bathyMetrec·X
User Manual

Version 1.56
19 April 2017

Revision History

Revision	Date	Description	Author
Version 0.0	2013-01-30	First Version of Manual	Pete Reedeker
Version 0.1	2013-03-12	Second version of manual	Ian Lougheed
Version 0.2	2013-04-23	Updates	Jehan Zouak
Version 0.3	2013-05-23	Updates	Ian Lougheed
Version 0.4	2013-05-31	Updates	Ian Lougheed
Version 1.0	2013-06-03	Updates	Ian Lougheed
Version 1.1	2013-06-20	Format revisions and updates	Jehan Zouak
Version 1.2	2013-08-26	Minor edits	Jehan Zouak
Version 1.3	2013-08-28	New external voltage range added	Dustin Olender
Version 1.4	2013-10-01	Instruction added to "Burp" Benthos altimeter connector.	Ian Lougheed
Version 1.5	2014-01-08	Edited voltage values.	Jehan Zouak
Version 1.51	2014-06-16	Edited instrument length	Jehan Zouak
Version 1.52	2014-07-16	Added Ordering Codes	Jehan Zouak
Version 1.53	2014-10-06	Added Calculated SV Discussion	Dustin Olender
Version 1.54	2014-10-29	Added new internal pressure sensor range	Jehan Zouak
Version 1.55	2015-06-22	Technical specification updates	Jehan Zouak
Version 1.56	2017-04-19	CT•Xchange™ and regulatory information	Andrew Beak-Taylor

Table of Contents

General Description of the Instrument

AML Oceanographic X•Series instruments and sensors are a major advancement in ocean instrumentation. Swappable and interchangeable sensors dramatically improve the capabilities of ocean instrumentation in the following ways:

- Change the instrument sensor types while at sea within seconds, and without tools. A CTD can be changed to a sound speed profiler by exchanging sensor heads.
- To optimize the resolution and accuracy of sensor data, sensors can be swapped to change the measurement range. For example, a 6000 dBar P•Xchange pressure sensor can be swapped with a 500 dBar P•Xchange sensor; the salt water C•Xchange conductivity sensor can be swapped for a fresh water C•Xchange conductivity sensor.
- Sensors from one instrument can be swapped to another instrument to maintain mission-critical capabilities.
- Calibrated sensors can be sent from the factory to the instrument. The instrument is not pulled from active duty for calibration.
- Spare sensors ensure that an instrument can be immediately returned to active duty after sustaining damage.
- All calibration and traceability data resides within each Xchange™ sensor. Calibration data for all sensors is available from the instrument, and calibration certificates can be printed from AML Oceanographic SeaCast software when the instrument is connected.
- Logged data is stamped with sensor traceability and instrument configuration data.
- Only Xchange™ sensors are sent for calibration, leaving the instrument working in the field.

bathyMetrec•X is an externally-powered, multi-parameter instrument that allows you to change the instrument's sensor load, in the field and on-demand. The instrument can output data in real-time and log data to its internal memory simultaneously.

bathyMetrec•X is available with two different sensor port arrangements: P1S4 or P2S2. On P1S4, one can mount a single primary Xchange™ sensor (C•Xchange, CT•Xchange or SV•Xchange) and up to four secondary Xchange™ sensors (T•Xchange, P•Xchange, Turbidity•Xchange). On P2S2, two primary and two secondary Xchange™ sensors can be installed.

For high accuracy pressure sensing, bathyMetrec•X houses a permanently installed Paroscientific Digiquartz™ pressure sensor. In addition, up to 4 analog ports can be added by the factory, if required.

Sampling rates are set by time (2 Hz to every 24 hours), by pressure (0.1 dbar or greater increments), or by sound speed (0.1 m/s or greater increments).

Supported communication protocols for bathyMetrec•X are RS-232 or RS-485. The instrument must be connected to a power supply capable of supplying +8 to 26 VDC with minimal line noise.

Where Do I Start?

AML Oceanographic X•Series instruments ship with several manuals on the USB stick:

- An instrument manual (this bathyMetrec•X manual) providing an overview on how to use and maintain the instrument;
- A SeaCast manual providing instructions on how to use the software to configure the instrument and review instrument data;
- Xchange™ sensor manuals (C•Xchange™, CT•Xchange™, SV•Xchange™, P•Xchange™, T•Xchange™, and Turbidity•Xchange™) providing overviews on how to install and maintain each of the Xchange™ sensors;

If you are configuring an instrument for field use or lab testing, begin with the SeaCast manual.

If you are performing instrument maintenance, begin with the instrument manual.

If you are planning to swap an Xchange™ sensor, read the Xchange™ manual corresponding to your sensors.

Shipping & Receiving

Receiving an Instrument

When receiving an instrument, perform the following steps to ensure the instrument will be ready for deployment when required:

- Inspect the shipping container, looking for signs of damage. Damage to the shipping container could indicate damage to the instrument inside.
- The shipping package should include all of the following items:
    - bathyMetrec•X instrument
    - Data/Power cable
    - Black dummy plug
    - Primary sensor blanking plugs (1 for each primary Xchange™ sensor mount)
    - Secondary sensor blanking plugs (1 for each secondary Xchange™ sensor mount)
    - USB stick with manuals and documentation
- Inspect for damage
    - Check the cable for slices or gouges
    - Check the connector sockets for corrosion, dirt, and salt deposits
    - Check the pressure case for dents and scrapes
    - Check the sensors for cracks or bends
- Ensure all the Xchange™ sensors are installed tightly onto their mounts. The blue locking sleeve should be tight, and sitting less than 1mm from the instrument end cap.
- Connect the instrument to a computer with the data cable and perform a scan or monitor if using SeaCast.

Returning an Instrument to the Factory

- If shipping for repair or recalibration, obtain an RMA number from the service centre.
- Pack the instrument in its original shipping box to prevent damage during shipping.

An RMA number can be requested using the contact options given in the Support section of this manual.

Using the Instrument

Pressure Ratings

Pressure ratings are given for Xchange™ sensors and the entire instrument. **Deployments should never exceed the lower of these two pressure ratings.** For example, a 5000m rated instrument equipped with a 6000 dBar (0-6000m) P•Xchange sensor is limited to deployments of 5000m depth or less. Similarly, a 6000m instrument equipped with a 500 dBar (0-500m) P•Xchange sensor is limited to deployments of 500m depth or less.

It is desirable to optimize the accuracy of pressure measurements by using a P•Xchange sensor with a pressure range that closely matches the depth of the deployment.

Caution: Do not exceed the specified pressure ratings of the P•Xchange sensor, Turbidity•Xchange sensor, or the instrument housing. Turbidity•Xchange sensors are limited to deployments of 500m or less, regardless of the pressure rating of the instrument on which they are installed. Overpressure can result in damage to the sensors and the instrument.

Pre-Deployment Procedures

- Upon Receipt
  - Use the Shipping & Receiving instructions to verify the condition of the instrument.
  - Verify that all sensor calibrations are valid for the duration of the deployment. If not, swap the Xchange™ sensors for sensors with valid calibrations or send the Xchange™ sensors to a service centre for recalibration.
  - Lightly lubricate the underwater connectors with 3M silicone spray or equivalent.
- Before leaving the jetty
  - If applicable, verify the P•Xchange pressure range is correct for the deployment.
  - Connect the instrument to a computer using the data cable.
  - Check the instrument memory
    - Save any unsaved memory files.
    - Initialize the memory (Note: This deletes ALL files stored in the instrument memory. Be sure to have a copy of all important logged data before performing this step.).
      - If using SeaCast, click the *Clear Memory* box.
      - If using a Terminal Emulator, send instrument an *INIT* command.

Caution: Install blanking plugs in all unused sensor ports prior to deployment. Failure to install blanking plugs will result in damage to the connectors.

- If the instrument is equipped with a *Benthos* altimeter, be sure to purge the altimeter's connector of air during connection. Once plugged in past the seal, squeeze the in-line (cable side) connector body until air is heard escaping. This prevents the connector from partially disconnecting due to built-up air pressure.

Primary Xchange™ mount blanking plug

Secondary Xchange™ mount blanking plug

LED Indicator

The LED indicator is located next to the data/power connector on the instrument top end cap.

- The LED indicator will be on whenever the data/power cable is plugged into the instrument.
- The instrument will not start logging until it is immersed in water and it takes its first sample at the programmed sampling rate.

The LED indicator displays are as follows:

- **LED is a constant green**: This indicates the instrument is on and has sufficient power.
- **LED is flashing green**: The instrument has sufficient power and is collecting data.
- **LED is off with data/power cable attached**. The instrument is not working properly. Consult the troubleshooting section or call the service department.

