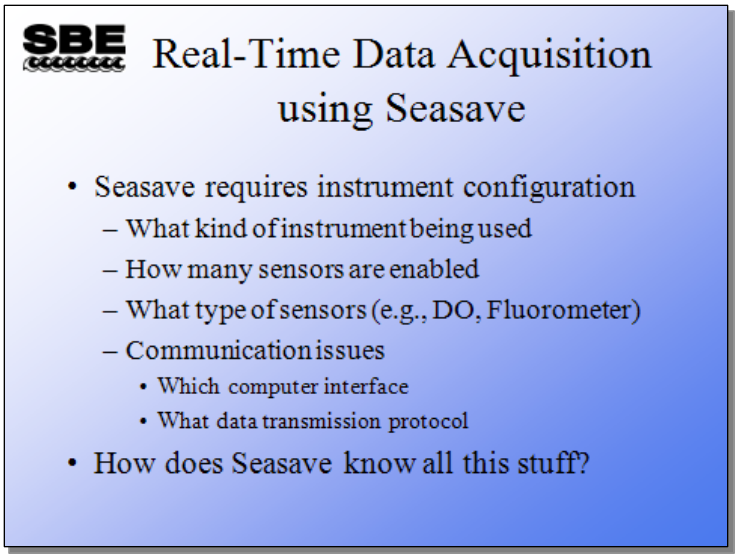
The capture capability allows Seaterm232 to place all characters received into a file. This is useful for testing instruments, performing diagnostics, or in some cases recording real-time data. Note that there is no testing of data integrity and the act of displaying the characters on the screen while they are being written to a file may cause some characters to be lost.

Seasave: Setup for Real-Time Data Acquisition



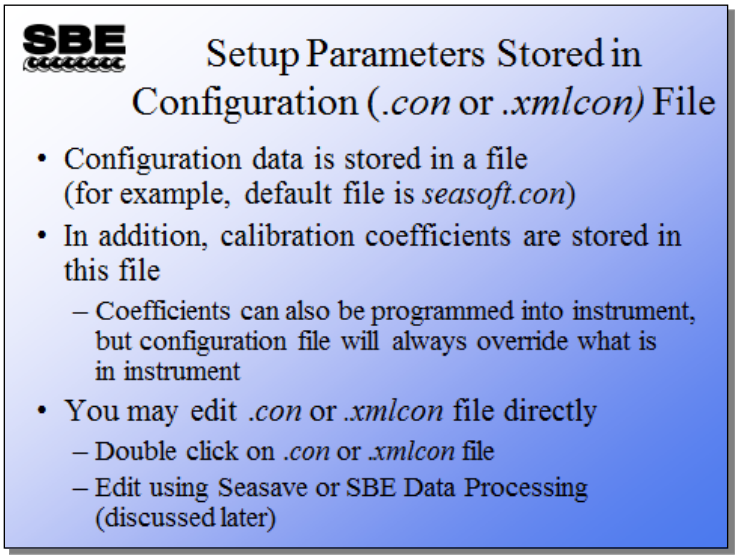
Next, we are going to discuss Seasave, an application that collects real-time data and saves it to a file. We will learn how to set up Seasave and what files are created in the process of data collection.

Seasave: Instrument Configuration



Without this information Seasave is not able to properly process the data stream that is received from an instrument. This is the template for all communications and data processing.

Seasave: *.con* or *.xmlcon* File



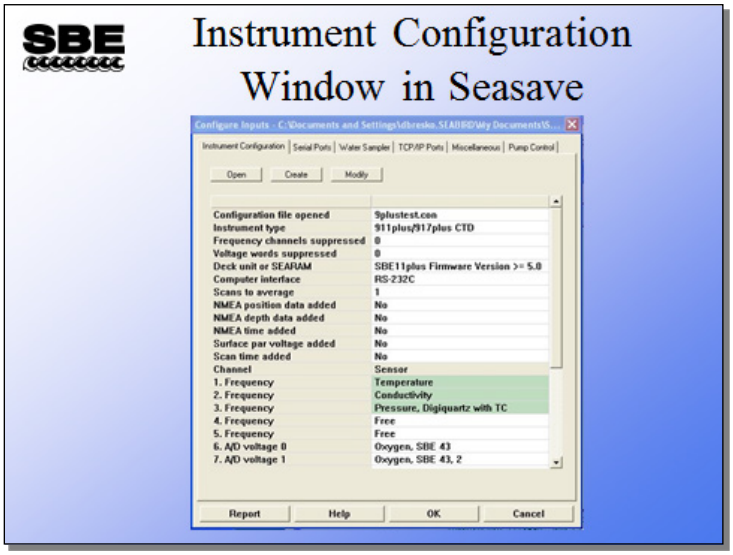
Sea-Bird supplies a configuration file with each new or recalibrated instrument, on a CD shipped with the instrument. The configuration file defines what sensors are integrated with the CTD, what channels are used by those sensors, sensor calibration coefficients, and sampling rate. **The configuration file must match the instrument and contain current calibration coefficients.** If you make changes in the field (for example, replace an old transmissometer with a new one, or add or remove a sensor), **YOU MUST UPDATE THE CONFIGURATION FILE!!**

- Along with changing the configuration file, you must update the setup **in the instrument**. Remember commands we sent to the 19*plus* V2 to disable auxiliary sensor channels (Volt0=N, etc.)? If you now want to connect an auxiliary sensor to one of those channels, you must *enable* the channel in the CTD, as well as update the configuration file to include the new sensor. If you do not enable the channel in the instrument, you will not get any data from the channel.

The most common customer problem is mistakes in the configuration file. All Sea-Bird profiling instruments produce a coded data file. The information to decode this file is found in the configuration file. The configuration file allows one application to service many instrument types.

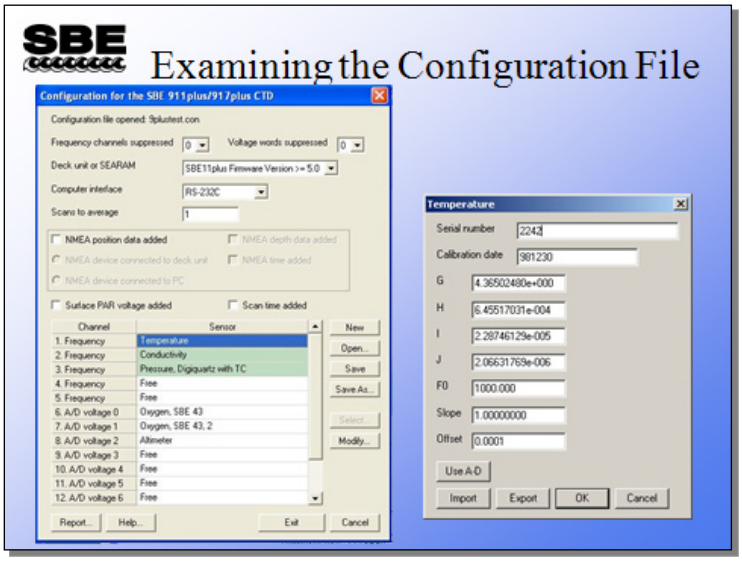
- **In 2009,** Version 7.20a of Seasave and SBE Data Processing introduced the ***.xmlcon*** file, written in XML format. The software allows you to open a .con **or** .xmlcon file, and to save the configuration to a .con **or** .xmlcon file. We'll use .con files for some exercises in the class, but .xmlcon files provide the same results.

Seasave: Selecting a Configuration (.con or .xmlcon) File



Click the Configure Inputs menu to get the Configure Inputs dialog box; the first tab is the Instrument Configuration tab. From the Instrument Configuration tab, you can open and examine an existing .con or .xmlcon file, or create a new .con or .xmlcon file.

Seasave: Configuration (.con or .xmlcon) File Contents



The configuration (*.con* or *.xmlcon*) file contains information about your instrument configuration and the calibration coefficients for your sensors. For example, you can suppress unused frequency channels; many 9*plus* CTDs only have one temperature and one conductivity sensor. Suppressing 2 frequency channels allows you to collect data from the 9*plus* without 2 frequency channels that will always be zero. Similarly, you can suppress unused voltage channels in pairs (shown as voltage words). You must suppress pairs because of constraints on the binary data format that comes from the 9*plus*. For example, if you have 1 temperature sensor, 1 conductivity sensor, a fluorometer, and an SBE 43 dissolved oxygen sensor, you can suppress 2 frequency channels and 3 voltage words, saving 14 bytes per data scan.

The configuration file also has a selection of computer interface, RS-232 or IEEE-488. If your computer is equipped with an IEEE-488 board, you may select IEEE-488. The IEEE-488 communication protocol is faster than the serial port and was more commonly used when computers were slower than those available today.

The 11*plus* can average incoming scans and present the result to your computer. This will also reduce the file space needed to store your data. However, modern computers have large memories, and the loss of resolution in your CTD data makes averaging any more than 2 scans unattractive for most applications.

You may plug a light meter into the 11*plus* and include Surface PAR (photosynthetically active radiation) in your data stream. This is useful for determining percent available PAR as your CTD equipped with a PAR sensor descends into the darkness.

Time and position may be added to the data scans as well. The *Scan time added* check box causes Seasave to append your computer system time to each scan and the NMEA position check box appends a Latitude and Longitude from a GPS receiver that is transmitting NMEA message 0183.

Each data channel can then be assigned a sensor.

Activity: Create Configuration File

1. Click Start / Programs / Sea-Bird / Seasave**V7** (**not** Seasave-Win32!).

2. In Seasave V7, open and modify new instrument configuration:
   A. Click *Configure Inputs* menu.
   B. On Instrument Configuration tab, click *Open*.
   C. Navigate to the Data folder on your hard drive, and select 7402.xmlcon. Click *Open*.
   D. On Instrument Configuration tab, click *Modify*.
   E. Make or verify the following selections in the Configuration dialog box:

Select:	**Discussion**
Pressure sensor type -- Strain Gauge	Must match factory setting in 19*plus* V2 - see **DS** response.
External voltage channels – 0	Must match voltage sensor enabling/disabling in 19*plus* V2 (Volt0=, Volt1=, etc.) - see **DS** response.
Mode – Profile	Must match mode in 19*plus* V2 (MP) - see **DS** response.
Serial RS-232C sensor – None	Must match auxiliary sensor enabling / disabling in 19*plus* V2 - see **DS** response.
Scans to average – 1	Must match number of scans to average in 19*plus* V2 (NAvg=) - see **DS** response.
NMEA data added – **not** checked	
Surface PAR voltage added – **not** checked	
Scan time added – **not** checked	

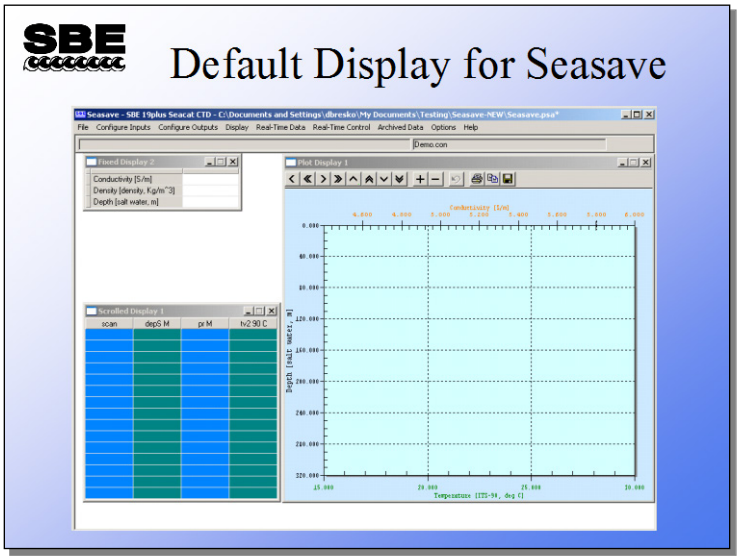
   In the Sensor list, click *Temperature*, and click the *Modify* button. In the dialog that pops up: verify that the calibration coefficients match the Temperature calibration sheet and verify that the slope is 1.0 and offset is 0.0. Make any necessary changes, and click OK.