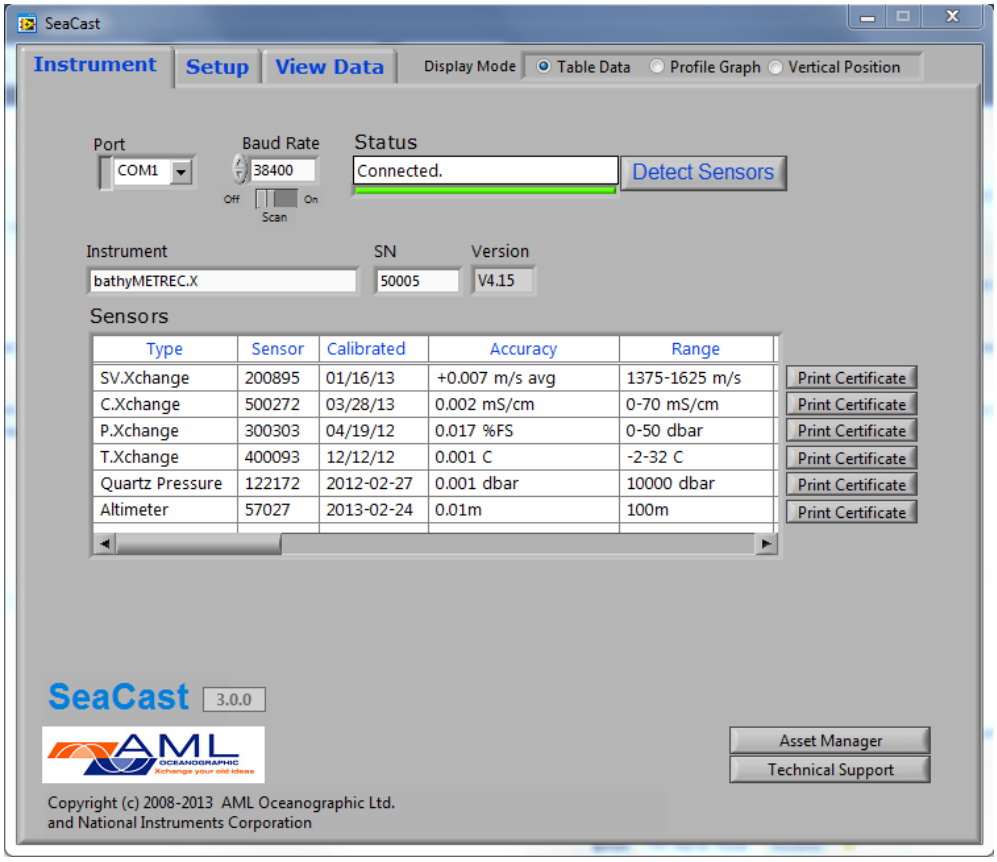
Configuring Sampling Parameters Using SeaCast

AML Oceanographic SeaCast can be used to set up an instrument for profiling or monitoring data.

Full details on the instrument configuration process can be found in the SeaCast manual. The following is an overview of the setup process:

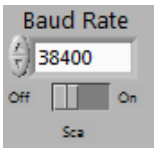
Selecting an Instrument for Configuration

On the *Instrument* tab, the first row of fields *Port*, *Baud Rate*, and *Status* control and display the communications with the instrument.

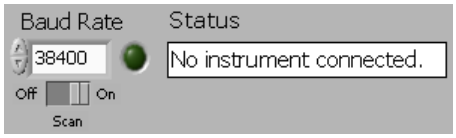


The *Port* field selects which computer communications port to use for communication with the instrument. To determine which port is connected, check the ports in the *Device Manager* or *Hardware Manager* found in the Windows *Control Panel*. The *Refresh* option at the bottom of the list forces SeaCast to refresh the list of available ports. This is useful if a connection is made while SeaCast is running.

The *Baud Rate* field selects the baud rate to use while communicating to the instrument. Lower baud rates allow longer cables to be used if using RS-232 or RS-485. Higher baud rates transfer data more quickly. Choose 38,400 baud whenever possible.

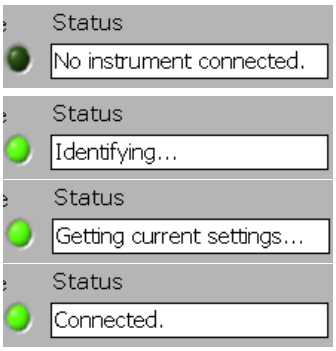


If an instrument is set to autobaud (default setting) it will detect the baud rate chosen in SeaCast and communicate at that baud rate. If the baud rate is changed in SeaCast, cycle power to the instrument to re-establish communications at the new baud rate.

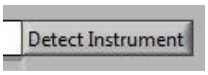


Some instruments are set up to communicate at fixed baud rates. In this case, the baud rate in SeaCast must be set to the same baud rate as the instrument. If the instrument baud rate is unknown, the *Scan* switch below the *Baud Rate* field will force SeaCast to cycle through all possible baud rates to detect the correct one.

The *Status* field shows the status of the communications with the instrument. The green light indicates successful communications with the instrument. During the identification process, SeaCast determines the type and serial number of the instrument and any connected sensors. During the settings process, SeaCast determines the latest sampling and logging settings that were programmed into the instrument. When identification is complete, the *Status* field will show "Connected" and the instrument is ready to use. Note that identification can take up to 30 seconds to complete.

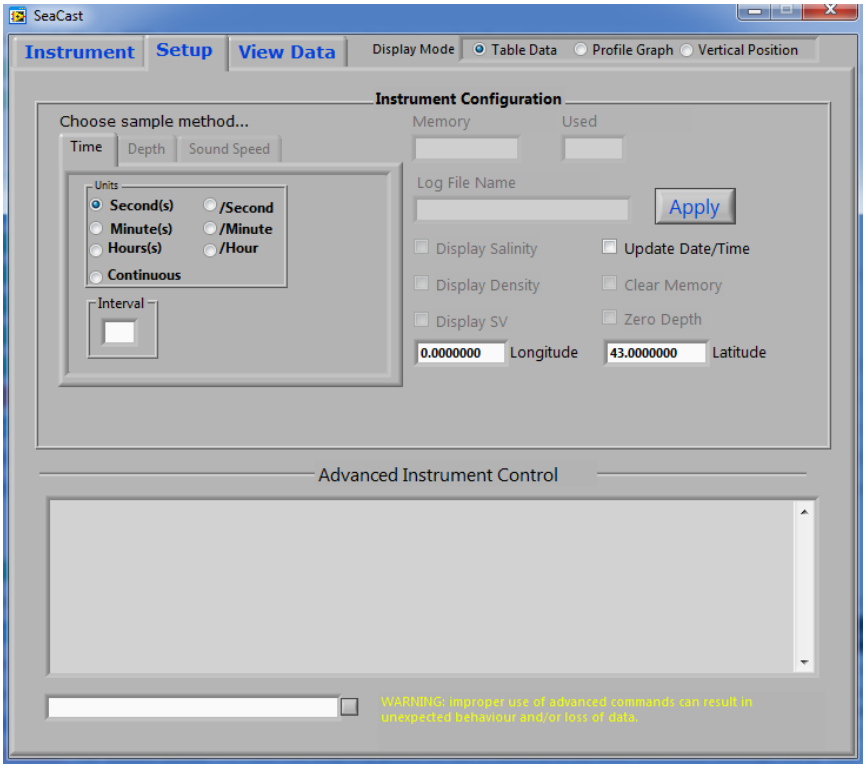


The *Detect Instrument* button forces SeaCast to re-detect and re-identify the instrument and its sensors.



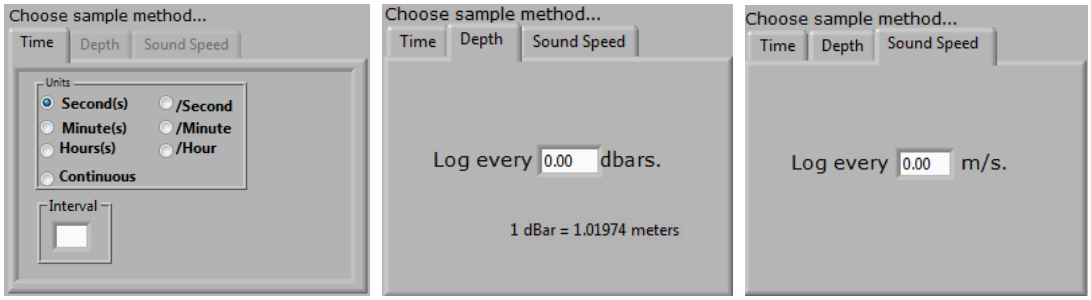
Configuring the Selected Instrument

After the instrument has been detected by SeaCast, select the *Setup* tab at the top of the SeaCast window.