   In the Sensor list, click *Conductivity*, and click the *Modify* button. In the dialog that pops up: verify that the calibration coefficients match the Conductivity calibration sheet and verify that the slope is 1.0 and offset is 0.0. Make any necessary changes, and click OK.

   In the Sensor list, click *Pressure, Strain Gauge*, and click the *Modify* button. In the dialog that pops up: verify that the calibration coefficients match the Pressure calibration sheet and verify that the offset is 0.0. Make any necessary changes, and click OK.

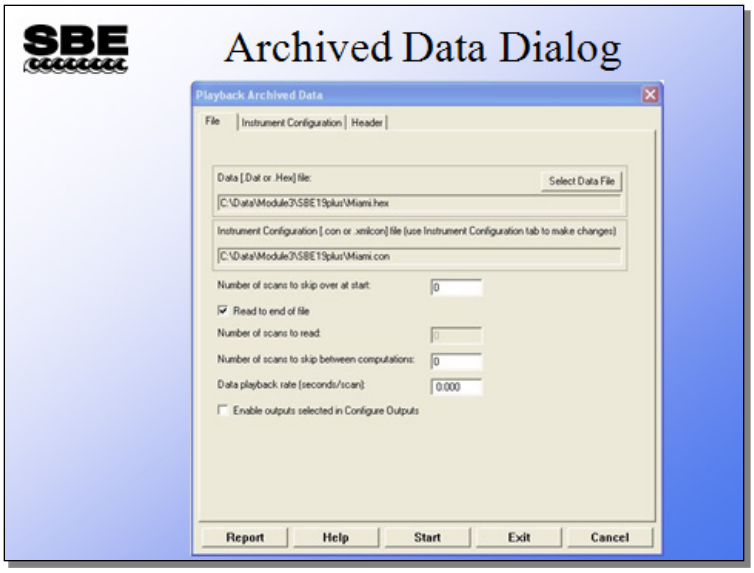
   F. In the Configuration dialog box, click *Save As* and save your .xmlcon file in C:\Data with file name *test* (i.e., C:\Data\test.xmlcon).

Seasave: Default Display



The slide above has all three data windows visible. The top left window is a fixed display and the bottom left window is a scrolling display. The right window is a multi-axis plot.

Seasave: Displaying Archived Data



In the *Archived Data* menu, select *Start* to get the dialog box shown above.

You have the option of skipping data scans at the beginning of the file; this allows you to skip scans collected while the instrument was on deck and going into the water. There is also the option to skip scans when displaying the data; for very long casts this allows you to decimate the data. You can skip 1 or more seconds between scans displayed. You can play back the data at the same rate it was acquired, or you can play it back really fast (set Data playback rate to 0) to generate a plot quickly.

If desired, you can *Enable outputs selected in Configure Outputs*, such as outputs to a serial port, TCP/IP port, shared file, or SBE 14 Remote Display. If enabled, the archived data will be written to / sent to those devices / files as if real-time data was being collected at the designated data playback rate. We'll talk more about Configure Outputs in a few minutes.

Activity: Display Bench Cast in Seasave

1. Click Start / Programs / Sea-Bird / Seasave**V7**.

2. Select configuration (.xmlcon) file you created:

   A. Click *Configure Inputs*.

   B. On Instrument Configuration tab, click *Open*. In dialog box, select .xmlcon file (test.xmlcon) and click *Open*.

   C. Click *OK*.

3. Set up display windows to show time and temperature:

   A. Right click on the **plot** display -> Modify
   (or, select Display menu -> Add New Plot Display Window)
   - On Plot Setup tab
     Set *Plot type* to Single Y – Multiple X, and *Number of Axes* to 2.
   - On Y axis tab
     Click *Select Variable* button, select Time, Elapsed -> seconds, click OK.
     Set *Scale Minimum* to 0 and *Maximum* to 600.
   - On X-Axis 1 tab
     Click *Select Variable* button, select Temperature -> ITS-90 -> deg C, click OK.
     Set *Scale Minimum* to 20 and *Maximum* to 25.

   Click *OK*.

   B. Right click on the **scrolled** display -> Modify
   (or, select Display menu -> Add New Scrolled Display Window)
   - Click *Delete All*.
   - With 1st row in the table highlighted, double click Time, Elapsed -> seconds.
   - With 2nd row in the table highlighted, double click Temperature -> ITS-90 -> deg C.
   - Set *Digits* (right of decimal place) to 0 for time, 3 for temperature.

   Click *OK*.

   C. If desired, set up the **fixed** display. The method is the same as for the scrolled display.

4. Click *Archived Data, Start*

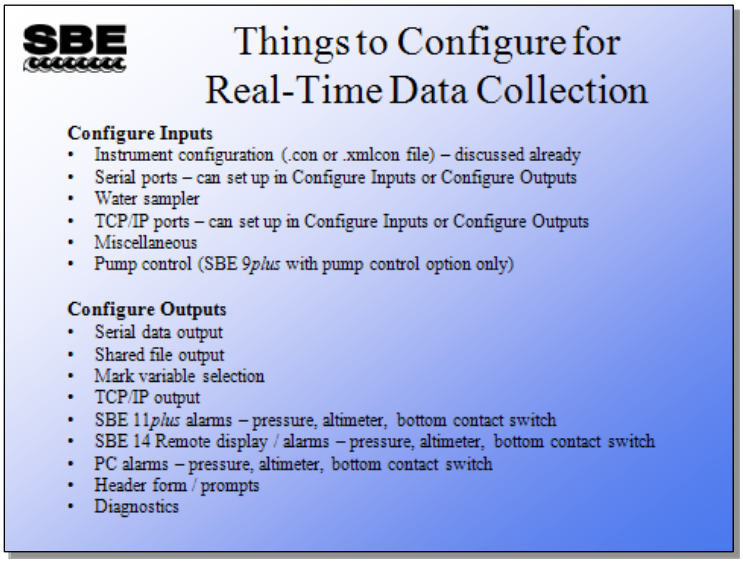
   A. Select .hex data file uploaded from memory (C:\Data\intrec.hex).

   B. Select .con configuration file you created (C:\Data\test.xmlcon).

   C. Set *number of scans to skip over at start* to 0.

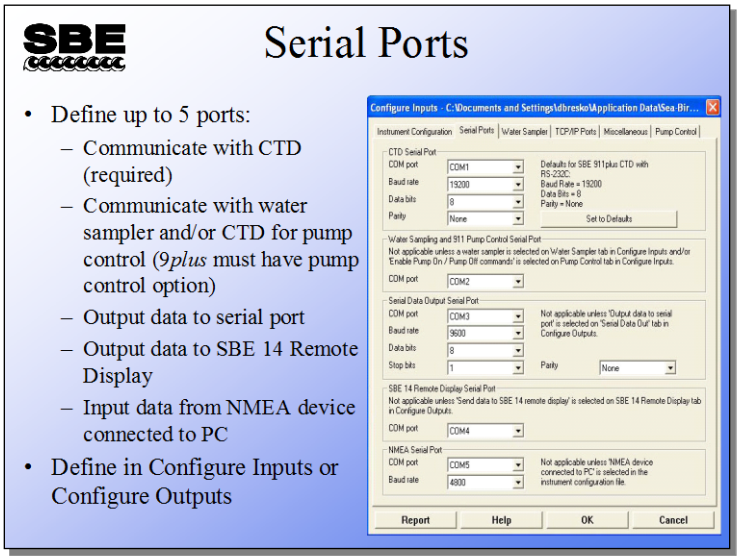
   D. Click *Start*.

Seasave: Configuring Seasave



We'll talk about most of these briefly.

Seasave: Configuring Serial Ports



We'll start by looking at each tab in **Configure Inputs**.

Entries for CTD Serial Port are always required. The other entries are ignored if the applicable input or output is not enabled.

CTD Serial Port

- For the SBE 11*plus* Deck Unit, this is the COM port connected to the *SBE 11 Interface* connector.
- For the SBE 33 or 36 Deck Unit, this is the COM port connected to the *Serial Data* connector
- If you're not using a Deck Unit, this is the COM port connected to the CTD.

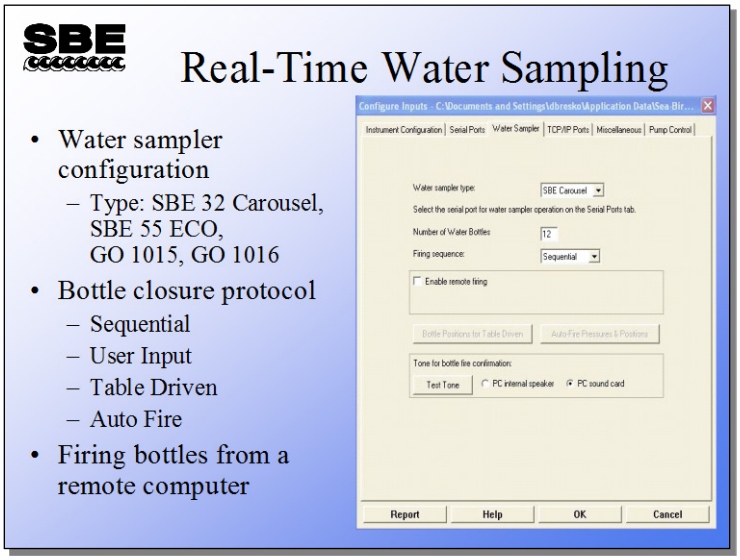
Water Sampler / 911 Pump Control Serial Port

- For the SBE 11*plus* Deck Unit, this is the COM port connected to the *Modem Channel* connector.
- For the SBE 33 Deck Unit, this is the COM port connected to the *Carousel Data* connector.

NMEA Serial Port – Seasave can acquire data from a NMEA device connected directly to your PC (instead of to a Sea-Bird deck unit or interface box).

Serial Ports can be defined in Configure Inputs or in Configure Outputs – changes you make in one dialog box are automatically shown in the other.

Seasave: Configuring Water Sampling



There are several choices for **bottle closure protocols**:

- Sequential – When commanded to fire, bottles are fired in order of position (1, 2, 3, etc.).
- User Input - When commanded to fire, Seasave prompts you to select which bottle to fire.
- Table Driven – When commanded to fire, bottles are fired in order pre-defined by the user-input table (click Bottle Positions for Table Driven button to input the bottle positions).
- Auto Fire – Fire bottles automatically at user-input, pre-defined pressures or depth, ***on upcast*** (click Auto-Fire Pressures & Positions button to input the parameters).
  Auto Fire Notes:
  1. Seasave allows manual firing of some bottles along with auto firing of other bottles, referred to as *mixed mode* firing.
  2. Seasave allows auto fire on downcast with the use of a command line parameter, -autofireondowncast.

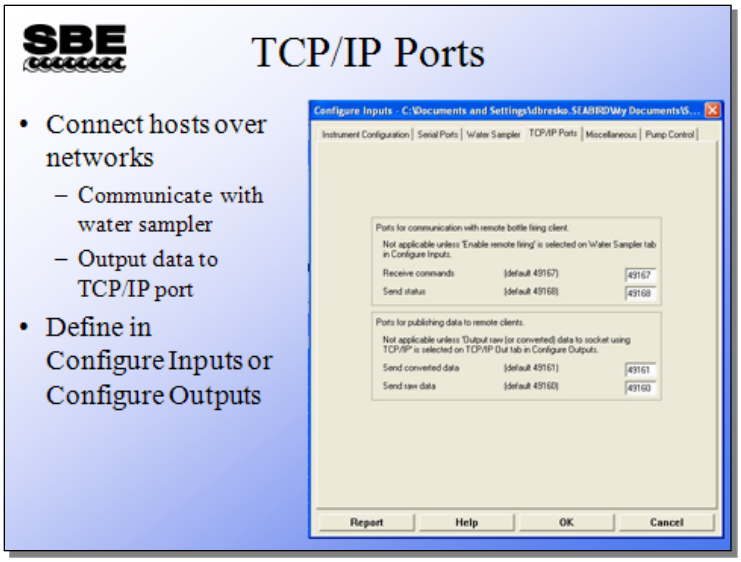
Don't forget to select the desired COM port for communication with the water sampler on the Serial Ports tab!