The box in the upper left of the *Setup* page controls the sampling of the instrument. There are three sampling methods available:

- By Time Interval (ie. sample 2 times per second, 10 times per hour, 1 sample every 5 seconds, etc.)
- By Depth Interval (ie. 1 sample every 1 dbar, 1 sample every 20 dbars, etc.) This option is only available when a Pressure•Xchange™ sensor is installed in the instrument.
- By Sound Speed Interval (ie. 1 sample every time sound velocity changes by more than 1 m/s, 1 sample every time sound velocity changes by more than 4 m/s, etc.) This option is only available when a Sound Velocity•Xchange™ sensor is installed in the instrument.

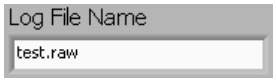


Sampling Method Selection Tab

SeaCast will allow the use of only one sampling method at a time. Thus, if two samples per second is chosen, the depth and sound velocity increments are zeroed. This prevents conflicting sampling requirements from being programmed into the instrument.

Instrument Time, Memory, Log File and Calculated Parameter Settings

The memory fields show the size of the memory installed in the instrument and the percentage of memory that has been used. The *Clear Memory* check box allows the user to erase the entire memory. A pop up warning window will be displayed if this check box is selected.



The *Log File Name* field displays the current log file name that data will be logged to in the instrument memory. The name is limited to 8 characters plus 3 characters for the file extension, for example; data.txt, profile1.raw, or april.dat. Please note: This is the log file in the instrument not the export file for SeaCast.

The *Update Date/Time* check box will synchronize the instrument clock to the computer's clock.

Checking *Display Salinity, Display Density* or *Display SV* has the instrument calculate parameters, such as salinity, density and sound velocity and output them in columns adjacent to measured parameters.

A note on sound velocity calculated from conductivity, temperature and pressure: Owing to the error associated with each individual sensor and Chen and Millero's equation[1], sound velocity calculated from CTD values will fall within approximately ±0.4 m/s of the actual value 95% of the time. It is not uncommon to see differences of this size between directly measured sound velocity and CTD-calculated sound velocity.

Configuring Sampling Parameters with HyperTerminal

Instruments can also be configured for deployment using *HyperTerminal* or other terminal emulation programs. As with SeaCast, communications with the instrument must be established using the correct communications port and settings. The communications settings are 8 data bits, 1 stop bit, no parity, no flow control, and the desired baud rate.

The following steps must be completed by issuing text commands:

Step	Possible Commands
Initialize Memory (erases instrument memory)	INIT
Set Log File Name	SET LOG filename.txt
Set Instrument Time & Date	SET TIME hh:mm:ss SET DATE mm/dd/yy
Set Sampling Parameters	SET SAMPLE RATE CONTINUOUS SET SAMPLE RATE 5/s SET P INC 1 SET SOUND INC 2

The above table provides example commands only; many additional sampling regimes can be established using available commands. Please consult the Commands section of the Appendix for full syntax details on the commands you wish to use.

Accounting for Atmospheric Pressure Variations at the Surface

Climate and altitude changes can create fluctuations in atmospheric (barometric) pressure. AML's pressure sensors are sensitive enough to detect these variations. When this happens, the instrument's pressure channel may not read exactly zero when data is taken prior to submersion in the water. Nearly all absolute pressure sensors experience atmospheric pressure offsets if they are sufficiently sensitive.

To compensate for this atmospheric pressure offset, AML instruments have the ability to reset the pressure sensor's zero point. This can be initiated using AML Oceanographic SeaCast software or a Terminal emulator command. The compensation does not affect the calibration of the pressure sensor, and can be turned off or recalculated at any time. The compensation factor is applied through the entire calibrated pressure range. Note that this compensation cannot be applied to a built-in Paroscientific Digiquartz sensor, as found in bathyMetrec•X.

[1] Chen-Tung Chen and Frank J. Millero, "Speed of sound in seawater at high pressures," *The Journal of the Acoustical Society of America* 62, no. 5 (1977): 1129-1135.

Once the atmospheric pressure compensation is applied, it will be applied to all pressure sensor data until it is turned off or recalculated. The setting is written to memory, so it remains set when the instrument is powered down.

Using SeaCast
Atmospheric compensation is applied to a P•Xchange™ sensor if it is installed. If a P•Xchange™ sensor is not installed, only the Paroscientific Digiquartz pressure sensor is used. In this case, the "Zero Depth" option will be disabled in SeaCast. For Bathymetry instruments to calculate true depth accurately, use the Atmospheric compensation in SeaCast's Vertical Position view. For more information, please refer to the SeaCast manual.

Using a Terminal Emulator

- Establish serial communications with the instrument on your computer. Refer to the "Communications" section of this manual for more information.
- Once connection is established, ensure the instrument is stationary, and is not submerged in water.
- To turn ON Atmospheric pressure compensation, issue the *ZERO ON* command. This will calculate and apply the offset required to compensate for current atmospheric pressure conditions.
- To turn OFF Atmospheric pressure compensation, issue the *ZERO OFF* command. This will disable the offset.
- Issuing the *ZERO* command again will calculate a new offset based on current conditions.

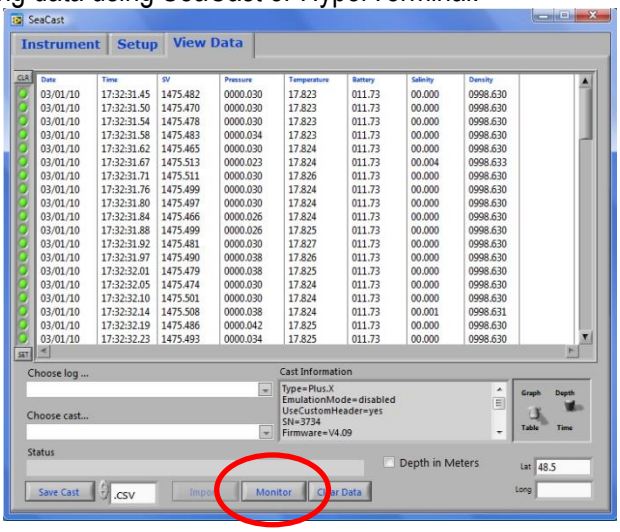
Logging a Profile

- Ensure the pre-deployment procedures have been completed (see page 5).
- **bathyMetrec•X is a real-time instrument with the ability to log data. To enable logging, send the command *SET SCAN LOGGING* to the instrument (see Commands on page 25).**
- Plug the data/power cable into the instrument.
- Ensure that the desired sampling settings have been selected and applied.
- With the instrument in air (NOT submerged), use the *ZERO* command to zero the barometric pressure offset (P•Xchange™ only).
- Enter the *M* or *MONITOR* command to begin monitoring data. All monitored data will be logged, provided the *SET SCAN LOGGING* command is enabled.
- The status LED should start to flash green to indicate data is being logged. Keep the instrument at this depth for 2 minutes prior to beginning the cast. This allows time for the sensors to fully wet and for the pressure case to shed heat.
- Send the instrument down to the desired depth and return it to the surface.

Monitoring Real Time Data

- Ensure the pre-deployment procedures have been completed (see page 5).
- Ensure that the desired sampling settings have been selected and applied.

- Plug the data/power cable into the instrument. If you power the instrument externally over a long cable, please note the following:
    - Voltage drop due to cable resistance increases with cable length. The voltage drop on a standard AML cable, with a standard bathyMetrec•X, is about 2 volts per 100m of cable while sampling and 0 volts per 100m when in low power mode.
    - The instrument's minimum voltage is 10 volts.
        - When used with a Tritech altimeter, the minimum voltage is 15 volts.
        - When used with a Kongsberg altimeter, the minimum voltage is 24 volts.
        - Minimum voltage may vary depending on the altimeter being used.
    - The instrument's maximum voltage is 36 volts.
    - The voltage at the instrument, while sampling, must be above the shutdown level for the instrument to operate.
- With the instrument in air, use the *ZERO* command to zero the barometric pressure offset (P•Xchange™ only).
- Lower the instrument until the sensors are fully submerged; the LED should start to flash green. Keep the instrument at this depth for 2 minutes prior to beginning the cast. This allows the sensors time to wet, and the pressure case to shed heat.
- Begin monitoring data using SeaCast or HyperTerminal.



- Send the instrument down to the desired depth and return it to the surface.

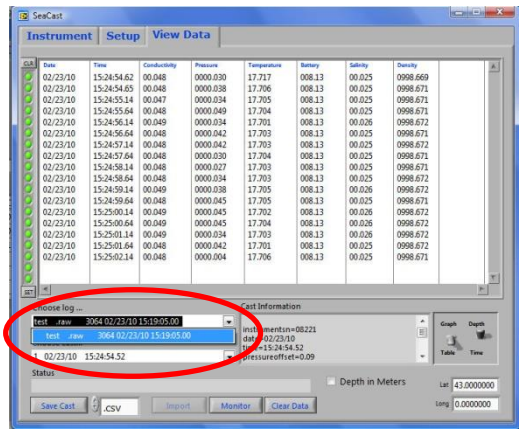
Post-Deployment Procedures

- When the instrument is pulled from the water it should be rinsed with fresh water.
- Dry the area around the connectors with a clean cloth or compressed air prior to disconnecting the plugs or cables. Do not blow compressed air into the Pressure•Xchange™ sensor. Doing so may damage the sensitive pressure transducer diaphragm.
- Remove the cable. Place the dummy plug in the connector to protect it.
- Dry the instrument and stow it securely.

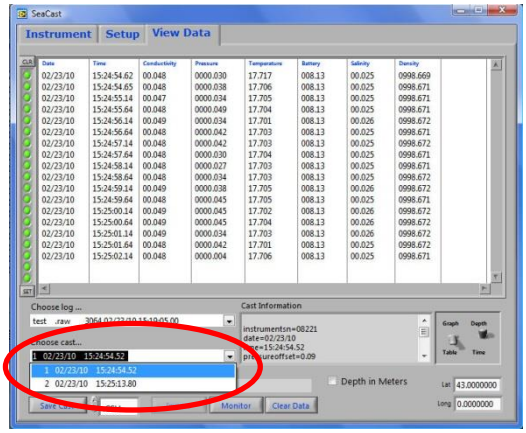
Viewing your Data

You may download and view data using SeaCast or HyperTerminal. To download and review data:

- Connect the instrument to the computer using the data/power cable.
- Click "Detect Sensors" on the *Instrument* tab in SeaCast.
- Download the files to the computer:
    - With SeaCast, enter the *View Data* tab, then use the *Choose Log File* and *Choose Cast* fields to retrieve the desired cast.



Choose Log File



Choose Cast

    - With HyperTerminal, use the *DIR* command to list all the files on memory, use the *DUMP* command to retrieve the file of interest. For example:

```
bathyMetrec.X Version 4.13.10 SN:50002
AML Oceanographic Ltd.
969.0 MBytes installed

>dir
data.txt       37600 05/23/13 11:52:37.00

 938 MBytes free
   3 MBytes Used
   1 File(s) listed
>
>dump data.txt
[cast header]
InstrumentSN=50005
Date=2013-05-23
Time=11:52:37.58
PressureOffset=0.00
UsePressureOffset=no
Latitude=48.6000
Longitude=123.0000
Slot1Sensor1=SV-C.Xchange SV.X SN 200634 02/10/11
Slot3Sensor1=SV-C.Xchange C.X SN 500272 03/28/13
Slot5Sensor1=P-T-TU-DO.Xchange T.X SN 400304 12/07/12 TU.X SN 600010 01/02/03
Slot6Sensor1=Quartz Pressure Sensor SN 122172 2012-02-27
Slot6Sensor2=Quartz Pressure Sensor SN  2012-02-27
Slot7Sensor1=Altimeter Sensor SN 57027 2007-07-07
Slot7Sensor2=Altimeter Sensor SN  2007-07-07
[Data]
2013-05-23 11:52:37.79  1485.328  32.361  10.187  0018.65  0009.554  001.24  010.10  39.465  1031.714
2013-05-23 11:52:38.29  1485.096  32.363  10.215  0021.76  0009.614  001.24  010.03  39.468  1031.716
2013-05-23 11:52:38.79  1484.310  32.362  10.210  0023.70  0009.581  001.54  010.28  39.558  1031.795
2013-05-23 11:52:39.29  1485.044  32.361  10.186  0021.88  0009.675  001.41  010.05  39.465  1031.714
2013-05-23 11:52:39.79  1485.279  32.393  10.186  0020.37  0009.608  001.31  010.30  39.507  1031.749
2013-05-23 11:52:40.29  1485.182  32.377  10.275  0021.68  0009.614  001.24  010.03  39.486  1031.731
```

Configuring the Instrument for Data on Power Up

Perform the following steps:

- Open a terminal emulation program such as HyperTerminal. Ensure the serial port has been selected in the program. If the instrument has been set to a specific baud rate with the *SET DETECT* command, the terminal emulation program must be configured for that baud rate.
- Connect the instrument to the computer using the data/power cable.
- Using the terminal emulation program, issue the following commands to the instrument:
    - *SET STARTUP NOHEADER* (disables the power up header information)
    - *SET STARTUP MONITOR* (enables data output on power up)
    - *SET SAMPLE RATE 2/S* (sets the desired sampling rate)
    - *SET DETECT 07* (sets fixed 38400 baud rate)

      Note: Details on the *SET DETECT* command can be found in the appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.
- Plug the data/power cable into the instrument to turn the instrument on.

Disabling Data on Power Up

Perform the following steps:

- Open a terminal emulation program such as HyperTerminal. Ensure the serial port has been selected in the program. If the instrument has been set to a specific baud rate with the *SET DETECT* command, the terminal emulation program must be configured for that baud rate.
- Connect the instrument to the computer using the data/power cable.
- Unplug the data/power cable from the instrument to turn the instrument off.
- Hold down the <ENTER> key.
- Plug the data/power cable into the instrument to turn the instrument on.
- Release the <ENTER> key once the prompt '>' is displayed.
- Using the terminal emulation program issue the following commands to disable data on power up:
    - *SET STARTUP HEADER* (enables the power up header information)
    - *SET STARTUP PROMPT* (disables data output on power up)
    - *SET SAMPLE RATE 2/S* (selects the desired sampling rate)
    - *SET DETECT A7* (sets 10 autobaud attempts then defaults to 38400 baud)

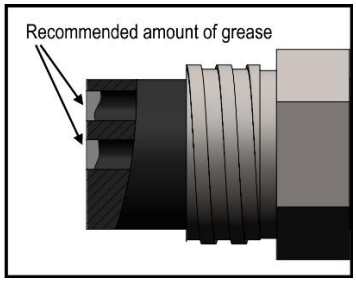
      Note: Details on the *SET DETECT* command can be found in the appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.

Maintaining the Instrument

Periodic Maintenance

Periodic preventative maintenance will prolong the life of the instrument. The following steps are recommended:

- If the instrument is very dirty or oily, allow it to soak in warm, soapy water before cleaning with a rag or soft brush. When finished, rinse with fresh water to remove any residual soap or dirt.
- Before each use:
    - Check for proper installation of all Xchange™ sensors.
    - Check for nicks and cuts on the cable.
- After each use:
    - Clean and rinse the instrument using fresh water.
    - Dry the instrument completely, and store it in a cool, dry place.
- Monthly:
    - Apply a layer of Molykote 44 medium silicone grease to the female half of the connection as shown and fully insert the plug. Wipe away any excess that squeezes out. This will lubricate both male and female connectors.



- Yearly:
    - Send the instrument or Xchange™ sensors to a service centre for diagnostics and re-calibration.

Communications

PC Settings

bathyMetrec•X will communicate with both RS-232 and RS-485 serial connections. The computer to which the instrument is connected must be set up as follows:

- 8 bits
- 1 stop bit
- No parity
- No hardware flow control
- Baud rate of 600, 1200, 2400, 4800, 9600, 19,200, or 38,400 baud

After power up, the bathyMetrec•X will wait for an ASCII carriage return. The instrument will automatically detect whether communications are RS-232 or RS-485 as well as the baud rate.

Output Formats

Output formats can be modified. If the required modifications are not supported by the commonly used command list in the next section, please contact the factory for support with custom output formats.

Formatting can be changed in the following ways:

- The number of decimal places for each channel
- Turn on or off
    - date and time
    - calculated parameters (Salinity and Density)
    - battery voltage
    - power up information (header)
    - automatic monitoring on power up

Default Output Format

The output from bathyMetrec•X is space delimited values. The following table shows the output units for each Xchange™ sensor:

Sensor	Units	Default Format
SV•Xchange™	m/s	1234.567
Conductivity•Xchange™	mS/cm	12.346
CT•Xchange™ Conductivity	mS/cm	12.345
CT•Xchange™ Temperature	C	12.345
Pressure•Xchange™	dBar	1234.56
Temperature•Xchange™	C	12.345
Quartz Pressure	dBar	1234.567
Turbidity•Xchange™	NTU	1234.56

The default data channel outputs with all calculated parameters turned on are the following:

P1S4 Configuration (with SV, P, T, and Turbidity sensors)

Date	Time	Sound Velocity	Pressure	Temperature	Turbidity	Battery	Density	Salinity
mm/dd/yy	hh:mm:ss.ss	m/s	Dbar	C	NTU	volts	kg/m^3	ppt

P2S2 Configuration (with SV, C, P, and T sensors or SV, CT, and P sensors)

Date	Time	Sound Velocity	Conductivity	Pressure	Temperature	Battery	Density	Salinity	Sound Velocity (Calculated)
mm/dd/yy	hh:mm:ss.ss	m/s	mS/cm	dbar	C	volts	kg/m^3	ppt	m/s

Notes:

1. These are examples of the default configurations. Your data channel outputs will be entirely dependent on which Xchange™ sensors are installed.
2. bathyMetrec•X will not calculate Density or Salinity when the Paroscientific Digiquartz is the only pressure sensor. In this configuration, use the *Vertical Position* tab of SeaCast to capture Salinity and Density data along with True Depth.