If you enable **remote firing**, you can control bottle closures from a remote computer through TCP/IP ports, instead of as defined by the Firing Sequence.

- Sea-Bird provides a software program, Seasave Remote, to display data on the remote computer and to fire bottles from the remote computer.

Don't forget to select the desired TCP/IP ports for communication with the water sampler on the TCP/IP Ports tab!

Seasave: Configuring TCP/IP Ports

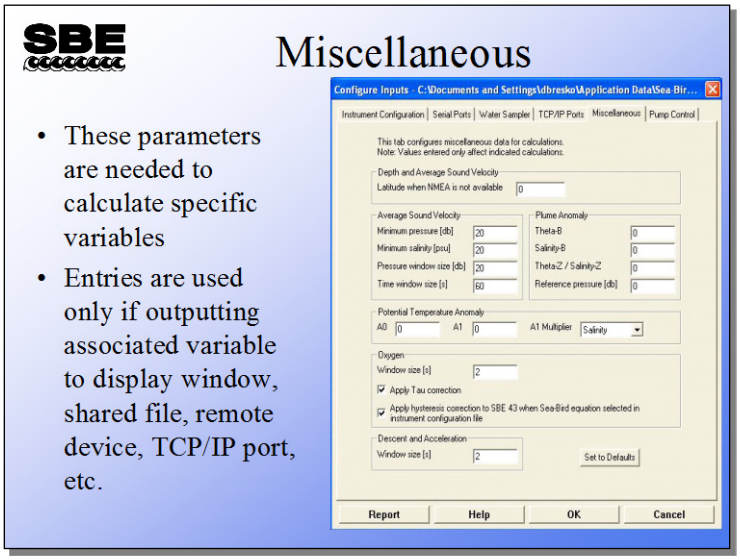


TCP/IP (Transmission Control Protocol / Internet Protocol) is a set of communications protocols used for the Internet and other similar networks. Transmission of Seasave data via TCP/IP allows you to view real-time data and to fire water sampler bottles at a remote computer on the ship.

Entries for ports are ignored if the applicable input or output is not enabled.

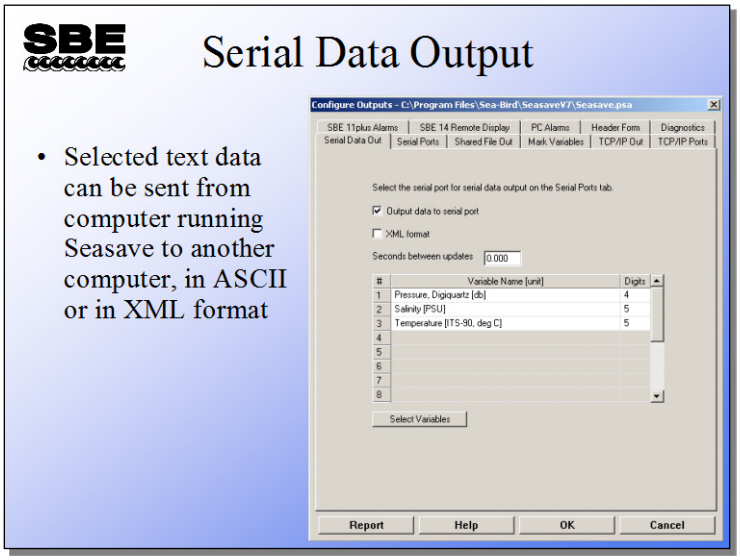
TCP/IP Ports can be defined in Configure Inputs or in Configure Outputs – changes you make in one dialog box are automatically shown in the other.

Seasave: Defining Miscellaneous Parameters



The Miscellaneous tab defines parameters required for output of specific variables. These entries are used only if you are outputting the associated variable to a display window, shared file, remote device, TCP/IP port, etc. For example, if you do not select Oxygen as an output variable for a display window or on any tab in the Configure Outputs dialog box, Seasave ignores the value entered here for Oxygen window size.

Seasave: Configuring Serial Data Output



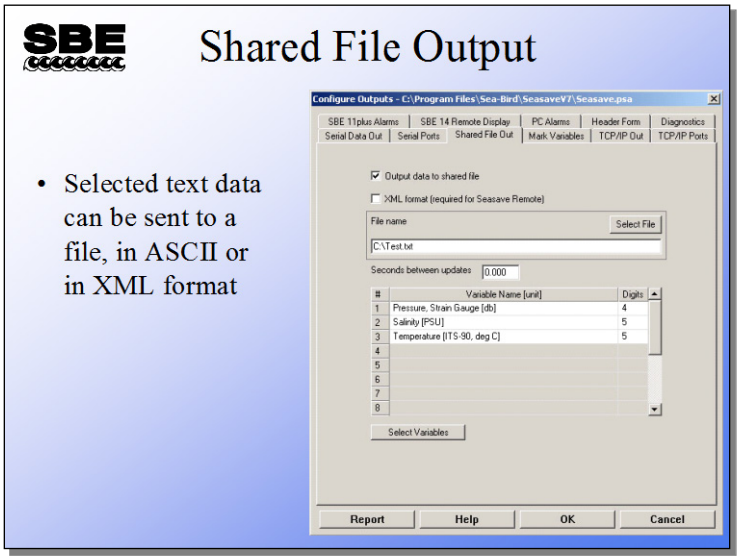
Now let's look at each tab in **Configure Outputs**.

An ASCII stream of data can be sent out via a spare serial port on your computer. The data scan contains parameters that you have selected, displayed to the precision you have set.

If you select *XML format*, data is output in XML instead of in ASCII.

Don't forget to select the desired COM port for serial data output on the Serial Ports tab!

Seasave: Configuring Shared File Output

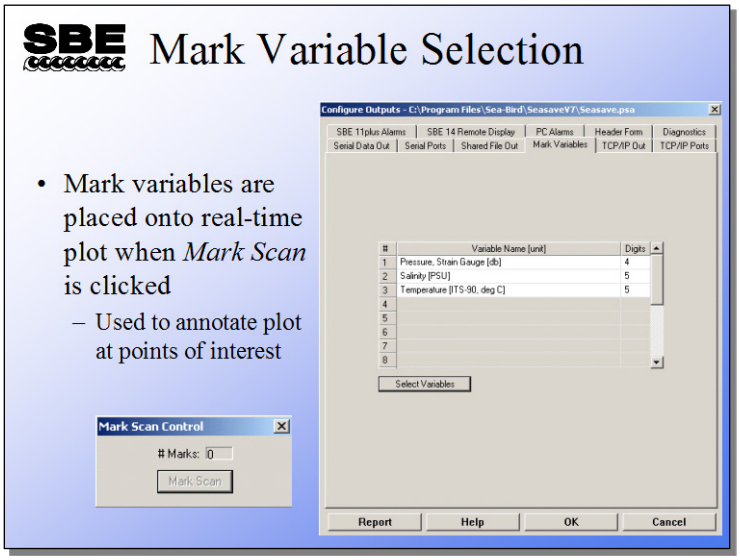


An ASCII stream of data can be sent out to a shared file on a network. The data scan contains parameters that you have selected, displayed to the precision you have set.

If you select *XML format*, data is output in XML instead of in ASCII.

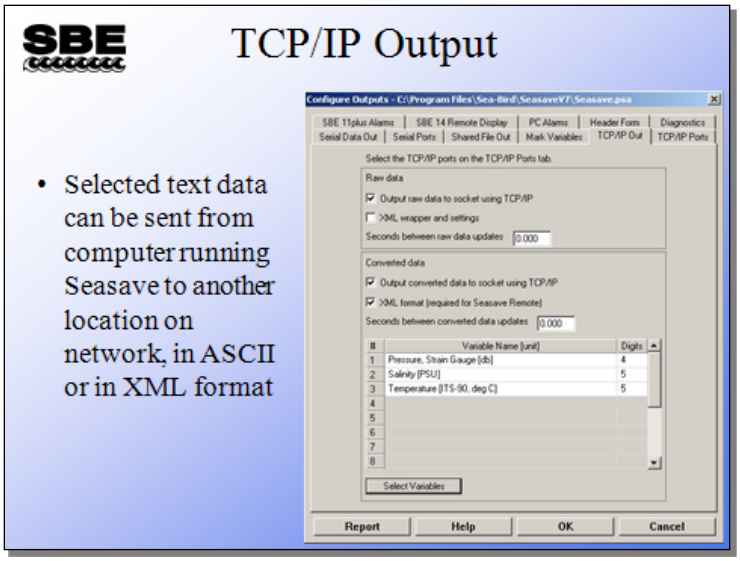
- Sea-Bird provides a software program, Seasave Remote, to display data on a remote computer and to fire bottles from a remote computer. **You must select XML format if planning to use Seasave Remote to view data on a remote computer.**

Seasave: Configuring Mark Variables



Mark Variables annotate a real-time plot with operator-chosen parameters. When *Mark Scan* is clicked, a line is placed across the plot and the requested variables are written on the line. A file is also created with a *.mrk* extension. This file contains a line for each mark with the selected mark variables.

Seasave: Configuring TCP/IP Output



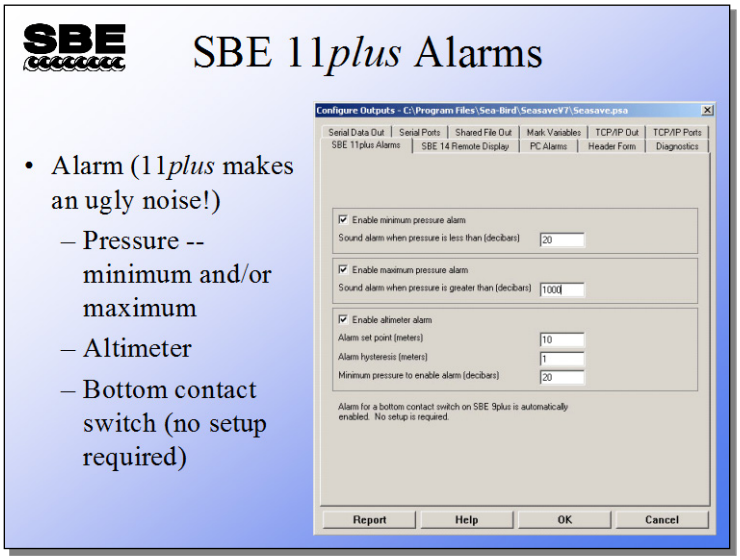
ASCII data (raw and/or converted data) can be sent out using the TCP/IP ports. For converted data, the data scans contain parameters that you have selected, displayed to the precision you have set.

If you select *XML format*, data is output in XML instead of in ASCII.

- Sea-Bird provides a software program, Seasave Remote, to display data on a remote computer and to fire bottles from a remote computer. **You must select converted data and XML format if planning to use Seasave Remote to view data on a remote computer.**

Don't forget to select the desired TCP/IP port for TCP/IP output on the TCP/IP Ports tab!