Default Example Outputs

Keyboard inputs in the output capture shown below are in bold type.

```
bathyMetrec.X Version 4.15.10 SN:50005
AML Oceanographic Ltd.
969.0 MBytes installed

>scan
05/08/12 12:56:06.54  1486.164  00.076 -0000.13  21.244  009.85
>monitor
05/08/12 12:56:08.26  1486.164  00.076  0000.02  21.244  009.83
05/08/12 12:56:08.32  1486.165  00.077 -0000.06  21.244  009.85
05/08/12 12:56:08.37  1486.169  00.077 -0000.06  21.244  009.85
05/08/12 12:56:08.44  1486.169  00.076  0000.09  21.244  009.85
05/08/12 12:56:08.51  1486.163  00.075  0000.17  21.244  009.85
05/08/12 12:56:08.58  1486.165  00.076  0000.17  21.244  009.85
05/08/12 12:56:08.65  1486.166  00.077  0000.25  21.244  009.85
05/08/12 12:56:08.72  1486.167  00.078  0000.09  21.244  009.85
>dis options
[Instrument]
Type=bathyMetrec.X
EmulationMode=disabled
UseCustomHeader=yes
SN=50005
Firmware=V4.15
SampleUnits=/ second
SampleInterval=2
PressureInc=0.00
```

```
SoundInc=0.00
LogFile=sidneyte.txt
DateFormat=ISO
Date=2013-06-03
Time=14:11:50
MemorySize=942.8 MB
MemoryUsed=3.8 MB
DisplayTime=yes
DisplayDate=yes
DisplaySalinity=yes
DisplayDensity=yes
DisplaySoundVelocity=no
DisplayBattery=yes
RelayMode=RS232 mode
RealtimeLogging=yes
LoggingTimeout=0
StartupDelay=0
DisplayHeader=yes
StartupMode=prompt
CharacterReception=yes
LoggingBreakMode=yes
DetectionMode=A3
BatteryACoefficient=+3.500000E-01
BatteryBCoefficient=+2.500000E-02
ShutDownVoltage=8.0
WarningVoltage=9.9
PressureOffset=0.00
UsePressureOffset=no
SoundVelocityThreshold=1375.00
DelimterMode=Tab
SensorDetectionMode=Always
Traceability=yes
SkipPowerOff=yes
AnalogChannels=1
Latitude=40.0000
Longitude=10.0000

[Slot 1]
SensorName=SV-C.Xchange SV.X SN 200895 01/16/13
BoardSN=01111

[Slot 3]
SensorName=SV-C.Xchange C.X SN 500272 03/28/13
BoardSN=03333

[Slot 4]
SensorName=P-T-TU-DO.Xchange  P.X  SN  300303  04/19/12  T.X  SN  400093
12/12/12
BoardSN=05592

[Slot 6]
SensorName=Quartz Pressure
BoardSN=01234
SensorSN1=122172
CalDate1=2012-02-27
CalBy1=Par
CalRange1=10000 dbar
```

```
CalAccuracy1=0.001 dbar
SensorSN2=
CalDate2=2000-00-00
CalBy2=
CalRange2=
CalAccuracy2=

[Slot 7]
SensorName=Altimeter
BoardSN=04321
SensorSN1=57027
CalDate1=2013-02-24
CalBy1=MT
CalRange1=100m
CalAccuracy1=0.01m
SensorSN2=
CalDate2=2000-00-00
CalBy2=
CalRange2=
CalAccuracy2=
```

>**dir**

```
test    .raw       1750 05/08/12 12:52:16.00
data    .txt       1750 05/08/12 12:54:18.00

 961 MBytes free
   7 MBytes Used
   2 File(s) listed
```

>**dump data.txt**

```
[cast header]
InstrumentSN=50005
Date=2013-05-23
Time=11:52:37.58
PressureOffset=0.00
UsePressureOffset=no
Latitude=48.6000
Longitude=123.0000
Slot1Sensor1=SV-C.Xchange SV.X SN 200634 02/10/11
Slot3Sensor1=SV-C.Xchange C.X SN 500272 03/28/13
Slot5Sensor1=P-T-TU-DO.Xchange T.X SN 400304 12/07/12 TU.X SN 600010 01/02/03
Slot6Sensor1=Quartz Pressure Sensor SN 122172 2012-02-27
Slot6Sensor2=Quartz Pressure Sensor SN  2012-02-27
Slot7Sensor1=Altimeter Sensor SN 57027 2007-07-07
Slot7Sensor2=Altimeter Sensor SN  2007-07-07
[Data]
2013-05-23 11:52:37.79  1485.328  32.361  10.187  0018.65  0009.554  001.24  010.10  39.465  1031.714
2013-05-23 11:52:38.29  1485.096  32.363  10.215  0021.76  0009.614  001.24  010.03  39.468  1031.716
2013-05-23 11:52:38.79  1484.310  32.362  10.210  0023.70  0009.581  001.54  010.28  39.558  1031.795
2013-05-23 11:52:39.29  1485.044  32.361  10.186  0021.88  0009.675  001.41  010.05  39.465  1031.714
2013-05-23 11:52:39.79  1485.279  32.393  10.186  0020.37  0009.608  001.31  010.30  39.507  1031.749
2013-05-23 11:52:40.29  1485.182  32.377  10.275  0021.68  0009.614  001.24  010.03  39.486  1031.731
```

Support

Troubleshooting

Instrument fails to communicate:

- Is the connector damaged?
- Check the cables
    - Is the data/power cable connected to the instrument and computer?
    - Are there any cuts in the cable?
    - If using a cable other than an AML cable, it should be configured as a null modem cable.
    - If using multiple cable lengths, the extensions should **not** be configured as null modem cables.
- If using external power over a long cable, check the voltage drop over the cable. Measure the voltage across a 10 watt, 27Ω resistor across pins 1 and 4 of the cable. The voltage should be between 10 and 36 volts.
- Are the communication settings in the program used on the computer correct?
    - Comm port selection
    - 8 bits
    - 1 stop bit
    - No parity
    - No hardware flow control
    - Baud rate between 600 and 38,400 baud
- Are the communication settings in the instrument correct?
    - Was the instrument specifically set to one baud rate last time? If so, use that baud rate to resume communications.
    - Was the instrument set to only RS-232 or only RS-485 last time? If so, resume communications in the required protocol.
    - Was the instrument set to *RX OFF* last time? If so, a carriage return must be sent to the instrument immediately after power is applied to interrupt this mode.
    - Was the instrument set to monitor on power up mode? If so, a carriage return must be sent to the instrument immediately after power is applied to interrupt this mode. To interrupt monitor on power up, hold down the ENTER key while applying power to the instrument.

Instrument fails to log:

- Verify the LED indicator status:
    - With the instrument in air (NOT submerged), insert the communication cable. The LED indicator should show solid green indicating the instrument is powered and ready

      Note: If neither a SV•Xchange™ or Conductivity•Xchange™ sensor is installed the instrument will begin logging in air.
    - Place the instrument sensors in water. The LED indicator should remain green and begin flashing, indicating the instrument is powered and collecting data.

    - If the indicator does not light up, the instrument is not operating correctly. Continue with the remaining troubleshooting items.
- Allow at least two sample periods for the instrument to detect that it is immersed.
- Were the sound velocity increment, pressure increment and/or sample rate settings set to values that could prevent logging?
- Was the log file name set correctly?
- Is the connector damaged, dirty, or corroded?
- If all previous steps fail, you will have to reset the instrument. Send an *INIT* command to the instrument to re-initialize the memory.

  Note: The *INIT* command will completely erase all settings stored on the instrument.

Instrument generates noisy data:

- Is the connector damaged, dirty, or corroded?
- If connected to external power, is there noise on the power supply? Switch-mode power supplies are common sources of noise.
- Nearby EMI sources such as electric motors, generators, and transformers can create noise. If possible, move the instrument and its cables away from the noise source.
- Are the sensor/s clean?
- Are there bubbles on or in the sensor/s?
- Are the sensor/s damaged?
- Is there something nearby affecting the water temperature?

SeaCast fails to recognize a sensor:

- Be sure to download the latest version of SeaCast.
    - Turbidity•Xchange™ requires SeaCast version 3.0 or greater for full functionality.

SV•Xchange does not match CTD-calculated SV:

- Owing to the error associated with each individual sensor and Chen and Millero's equation[2], sound velocity calculated from CTD values will fall within approximately ±0.4 m/s of the actual value 95% of the time. It is not uncommon to see differences of this size between directly measured sound velocity and CTD-calculated sound velocity.

[2] Chen and Millero, "Speed of sound in seawater at high pressures," 1129-1135.