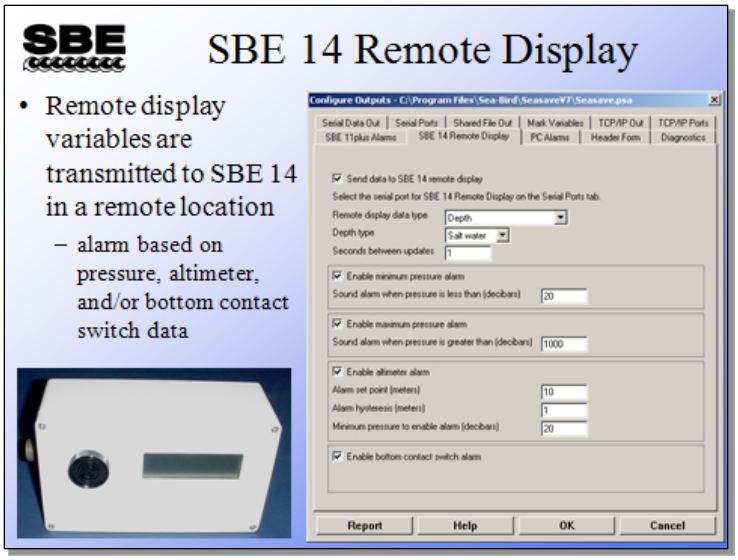
Seasave: Configuring SBE 11*plus* Alarms



The SBE 11*plus* Deck Unit has an alarm that can be set up to operate based on minimum pressure, maximum pressure, data from an altimeter, and/or data from a bottom contact switch.

- The alarm sounds based on minimum pressure, providing a warning that the CTD is nearing the surface.
- The alarm sounds based on maximum pressure, providing a warning that the CTD is deeper than desired.
- The alarm sounds based on the output from an altimeter integrated with the 9*plus* CTD, providing a warning that the CTD is nearing the bottom. This alarm requires a set point (the height above the bottom where it sounds), a hysteresis value (keeps it from going on…off...on...off...on… as the boat rocks), and a minimum pressure to enable (to keep spurious data from setting off the alarm, like when the instrument package goes into the water).
- The alarm also sounds based on the output from a bottom contact switch integrated with the 9*plus* CTD, providing a warning that the CTD is nearing the bottom. No setup is required for the alarm to operate based on bottom contact switch data.

Seasave: Configuring SBE 14 Remote Display

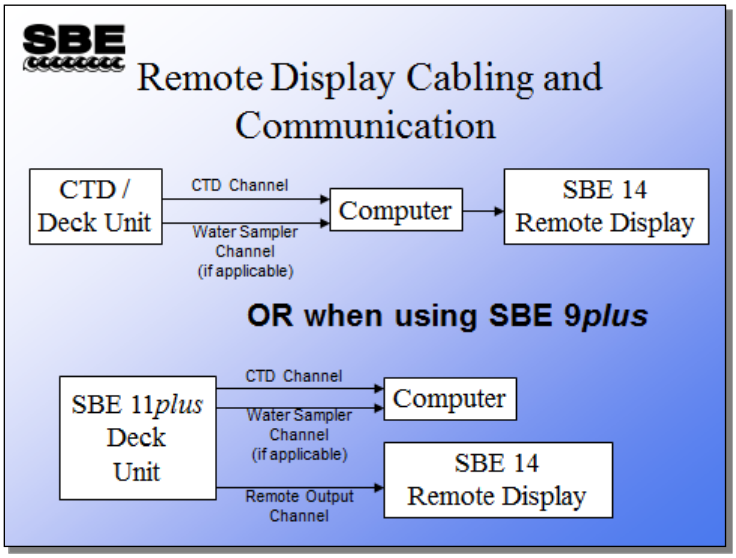


The SBE 14 remote display receives pressure, depth, and/or altimeter data and displays it on a large, liquid-crystal display. The SBE 14 may be placed anywhere it is useful, for example: in the winch dog house, in the wet lab, on the bridge, or in the chief scientist's stateroom to name just a few. The SBE 14 also has an audible alarm that may be triggered by minimum pressure, maximum pressure, altimeter data, and/or bottom contact switch data.

Setup of the alarm parameters is similar to that for an SBE 11*plus* with one exception. If you want an alarm based on bottom contact switch data, you must enable it on this tab.

Don't forget to select the desired COM port for remote display output on the Serial Ports tab!

Cabling a Remote Display

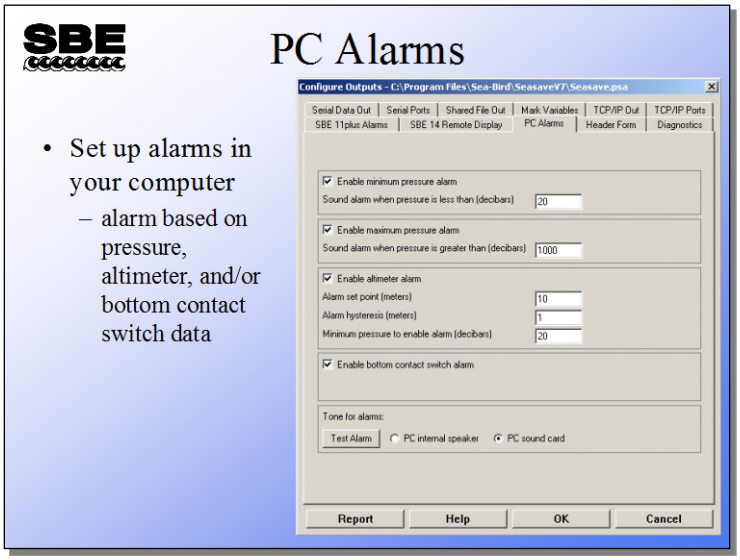


The SBE 14 remote display can be cabled to your system in one of two ways:

- Connected to one of the com ports on your PC (applicable to use of the SBE 14 with any of our CTDs/Deck Units, including the SBE 11*plus*), or
- Connected directly to the SBE 11*plus* – If connected this way, setup of the Remote Display is not done in Seasave; see the 11*plus* manual.

Note that the deck unit requires either a com port or a GPIB port (GPIB port only available for 11*plus*), and the water sampler requires a com port. If the remote display is connected to the computer, it requires an additional com port.

Seasave: Configuring PC Alarms

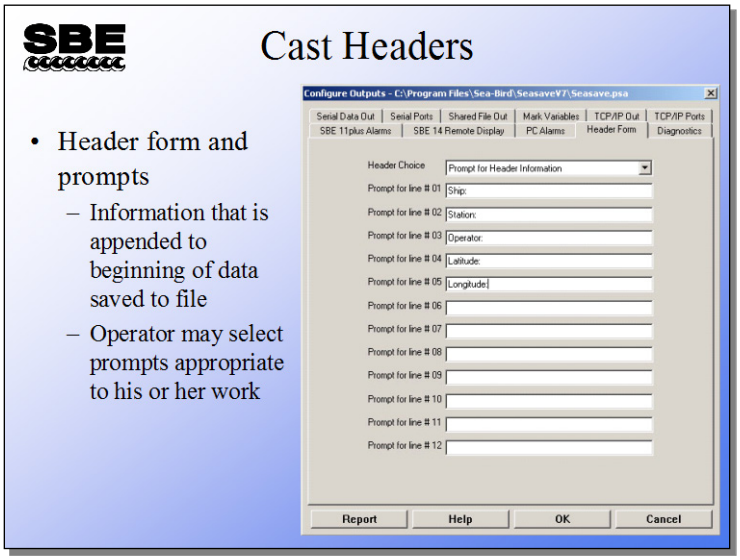


You can also set up an audible alarm in your computer that may be triggered by minimum pressure, maximum pressure, altimeter data, and/or bottom contact switch data.

Setup of the alarm parameters is similar to that for the SBE 14 Remote Display.

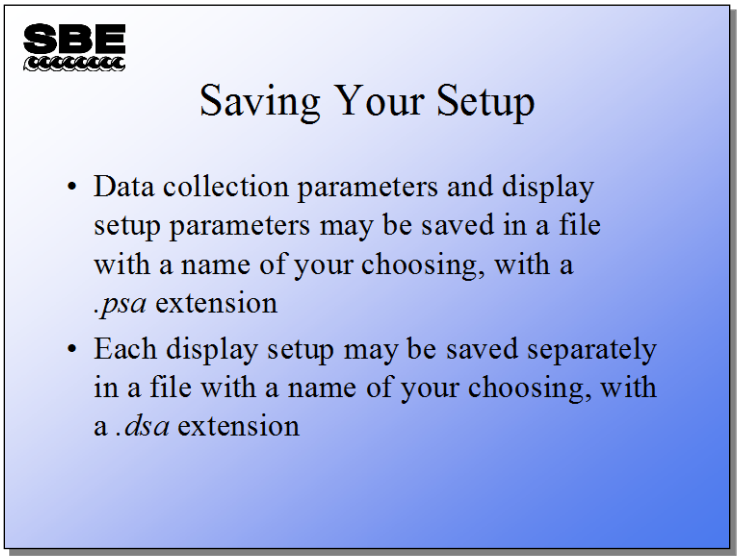
After you enable one or more alarms on this tab, you can enable a *visual* alarm, in addition to the sound alarm (in the Display menu, select Alarms).

Seasave: Configuring Cast Headers



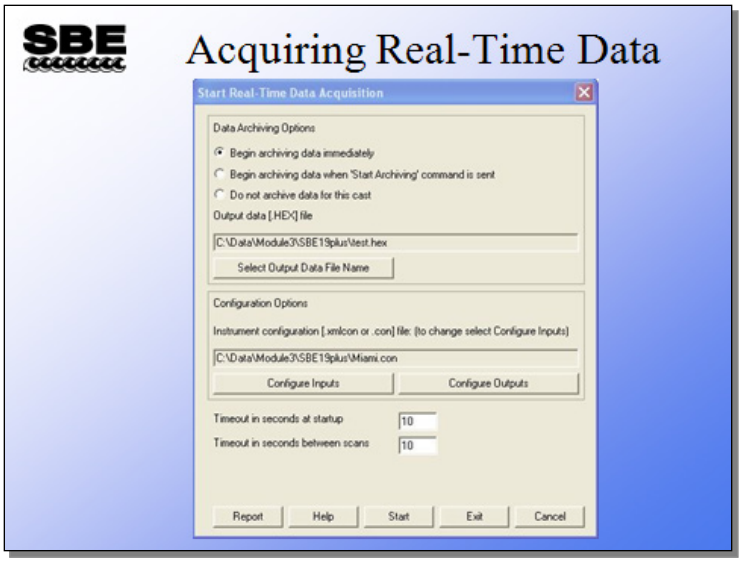
User headers allow the CTD operator to add annotation to the data file. This can take the form of an operator filled out table or a set of default text. The header form may be skipped altogether if desired.

Seasave: Saving Your Setup



Setup files are handy for different instrument types or for pre-deployment instrument checkout *vs.* deployment display. For example, you might use fixed display or scrolled display for pre-deployment check out and then switch to a full screen plot for the cast.

Seasave: Acquiring Real-Time Data



Click the Real-Time Data menu to get the Start Real-Time Data Acquisition dialog box.

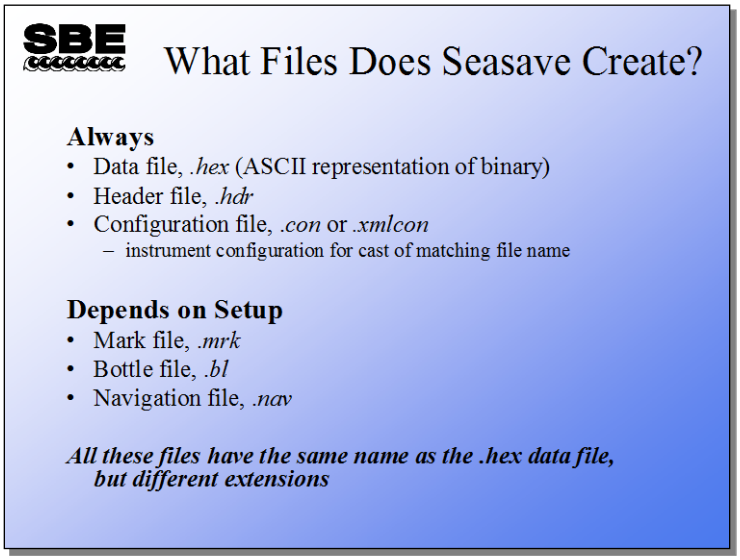
Acquiring real-time data requires the operator to select a configuration (*.con* or *.xmlcon*) file, and decide whether or not to store data to a file and what the name of the file should be. Clicking *Start* initializes the CTD/Deck Unit, sends operator choices regarding channel suppression and averaging, and begins displaying data.

Looking at a few of the choices in the dialog box:

- Begin archiving data when 'Start Archiving' command is sent – This feature is useful for not saving to a file the data that is associated with deploying the CTD and soaking it near the surface for a few minutes. If you make this selection, when you click the Start button a dialog box with a Start Archiving button appears. Click the Start Archiving button when you are ready to begin saving data to a file (for example, when you have finished soaking). Alternatively, if you don't enable this feature, you can remove the scans associated with the surface soak in post-processing.
- Timeout in seconds at startup – This is the maximum amount of time before the first data scan is received from the CTD; Seasave shuts down if a scan is not received within this time. Leave yourself enough time to turn on the magnetic switch.

Note: Don't forget to configure the Com port(s) in Configure Inputs or Configure Outputs before you click *Start*!

Seasave: File Types



If you archive data to a file name of *MyFile*, Seasave creates the following files:

Always:

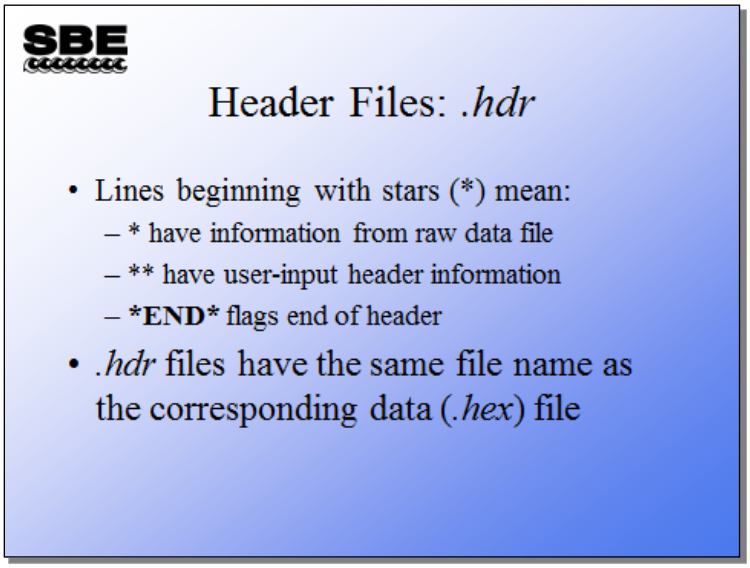
- *MyFile.hex* has an ASCII (text) representation of binary data in hexadecimal format plus the header in ASCII (text) at the beginning of the file.
- *MyFile.hdr* has the header information only, in ASCII.
- *MyFile.con* or *MyFile.xmlcon* has the instrument configuration and calibration coefficients (copied from the input instrument configuration file).

Depends on Setup:

- *MyFile.mrk* has data scans with the chosen mark file variables.
- *MyFile.bl* has scans that were collected when the water sampler bottle closure confirm was received.
- *MyFile.nav* has navigational information collected during the cast.

Note: Older versions (<6.0) of Seasave created a binary data file (.dat) instead of a .hex file during SBE 911*plus* data acquisition. *MyFile.dat* had binary data plus the header in ASCII (text) at the beginning of the file. The rest of the output files were the same as the current version of Seasave.

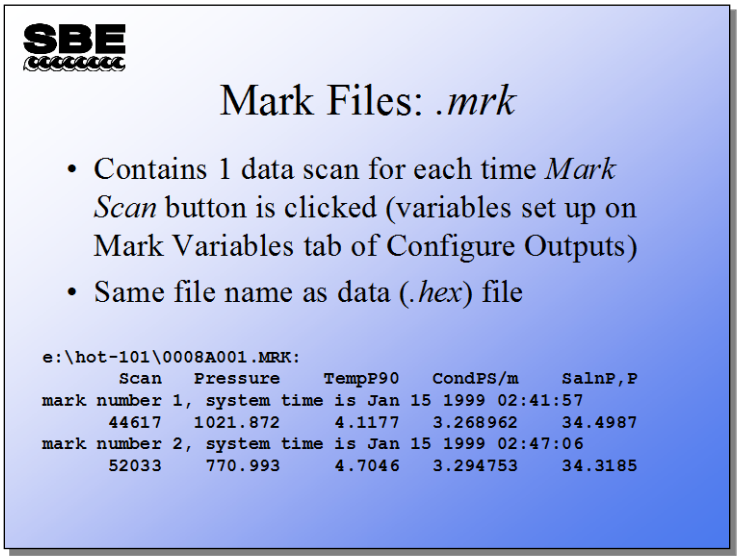
Seasave: Header Files



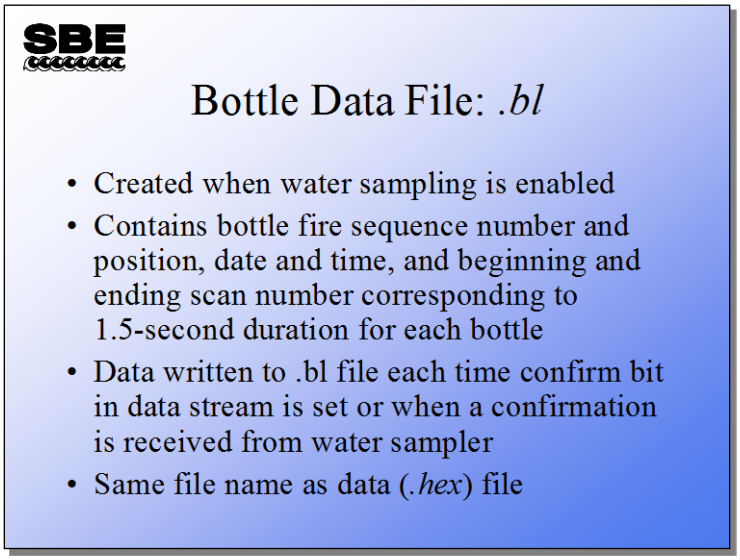
Here is a sample .hdr file for a 19*plus* V2:

* Sea-Bird SBE 19plus V2 Data File:
* FileName = C:\Documents and Settings\dbresko.SEABIRD\My Documents\19plusV2test.hdr
* Software Version Seasave V 7.21a
* Temperature SN = 4022
* Conductivity SN = 4022
* System UpLoad Time = Dec 22 2010 09:24:52
* Real-Time Sample Interval = 0.2500 seconds
* System UTC = Dec 22 2010 17:24:52
** Ship: RV TestBath
** Cruise: test
** Station: Bellevue WA
END

Seasave: Mark Files



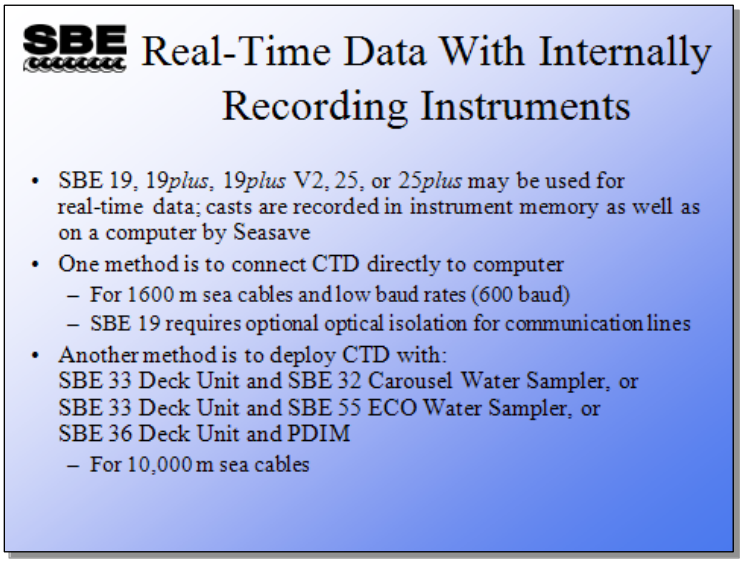
Seasave: Bottle Data Files



Whenever a bottle confirmation is received by Seasave from either the confirm status bit or via the modem port, a line is written to the output file with a .bl extension. This contains the bottle firing sequence number, bottle position, date, time, and beginning and ending scan number for the fired bottle. It is used in data processing to build up a larger file of data parameters collected while the water sampler was being closed.

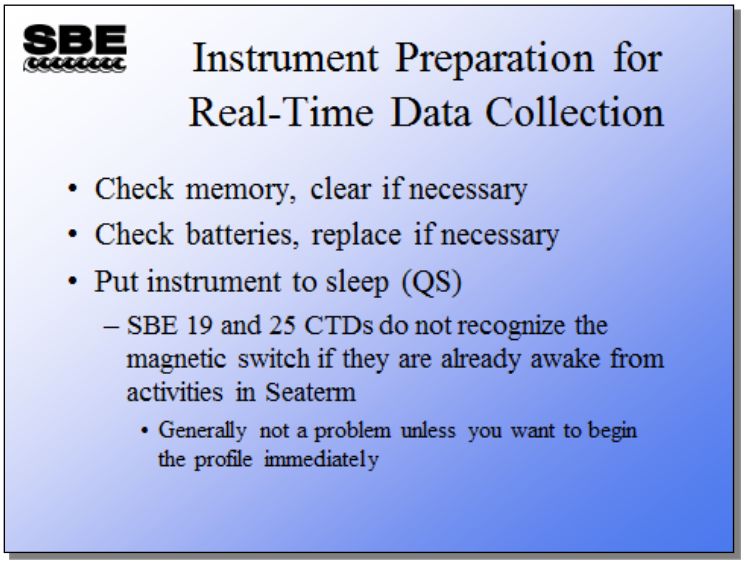
Note: A .bl file is not created if using the SBE 9*plus* / 11*plus* with a G.O. 1015 Rosette. For this system, Seasave instead sets a bottle confirm bit in the data each time a bottle is closed. The bottle confirm bit can also be used in data processing to build up a file of data parameters collected while the water sampler was being closed.

Using Internally Recording Instruments for Real-Time Applications



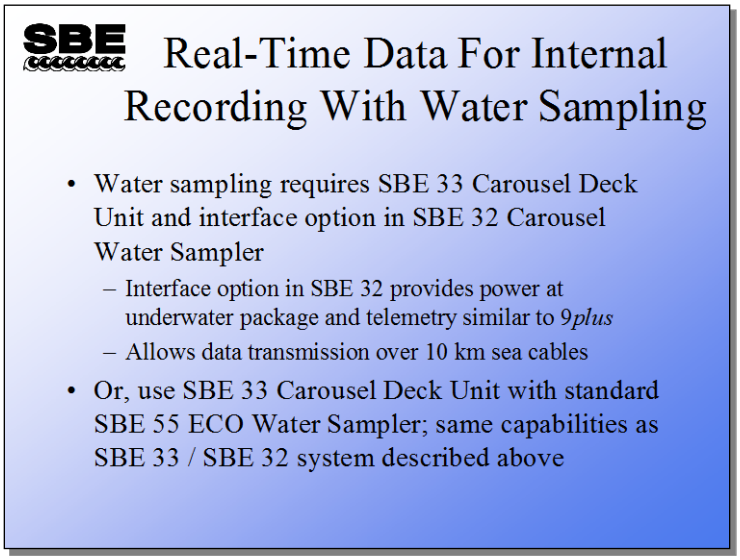
SBE 19s may be outfitted with high power cable drivers and optical isolation for transmitting real-time data. The SBE 19*plus*, 19*plus* V2, 25, and 25*plus* come standard with this equipment. With the addition of a Deck Unit and associated underwater equipment listed above, the data telemetry is the same as discussed for the SBE 911*plus*.