Contact AML Oceanographic

Service
To request an RMA or technical support

Email: service@AMLoceanographic.com
Phone: 1-250-656-0771
Phone : 1-800-663-8721 (NA)
Fax: 1-250-655-3655

Sales
For all general sales inquiries

Email: sales@AMLoceanographic.com
Phone: 1-250-656-0771
Phone : 1-800-663-8721 (NA)
Fax: 1-250-655-3655

Website
http://www.AMLoceanographic.com

Customer Portal
My AML Oceanographic is AML's online data centre. This secure area within our website is designed to offer one easy location for interested individuals and organizations - distributors, customers, prospects, and other members of our community - to manage their interactions with AML. *My AML Oceanographic* will allow you to:

- View and manage your assets (instruments and sensors)
- Consult instrument diagnostic summaries
- View and download calibration and conformity certificates
- View and manage your technical support cases
- Consult and download sales estimates, sales orders, and invoice copies
- View account balances and generate account statements
- Assess inventory availability at AML

To access the Customer Portal, please navigate to the *Support* button - located on the top right of the AML Oceanographic home page - select *Customer Centre* from the options on the drop down menu and follow the instructions provided.

Mailing and Shipping Address

AML Oceanographic
2071 Malaview Ave.
Sidney, BC, Canada
V8L 5X6

Appendices

Commands

When using SeaCast, the full command set is not usually necessary. However, text commands are available. Below is a listing of commonly used commands. Note that some commands are only available on instruments equipped with the applicable Xchange™ sensors.

Communications Commands

Command	Description	Requires
SET FORCE 232	Sets com mode to RS-232. Power must be cycled for changes to take effect.	
SET FORCE 485	Sets com mode to RS-485. Power must be cycled for changes to take effect.	
SET FORCE AUTO	Sets for auto-detection of RS-232 or RS-485 comms. Note that if instrument is not connected to a com port on power up, it assumes RS-485 operation and will remain in that mode until powered down.	
DISPLAY FORCE	Displays current com mode (ie RS232, RS485, AUTO).	
DISPLAY DETECT	Displays the baud rate detection settings.	
SET DETECT a b	Sets the baud rate detection. "a" sets the number of autobaud detection attempts before the instrument reverts to the default baud rate set by "b." Setting 'a'=0 forces the instrument to a fixed baud rate determined by "b." '"b"= 1 = 600 baud 4 = 4800 baud 7 = 38400 baud 2 = 1200 baud 5 = 9600 baud 8 = 57600 baud 3 = 2400 baud 6 = 19200 baud 9 = 115200 baud	

Sampling Rate Commands

Command	Description	Requires
DISPLAY SAMPLE RATE	Displays the time-based sampling rate.	
SET SAMPLE n t	Sets the desired sampling rate. "n" is a number and "t" is the time units. Using the slash (/) character should be read as "per". For instance, 5 s means sampling happens every 5 seconds. 5/s means 5 samples per second. Examples are: SET S C sets the sampling to continuous (25 Hz) SET S 5 /s 5 samples per sec SET S 1 s Sample 1 time every 1 second SET S 2 /m 2 samples per minute SET S 5 m Sample 1 time every 5 minutes SET S 2 /h 2 samples per hour SET S 24 h Sample 1 time every 24 hours	
DISPLAY INCREMENT	Displays logging increment for pressure in dBars.	P•X
SET PRESSURE INCREMENT n	Sets logging by increment of pressure specified by n = increment value in dBar (resolution of 2 decimal places).	P•X
SET SOUND INCREMENT n	Sets logging by increment of SV specified by n = increment value in m/s (resolution of 1 decimal place).	SV•X
DISPLAY SOUND INCREMENT	Displays the logging increment for sound velocity in m/s.	SV•X

Output Format Commands

Command	Description	Requires
DISPLAY SCAN	Displays current scan options.	
SET SCAN NOBAT	Turns the battery channel off.	
SET SCAN BAT	Turns the battery channel on.	
SET SCAN NODENSITY	Turns the calculated density channel off.	C•X, T•X, and P•X, CT•X and P•X or SV•X, T•X, and P•X
SET SCAN DENSITY	Turns the calculated density channel on.	C•X, T•X, and P•X, CT•X and P•X or SV•X, T•X, and P•X
SET SCAN NOSALINITY	Turns the calculated salinity channel off.	C•X, T•X, and P•X, CT•X and P•X or SV•X, T•X, and P•X
SET SCAN SALINITY	Turns the calculated salinity channel on.	C•X, T•X, and P•X, CT•X and P•X or SV•X, T•X, and P•X
SET SCAN NOSV	Turns the calculated sound velocity channel off, removing it from the instrument output scans. Current salinity display status is viewable using DIS SCAN.	C•X, T•X, and P•X, or CT•X and P•X
SET SCAN SV	Turns the calculated sound velocity channel on, allowing it to be present in instrument output scans. Current salinity display status is viewable using DIS SCAN. This is only available when C,P, and T sensors are attached.	C•X, T•X, and P•X, or CT•X and P•X
SET SCAN TIME	Enables displaying time in data scan.	
SET SCAN NOTIME	Disables time from being displayed in data scan.	
SET SCAN DATE	Enables displaying date in data scan.	
SET SCAN NODATE	Disables date from being displayed in data scan.	
DISPLAY STARTUP	Displays the power up output settings.	
SET STARTUP PROMPT	Sets the instrument to wait for user commands on power up.	
SET STARTUP SCAN	Sets the instrument to output one scan on power up, and then wait for a user command.	
SET STARTUP MONITOR	Sets the instrument to start monitoring data on power up.	
SET STARTUP NOHEADER	Disables the instrument identification header output on power up.	
SET STARTUP HEADER	Enables the instrument identification header output on power up.	

Logging Commands

Command	Description	Requires
SET SCAN LOGGING	Enables simultaneous logging and real-time output. If real-time logging in air is desired, set instrument conductivity threshold and sound velocity and pressure increments to zero.	
SET SCAN NOLOGGING	Disables simultaneous real-time logging.	
SET TIMEOUT nn	nn is time in minutes from 0 to 30. Enters logging mode after the specified time interval has passed in which the instrument has been idle. Power the unit off, then on, to exit the logging mode. A time interval of 0 will deactivate the command. Setting is viewable using DIS STARTUP.	
LOG	Puts unit into logging mode from real-time mode. It will remain in logging mode until power is turned off.	
SET LOG tttttttt.ttt	Sets new log file name. tttttttt.ttt = log file name. Name can be up to 8 characters in length and 3 characters for file extension	
INIT	Clears the instrument's logging memory.	
DIRECTORY	Displays list of files in instrument memory and memory status, including amount of memory space free and used	
DUMP tttttttt.ttt	Dumps the data of the specified logged file defined by tttttttt.ttt in REAL or RAW format depending on the current instrument mode.	
DELETE tttttttt.ttt	Erases specified logged file defined by tttttttt.ttt. Maximum 8 character name with 3 character extension.	
DISPLAY LOG	Displays current log file name	

General Commands

Command	Description	Requires
SCAN	Measures and outputs one scan of data.	
MONITOR	Scans at the set sampling rate.	
VERSION	Displays the instrument identification header.	
DISPLAY OPTIONS	Displays the instrument status and user settings.	
ZERO	Corrects the barometric offset to set zero pressure at surface for current barometric pressure.	P•X
ZERO OFF	Disables barometric offset.	P•X
DIS TIME	Displays current time. Time format is hh:mm:ss.ss	
SET TIME hh:mm:ss.ss	Sets instrument time using 24 hour clock in format hh:mm:ss.ss	
DIS DATE	Displays the current date.	
SET DATE mm/dd/yy	Sets date using mm/dd/yy format.	
DETECT	Checks each slot in logger board to identify what is plugged in and displays sensor / board type and serial number or "empty" for each slot.	
DISPLAY BATTERY	Displays battery channel coefficients and shutdown voltage.	
TALK n	Enables communications directly with a sensor board via the logger board, where n = value from 1-3 that identifies the slot number of the board to be communicated with. See *DETECT* command.	
CTRL+C	Press CTRL key and C key simultaneously to exit sensor board talk mode & return to logger communications.	