Instrument Preparation for Real-Time Data Collection



Unlike the SBE 19 and 25, the SBE 19*plus*, 19*plus* V2, and 25*plus* **do not** have to be asleep when you move the magnetic switch to the On position.

Water Sampling with Internally Recording Instruments



The SBE 19, 19*plus*, 19*plus* V2, 25, and 25*plus* can be equipped with water sampling equipment. The SBE 33 Carousel Deck Unit and SBE 32 Carousel (or SBE 55 ECO) provides power and telemetry for the CTD very similar to the 11*plus* / 9*plus* setup. In addition to water sampling, this equipment allows data telemetry over 10 km of sea cable and supplies more than enough power for the CTD and auxiliary sensors.

Activity: Take a Bench Cast and Collect Real-Time Data

1. If Seaterm232 is still open, select *Disconnect* in Seaterm232's Communications menu to free up the COM port for communications with Seasave.

2. Click Start / Programs / Sea-Bird / Seasave**V7**.

3. Check the display. Is it appropriate for conditions of the "cast"?

4. Click *Configure Inputs*.

   A. Instrument Configuration: Open your test.con file.
   B. Serial Ports: CTD Serial Port: COM port = port connected to CTD, Baud Rate = 9600, Data bits = 8, Parity = None; (communication parameters for other ports not applicable).
   C. Water Sampler: Set *Water sampler type* to *None*.
   D. Click OK.

5. Click *Configure Outputs*.

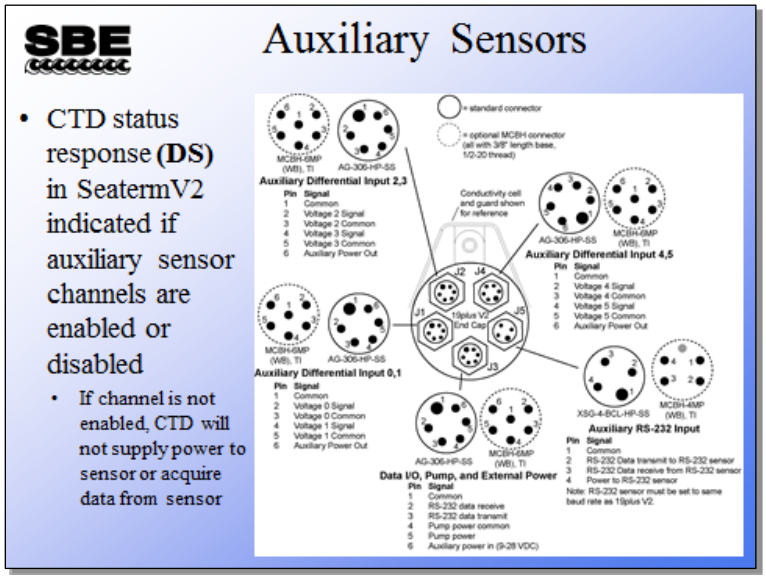
   A. Disable all outputs (Serial Data Out, Shared File Out, etc.).
   B. Click OK.

6. Select *Real-Time Data -> Start*.

   A. Select *Begin archiving data immediately*.
   B. Save data in C:\Data with file name *realtime* (C:\Data\realtime.hex).
   C. Click *Start*.

7. Move SBE 19*plus* V2 switch to ON.

Auxiliary Sensors

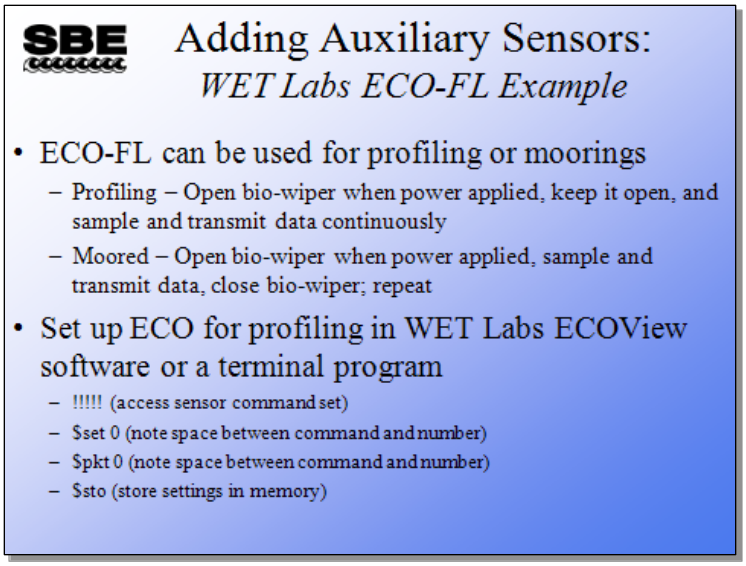


Sea-Bird CTDs can be configured with a wide range of auxiliary sensors. For example, the SBE 19*plus* V2 has three 6-pin bulkhead connectors for voltage output (0-5 volt) auxiliary sensors, each of which can accommodate two sensors (using a Y-cable). It also has one 4-pin bulkhead connector for an RS-232 output sensor. The connectors provide power to and acquire data from the auxiliary sensors.

Sea-Bird CTDs can accommodate almost any voltage output (0-5 volt) sensor whose response can be described with a polynomial equation. However, the 19*plus* V2 is currently limited to one of the following RS-232 sensors: SBE 63 optical DO sensor; SBE 38 secondary temperature sensor; WET Labs sensor (single, dual, or triple channel ECO sensor; WETStar; or C-Star); Pro-Oceanus Gas Tension Device; Aanderaa Oxygen Optode 4330 or 4835.
Note: Several WET Labs sensors are available as either voltage or RS-232 sensors.

As mentioned in Module 1, if you purchase auxiliary sensors from Sea-Bird along with the CTD, we handle the sensor integration – enabling the channel in the CTD, modifying the configuration file to describe where the data falls within the data stream and provide the calibration coefficients, and doing any required setup of the auxiliary sensor itself. If you add or remove a sensor in the field, you must do this work yourself.

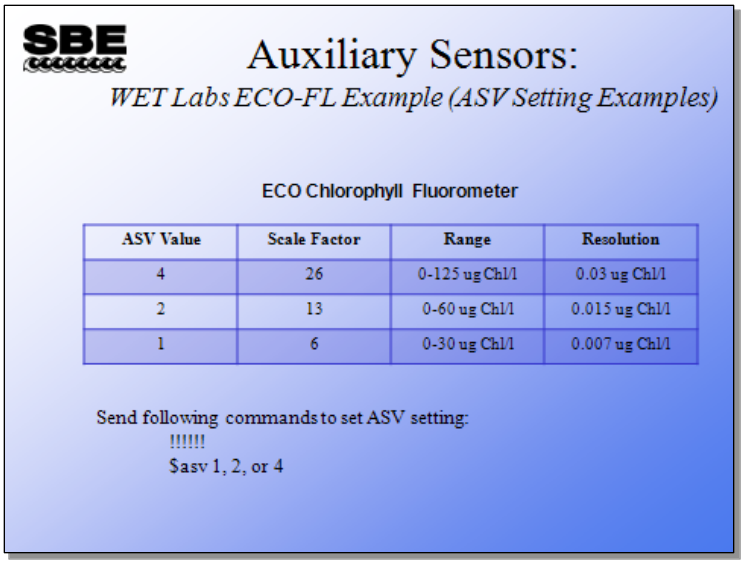
Auxiliary Sensors: WET Labs ECO Example



We will run through one example of setting up a CTD for use with an auxiliary sensor, using the WET Labs ECO-FL fluorometer sensor. Application Note 72 provides details on the setup of this sensor.

The ECO can be used as a profiling sensor or a moored sensor. For this example, we will be using the SBE 19*plus* V2 in profiling mode, so we must first plug the ECO directly into the computer and set it up to work in profiling mode. We will do another example in Module 11 on setting up the system for operating in moored mode.

Auxiliary Sensors: WET Labs ECO Example



ASV is the Analog Scale Value. **Single channel ECOs** allow users to modify the range of the analog signal output to:

- Encompass the full range of the sensor.
- Decrease the range, increasing resolution, by a factor of 2 or 4.

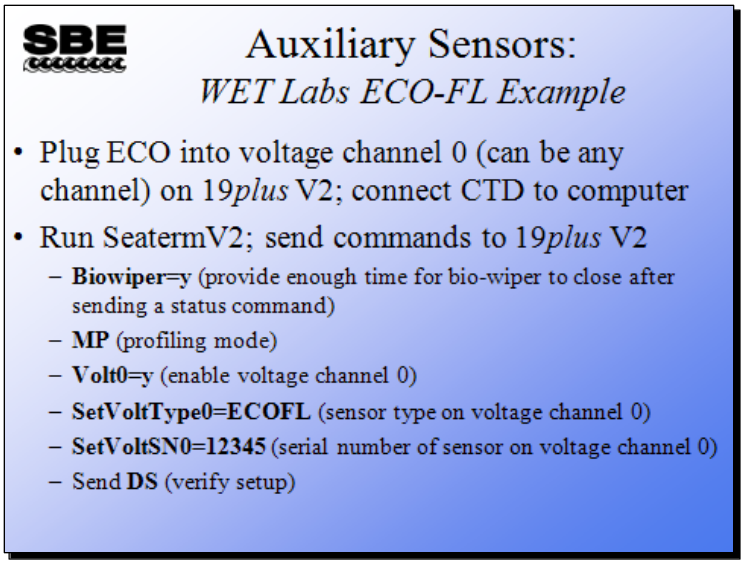
The factory default ASV is set to 4 (full scale).

The table above shows the ASVs and scale factors needed for your expected range of values for Chlorophyll a for the ECO-FL.

While still connected directly to the ECO sensor, set the ASV.

Note: The ASV cannot be modified in dual-channel ECOs (such as ECO-FLNTU, which has both fluorometer and turbidity channels) or triple-channel ECOs (such as the ECO Triplet, which has a user-defined combination of fluorometer and scattering channels).

Auxiliary Sensors: WET Labs ECO Example *(continued)*

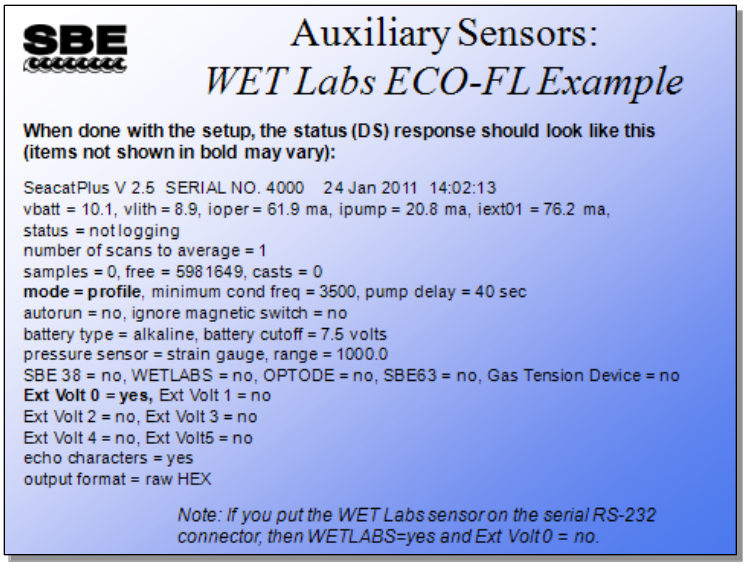


As mentioned earlier, when enabling/disabling a parameter, y and 1 are equivalent, and n and 0 are equivalent (i.e., **Volt0=y** and **Volt0=1** both enable voltage channel 0). The commands for enabling/disabling each voltage channel are **Volt0=** through **Volt5=**.