Technical Specifications

Sensors

Primary Xchange™ Sensors						
Type		Range	Accuracy	Precision	Resolution	Response Time
Conductivity•Xchange™		0 to 2 mS/cm	0.01 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow rate
Conductivity•Xchange™		0 to 70 mS/cm	0.01 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow rate
Conductivity•Xchange™		0 to 90 mS/cm	0.01 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow
SV•Xchange™		1375 to 1625 m/s	0.025 m/s	0.006 m/s	0.001 m/s	47 µs
CT•Xchange™	Cond.	0 to 100 mS/cm	**0-90**: ±0.01 mS/cm **90-100**: <±0.05 mS/cm	0.003 mS/cm	0.001 mS/cm	25 ms at 1 m/s flow
	Temp.	-5 to 60 °C	**-5-45**: ±0.005 °C **45-60**: <±0.05 °C	0.003 °C	0.001 °C	100 ms

Secondary Xchange™ Sensors					
Type	Range	Accuracy	Precision	Resolution	Response Time
Temperature•Xchange™	-2°C to 32°C	0.005°C	0.003°C	0.001°C	100 ms
Temperature•Xchange™	-5°C to 45°C	0.005°C	0.003°C	0.001°C	100 ms
Temperature•Xchange™	0°C to 65°C	0.005°C	0.003°C	0.001°C	100 ms
Pressure•Xchange™	50, 100, 200, 500, 1000, 2000, 4000, 5000, 6000 dBar	0.05%FS	0.03%FS	0.02%FS	10 ms
Turbidity•Xchange™	0-100 NTU	0.1 NTU	0.1 NTU	0.01 NTU	< 0.7s
Turbidity•Xchange™	0-400 NTU	0.2 NTU	0.2 NTU	0.01 NTU	< 0.7s
Turbidity•Xchange™	0-1000 NTU	0.5 NTU	0.5 NTU	0.1 NTU	< 0.7s
Turbidity•Xchange™	0-3000 NTU	1 NTU	1 NTU	0.1 NTU	< 0.7s

Internal Sensors					
Type	Range	Accuracy	Precision	Resolution	Response Time
Digiquartz™ Pressure	0 to 4000 dBar	0.01% FS	< 0.01% FS	0.0001% FS	400 ms
Digiquartz™ Pressure	0 to 6000 dBar	0.01% FS	< 0.01% FS	0.0001% FS	400 ms

Calculated Parameters				
Type	Required Sensors	Equation	Accuracy	Range
Salinity	C•X, T•X, P•X	TEOS10	±0.010 psu	0 to 42 psu
Salinity (from SV)	SV•X, T•X, P•X	AML '07	±0.035 ppt	0 to 42 ppt
Density	C•X, T•X, P•X	TEOS10	±0.027 kg/m^3	990 to 1230 kg/m^3
Density (from SV)	SV•X, T•X, P•X	TEOS10	±0.051 kg/m^3	990 to 1230 kg/m^3
SV (from CTD)	C•X, T•X, P•X	Chen & Millero '77[3]	0.5 m/s	---

Electrical

- Mother Board
  - Flash, non-volatile data memory (Minimum 1 GB)
  - Three dedicated slots
    - One or Two Primary Xchange™ sensor slots
    - One or Two Secondary Xchange™ sensor slots
  - Four expansion slots
- Sensor Boards
  - Primary Xchange™ sensor board(s)
  - Secondary Xchange™ sensor board(s)
  - Paroscientific Digiquartz sensor board
- Auto detect RS232 or RS485 (½ duplex ASCII)
- Autobaud to 38,400

Power

- External Power Supply: 10 to 36 VDC

[3] Chen and Millero, "Speed of sound in seawater at high pressures," 1129-1135.

- Current Draw
  - 320 mA when sampling
  - 37 mA in standby mode

Pressure Case

- Hard anodized 7075-T6 aluminum
- Environmental Limits
  - Storage: -40°C to 60°C
  - Usage: -20°C to 45°C

Housing						
Status	Type	Depth Rating	Diameter	Length	Weight (in water)	Weight (in air)
Standard	7075-T6	6000 m	100mm (4.0”)	490mm (19.3”)	3.1 Kg (6.7 lbs)	5.2 Kg (11.3 lbs)

Bulkhead Connector				
Type	Pins	Gender	Material	Manufacturer
Bulkhead	Micro 8	Female	Titanium	Subconn

Sampling Capabilities

- Frequency
  - Time: From 2 samples per second to 1 sample per 24 hours
  - Pressure: Specific pressure increments in 0.01 dbar steps
  - Sound Velocity: Specific sound velocity increments in 0.1 m/s steps
- Configurations
  - Single scan or continuous output
  - On command or autonomous on power up

Included Items

- bathyMetrec•X Instrument
- 2m Data/Power Pigtail
- Black dummy plug
- Two primary sensor blanking plugs
- Two secondary sensor blanking plugs
- USB stick with manuals and documentation

Software

- SeaCast

Ordering Codes

Instruments

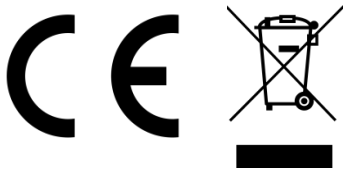
PDC-bMTX-P2S2-40	bathyMetrec•X, P2S2, 4000m Housing
PDC-bMTX-P2S2-60	bathyMetrec•X, P2S2, 6000m Housing

Sensors

XCH-SV-STD	SV•Xchange™ (1375-1625m/s) Range *Replaces XCH-0002*
XCH-SV-1120	SV•Xchange™ (1100-2000m/s) Range
XCH-SV-0520	SV•Xchange™ (500-2000m/s) Range
XCH-CND-RA002	C•Xchange™ Right Angle, Ultra Freshwater (0-2mS/cm) Range
XCH-CND-RA070	C•Xchange™ Right Angle, Oceanographic (0-70mS/cm) Range
XCH-CND-RA090	C•Xchange™ Right Angle, Oceanographic (0-90mS/cm) Range
XCH-CND-ST002	C•Xchange™ Straight, Ultra Freshwater (0-2mS/cm) Range
XCH-CND-ST070	C•Xchange™ Straight, Oceanographic (0-70mS/cm) Range
XCH-CT-RA090-n545	CT•Xchange™ Right Angle, Oceanographic (0-90mS/cm,-5-45 C) Range
XCH-TMP-n232	T•Xchange™ (-2 to 32 C) Range
XCH-TMP-n545	T•Xchange™ (-5 to 45 C) Range
XCH-TMP-065	T•Xchange™ (0 to 65 C) Range
XCH-PRS-0050	P•Xchange™ 50 dBar
XCH-PRS-0100	P•Xchange™ 100 dBar
XCH-PRS-0200	P•Xchange™ 200 dBar
XCH-PRS-0500	P•Xchange™ 500 dBar
XCH-PRS-1000	P•Xchange™ 1000 dBar
XCH-PRS-2000	P•Xchange™ 2000 dBar
XCH-PRS-4000	P•Xchange™ 4000 dBar
XCH-PRS-5000	P•Xchange™ 5000 dBar
XCH-PRS-6000	P•Xchange™ 6000 dBar
XCH-PRS-6000-T065	P•Xchange™ 6000 dBar, Extended temperature calibration from 0-65 C
XCH-TRB-0100-03	Turbidity•Xchange™ (0-100 NTU) Range, 300m
XCH-TRB-0100-05	Turbidity•Xchange™ (0-100 NTU) Range, 500m
XCH-TRB-0400-03	Turbidity•Xchange™ (0-400 NTU) Range, 300m
XCH-TRB-0400-05	Turbidity•Xchange™ (0-400 NTU) Range, 500m
XCH-TRB-1000-03	Turbidity•Xchange™ (0-1000 NTU) Range, 300m
XCH-TRB-1000-05	Turbidity•Xchange™ (0-1000 NTU) Range, 500m
XCH-TRB-3000-03	Turbidity•Xchange™ (0-3000 NTU) Range, 300m
XCH-TRB-3000-05	Turbidity•Xchange™ (0-3000 NTU) Range, 500m

Regulatory Information

This product is compliant within the requirements of CE standards.

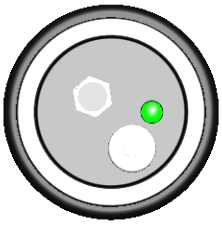


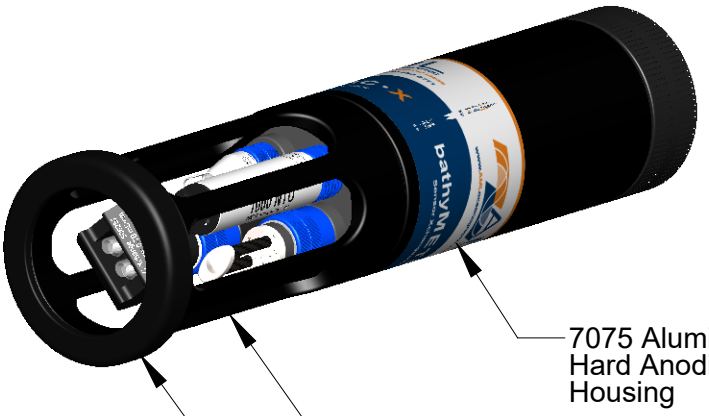
Warranty

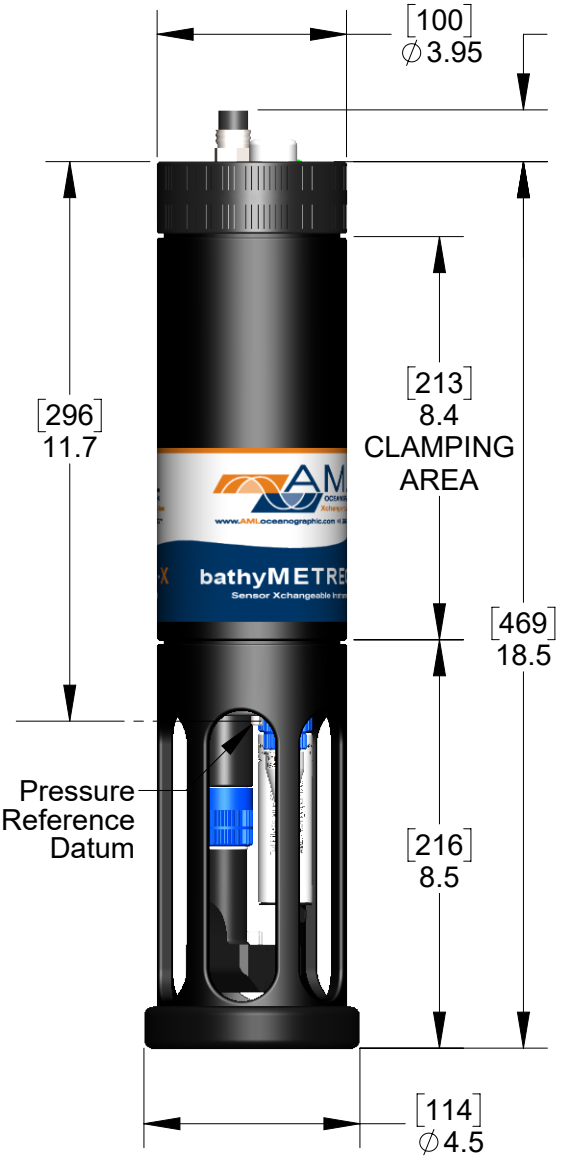
AML Oceanographic warrants the instrument for a period of two years from the date of delivery. AML will repair or replace, at its option and at no charge, components which are found to be defective. The warranty applies only to the original purchaser of the instruments. The warranty does not apply if the instrument has been damaged, by accident or misuse, and is void if repairs or modifications are made by any other than authorized personnel.

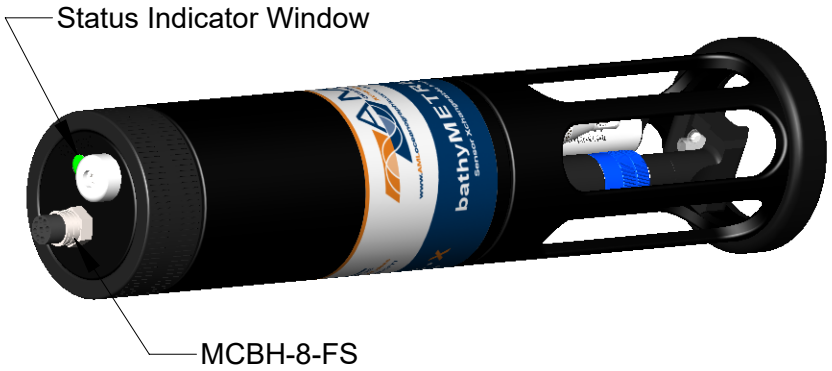
This warranty is the only warranty given by AML. No warranties implied by law, including but not limited to the implied warranties of merchantability and fitness for a particular purpose shall apply. In no event will AML be liable for any direct, indirect, consequential, or incidental damages resulting from any defects or failure of performance of any instrument supplied by AML.

Technical Overview Drawings









NOTES:

1. **Dimensions in inches [millimeters]**
2. **Depth Rating: 6000m**
3. **Weight (w/o sensors): 5.0 kg (Air) 3.0 kg (Water)**
4. **X-Series is available in two endcap configurations: PDC-bMTX-P2S2-60 and PDC-bMTX-P1S4-60**

where: PDC-bMTX-P_S_-60

No. of Primary Mounts:
SV Xchange
C Xchange

No. of Secondary Mounts:
DO Xchange
P Xchange
T Xchange
TU Xchange

REV	DESCRIPTION	BY	DATE
A	ADDED INTEGRATION DIMS	ABT	29MAR2017

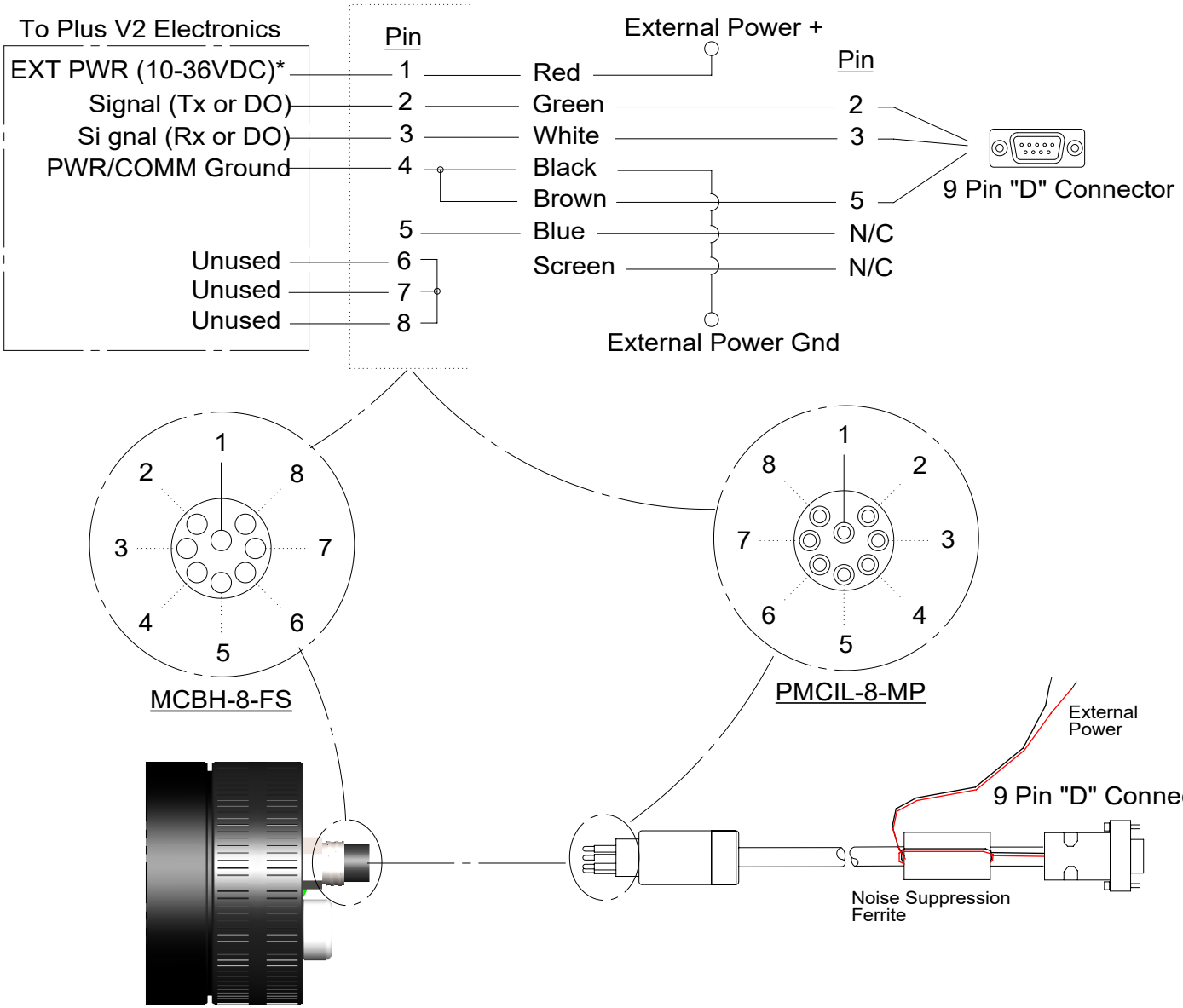
AML OCEANOGRAPHIC
Xchange your old ideas
2071 MALAVIEW AVE. W., SIDNEY, B.C. CANADA V8L 5X6
PH:(250) 656 0771 FAX: (250) 655 3655
www.AMLoceanographic.com

TITLE

bathyMETREC•X CUSTOMER OVERVIEW DRAWING

SYSTEM	*AML PART NO.*
bathyMETREC•X	PDC-bMTX-P1S4/P2S2-60
DATE	*SLDRW NO.*
27JUN2012	MC7-GA-03469-A

Micro 8 Provides RS232 or RS485 Serial Communications



* Voltage may change when certain altimeters are used
- Tritec RSE-0037: 15-36 VDC
- All Kongsberg altimeters: 24-36 VDC

REV	DESCRIPTION	BY	DATE
A	ADDED INTEGRATION DIMS	ABT	29MAR2017

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