The **SetVoltType0=** and **SetVoltSN0=** commands record the user-input sensor types and serial numbers, and are informational only; the **GetHD** status response displays these, which may be useful for record keeping. The commands for each voltage channel are **SetVoltType0=** through **SetVoltType5=** and **SetVoltSN0=** through **SetVoltSN5=**.

Note: For this example, we are using a voltage output version of the ECO-FL. It is also available as an RS-232 sensor. If using the RS-232 version, the command to enable the RS-232 channel in the 19*plus* V2 is **WetLabs=y**. And the informational commands to record the serial instrument type and serial number are **SetSerialType=** and **SetSerialSN=**.

Auxiliary Sensors: WET Labs ECO Example *(continued)*



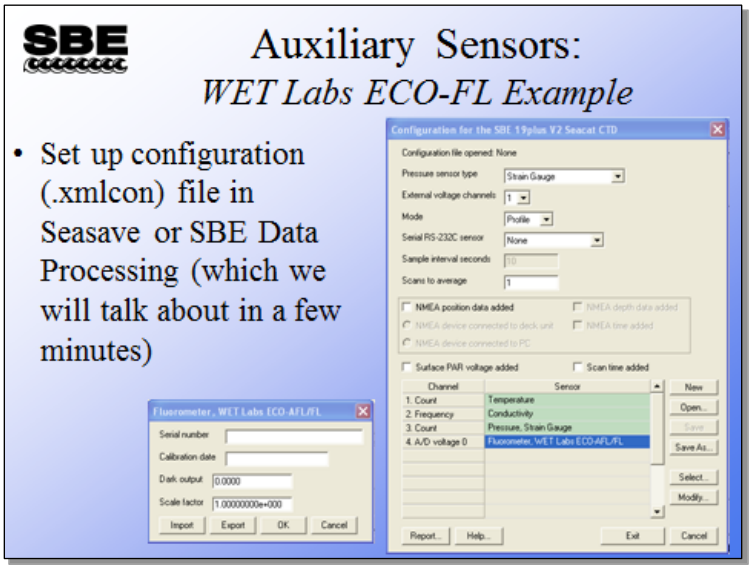
When the setup is complete, the **DS** response should show **mode = profile** (the CTD will operate in profiling mode) and **Ext Volt0 = yes** (you enabled voltage channel 0, so the CTD will supply power to that channel and incorporate data from that channel into the CTD data stream).

Additionally, because we set **Biowiper=y**, the response shows

```
wait 4 seconds for biowiper to close
```

before it measures the enabled external voltage currents.

Auxiliary Sensors: WET Labs ECO Example *(continued)*



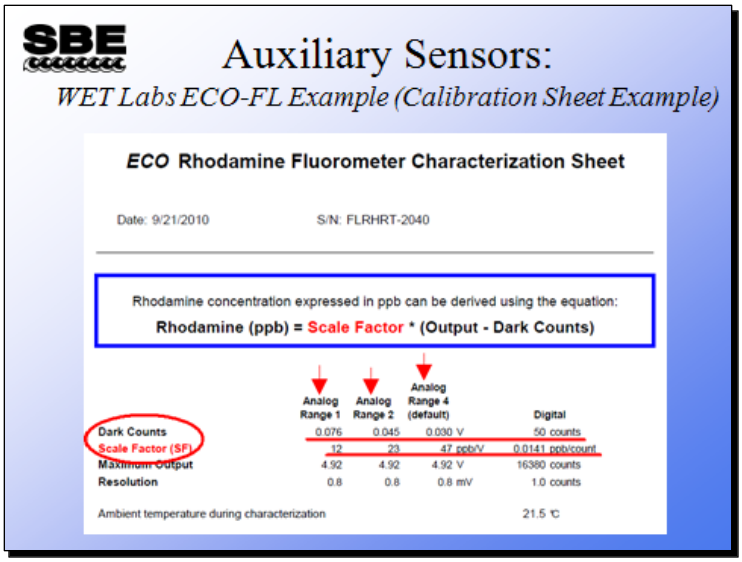
If using Seasave (real-time data acquisition), you must modify/create the configuration file before deploying. Select *1* for *External voltage channels*. *A/D voltage 0* appears in the table, labeled *Free*. Double click to get a list of supported voltage sensors; click the + sign by Fluorometers, and select WET Labs ECO-AFL/FL. A dialog box appears; enter calibration coefficients for the sensor.

What if you have multiple auxiliary sensors, and they are not using sequential channels (for example, sensors plugged into channels 0 and 4)? In SeatermV2, enable channels 0 and 4 in the CTD, so the CTD provides power to and receives data from those channels. In Seasave, select *2* for *External voltage channels*. *A/D voltage 0* and *A/D voltage 1* then appear in the table. In the configuration file, voltage 0 corresponds to the first auxiliary sensor voltage in the data stream, and voltage 1 corresponds to the second.

If not doing real-time data acquisition (i.e., deploying on non-conducting cable, and uploading data later), create/modify the configuration file when you run SBE Data Processing (post-processing software). Seasave and SBE Data Processing use the same configuration file.

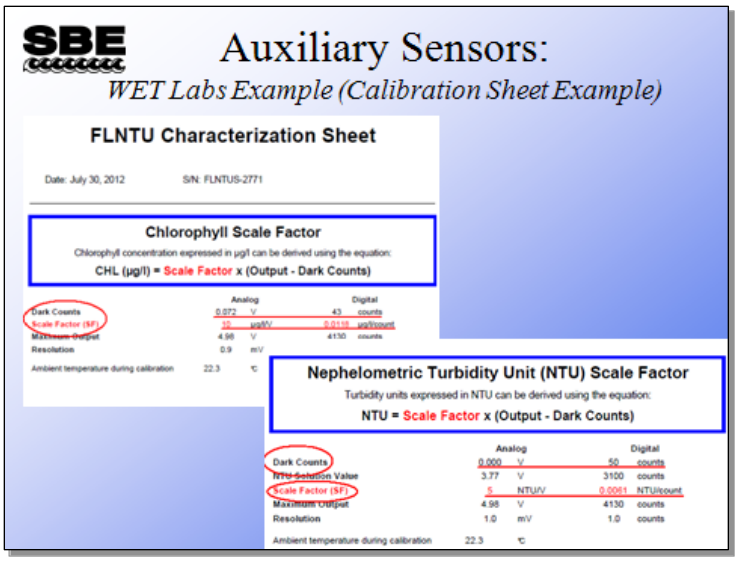
Note: For a dual-channel voltage-output ECO-FLNTU, you must enable two voltage channels in both CTD and configuration file. For a Triplet (available only as a RS-232 sensor), you must enable the RS-232 channel in the CTD (**WetLabs=y**) and select WET Labs as the RS-232 sensor in the configuration file; the software automatically creates 3 RS-232 channels in the configuration file.

Auxiliary Sensors: WET Labs ECO Example *(continued)*



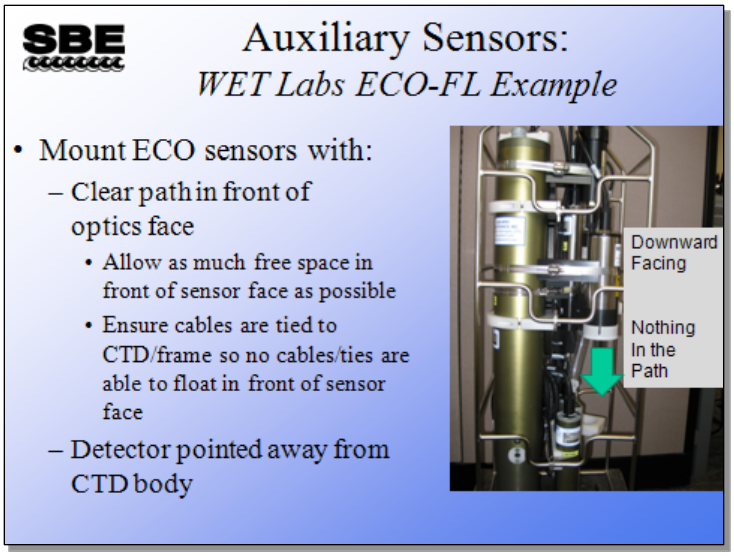
Here is an example calibration sheet from WET Labs. This calibration sheet is for an ECO-FL that measures Rhodamine; it shows the Dark Counts and Scale Factor to input in the Sea-Bird configuration file.

Auxiliary Sensors: WET Labs ECO Example *(continued)*



These are calibration sheets for an ECO-FLNTU; one calibration sheet is for the fluorometer (FL) channel while the other is for the turbidity (NTU) channel. As mentioned earlier, the ECO-FLNTU is a dual-channel voltage-output instrument. You must enable two voltage channels in both the CTD and configuration file when using this sensor.

Auxiliary Sensors: WET Labs ECO Example *(continued)*



Attach the ECO on the CTD cage or to the CTD housing, with the optical window facing in the direction you are profiling…preferred down. Be sure nothing is in the direct path of the optical window, and that nothing can reflect light back towards the sensor.

Remove the protective cap before deployment!

Auxiliary Sensors: WET Labs ECO Example *(continued)*

It is always good to be sure that all sensors are outputting data once they are installed. Sea-Bird does this by placing the assembled CTD with all auxiliary sensors into a test bath overnight and examining the recorded data the following day, prior to shipping to customers. If you install your own sensors, you may want to do something similar, or perform a bench test to ensure all sensor channels that are enabled are outputting data the way you think they should, and that you do not have something plugged into the wrong channel or enabled incorrectly in the CTD.

Easy checks for functionality include:

- The ECO-FL test described above. The fluorescent stick is shipped with the sensor.
- Conductivity check - Zero conductivity test with a dry conductivity cell and in air (should output a frequency very close to the zero conductivity calibration frequency on the conductivity sensor calibration sheet that came with your CTD).
- Temperature check.
- Pressure check - At a known elevation (quick check) or against a barometer (more precise).
- Scan output rate check.

Activity: View Example Data in Seasave

1. Click Start / Programs / Sea-Bird / Seasave**V7**.

2. Click *Configure Inputs*, and select 911*plus* configuration file:
   C:\Data\Module3\Hawaii.con

3. Right click on the plot and select *Modify*. Set up the plot with 1 Y and 2 X axes:

   A. Y Axis: *Pressure, Digiquartz -> db*, 0 to 1200 decibars.

   B. X Axis 1: *Temperature -> ITS-90 -> deg C*, 0 to 30 degrees C.

   C. X Axis 2: *Salinity, Practical*, 34 to 36 PSU.

   D. Click *OK*.

4. Click *Archived Data -> Start:*

   A. Click *Select Data File*. Select C:\Data\Module3\Hawaii.dat and click Open.
   Note: This data file has a *.dat* extension because it was created with an older version (<6.0) of Seasave; the current version always creates *.hex* files, but it can play back archived *.dat* data

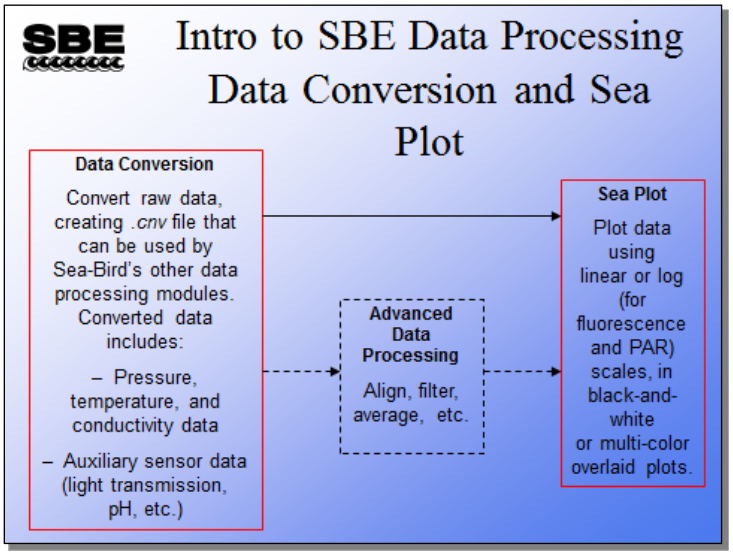
   B. Click *Start*.

5. Click *Archived Data* **->** *No Wait* to speed up the display.

If you have time, plot SBE 19*plus* data (use C:\Data\Module3\SBE19plus\Miami.hex and C:\Data\Module3\SBE19plus\Miami.con):

- Y axis: *Pressure, Strain Gauge -> db*, 0 to 350 decibars
- X axis: *Temperature -> ITS-90 -> deg C*, 10 to 30 degrees C
- X axis: *Salinity, Practical*, 36 to 38 PSU

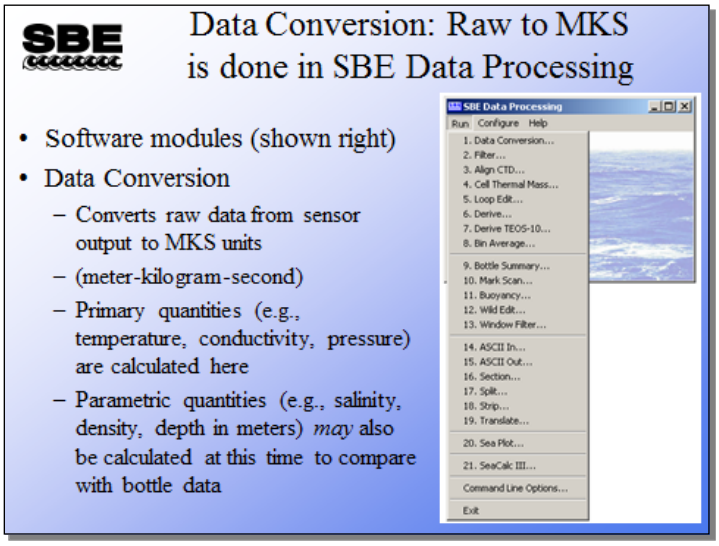
SBE Data Processing



Data processing involves operating on your raw data (which came from the sensors attached to the instrument) to convert it from the sensor outputs to scientific units, calculate any additional oceanographic parameters of interest, and reduce the data set to a tractable size. **It is always the best practice to archive your raw data, because there is no going backwards once you have processed it.** Should you discover calibration errors, omit necessary parameters, or make processing errors, it is imperative to return to your raw data set.

Sea-Bird's data processing program, SBE Data Processing, includes a number of modules for processing data. For now, we will only look at Data Conversion and Sea Plot. In Module 9, we will discuss other modules for advanced data processing, including aligning, filtering, remove cell thermal mass errors, removing ship heave errors, and bin averaging data.

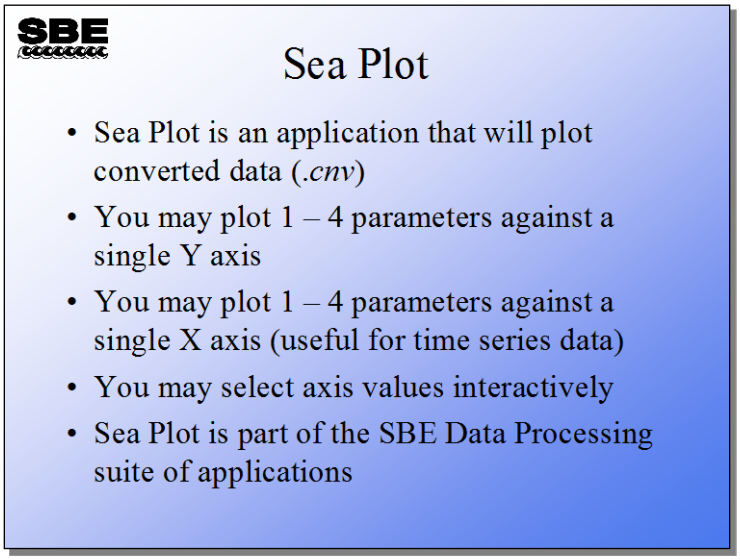
Data Processing: Conversion to Scientific Units



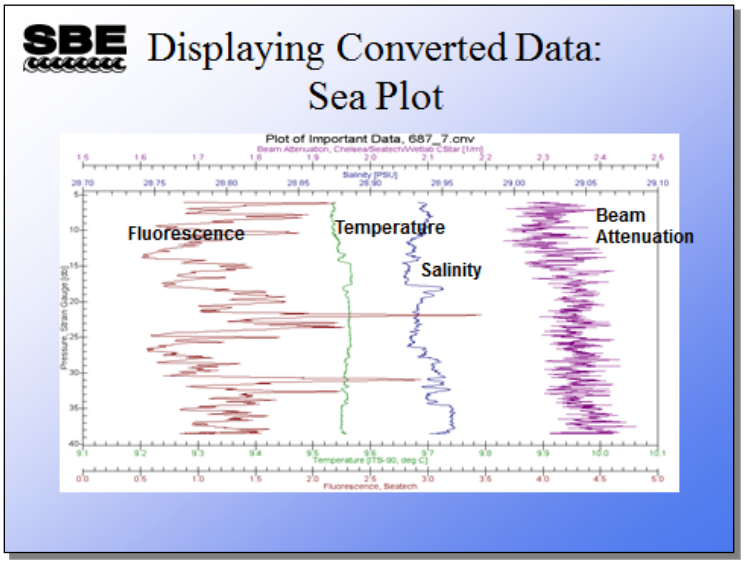
Data Conversion takes your raw data (.dat or .hex) file and, with the information contained in the configuration (.con or .xmlcon) file, converts it to scientific units. The form the converted data takes is set up in the SBE Data Processing Data Conversion dialog. In addition to quantities like temperature and conductivity, parameters that are calculated from these, such as salinity and density, are also available. **If you plan to do more advanced processing of your data, you should wait until the advanced processing is complete before calculating parameters derived from the measured parameters.**

Reminder about software revisions: In 2009, Seasave and SBE Data Processing introduced the ***.xmlcon*** file, written in XML format. The software allows you to open a .con **or** .xmlcon file, and to save the configuration to a .con **or** .xmlcon file. We'll use .con files for some of the exercises in the class, but .xmlcon files provide the same results.

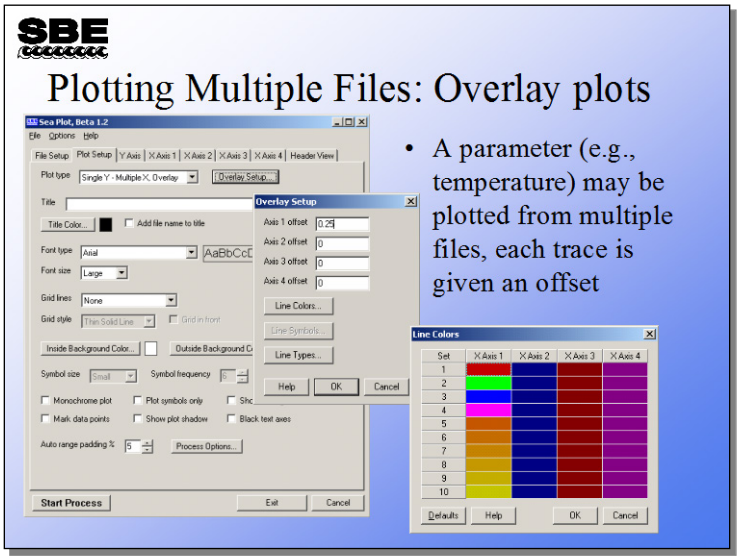
Sea Plot: Data Display



Sea Plot: The Plot



Sea Plot: Plotting Multiple Files, Overlay Plots



You can plot up to 4 parameters from multiple files by selecting the *overlay* plot type. To use this option you must specify the files in the order (left to right) you want them to appear. You must also enter an *offset* amount; this is amount of space between traces. For example, you might want to space temperature traces from casts taken at hour intervals at the same location by 0.2 degrees. You can also select the colors that each file will be plotted in. There is a color wheel that will allow selection of a graded set of line colors that is available by double clicking the axis identifier.

Note: When doing an overlay plot, all the files must have the same parameters.

Activity: Convert Example Data in SBE Data Processing

1. Click Start / Programs / Sea-Bird / SBEDataProcessing-Win32.

2. In SBE Data Processing, select *Run -> 1. Data Conversion*.

3. On File Setup tab:
   A. *Instrument configuration file*: Click *Select*. Navigate to C:\Data\Module3\Hawaii.con and click *Open*.
   B. *Input* file (data file): Click *Select*. Navigate to C:\Data\Module3\Hawaii.dat and click *Open*.

4. On Data Setup tab:
   A. Select *Process scans to end of file*.
   B. *Skip over* 0 scans.
   C. Select *output format* ascii.
   D. *Convert data* from *upcast and downcast*.
   E. Select *Create .cnv file only*.
   F. Click *Select Output Variables* button
      Click 1st Variable Name. Select *Pressure, Digiquartz -> db*. Click *Add* or *Change*.
      Click 2nd Variable Name. Select *Temperature -> ITS-90 -> deg C*. Click *Add* or *Change*.
      Click 3rd Variable Name. Select *Conductivity -> S/m*. Click *Add* or *Change*.
      Click OK.

5. On File Setup tab, for Program setup file click *Save As . . ,* and save file as C:\Data\Module3\HawaiiDatCnv.psa.

6. Click *Start Process*.

7. Open the .cnv file in Notepad or Wordpad, and take a look at the header and data.

If you have time, convert SBE 19*plus* data (use C:\Data\Module3\SBE19plus\Miami.con and C:\Data\Module3\SBE19plus\Miami.hex):

- *Pressure, Strain Gauge-> db*
- *Temperature -> ITS90 -> deg C*
- *Conductivity -> S/m*

We thank the Hawaii Ocean Time Series program and the Rosenstiel School of Marine and Atmospheric Science for sharing this data with us.

Activity: Plot Example Data in SBE Data Processing

1. Click Start / Programs / Sea-Bird / SBEDataProcessing-Win32.

2. In SBE Data Processing, select *Run -> 20. Sea Plot*.

3. On File Setup tab:
   - Input file: Click *Select*. Navigate to data that you converted (C:\Data\Module3\Hawaii.cnv) and click *Open*.

4. On Plot Setup tab:
   - Select a *Plot type* of *Single Y - Multiple X*.

5. On Y Axis tab:
   - For *Variable*, select *Pressure, Digiquartz [db]*.
   - Check *Auto range*.

6. On X Axis 1 tab:
   - For *Variable*, select *Temperature [ITS-90, deg C]*.
   - **Uncheck** *Auto range*. Enter a *Minimum* of 0, a *Maximum* of 30.

7. On X Axis 2 tab:
   - Check *Include axis*.
   - For *Variable*, select *Derived Salinity, Practical [PSU]*.
   - **Uncheck** *Auto range*. Enter a *Minimum* of 34, a *Maximum* of 36.

8. On File Setup tab:
   - For Program setup file click *Save As . . ,* and save file as C:\Data\Module3\HawaiiSeaPlot.psa.

9. Click *Start Process*.

Note that we were able to have Sea Plot calculate Salinity *on the fly*, because conductivity, temperature, and pressure were in the input .cnv file. This allows us to get a quick look at salinity before more advanced processing, even though the .cnv file does not contain a salinity column of data yet.

If you converted 19*plus* data in the previous activity and have time, plot that data (C:\Data\Module3\SBE19plus\Miami.cnv). Use same ranges as above for pressure and temperature, but change the Derived Salinity range to 35 - 37.