



# Base·X<sub>2</sub> User Manual



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### Revision History

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## General Description of the Instrument

AML Oceanographic X-Series instruments and Xchange™ 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.

Base•X<sub>2</sub> is the smallest multi-sensor data logging instrument in the X-Series family. Its compact size makes it ideal for hand deployments from small boats, jetties, suitable shorelines, etc. Base•X<sub>2</sub> shares the same pedigree as larger, more featured instruments in the X-Series family, providing the same capabilities, functionality, and accuracy in a condensed package.

Base•X<sub>2</sub> is equipped with one primary Xchange™ sensor port (C•Xchange, CT•Xchange, SV•Xchange) and one secondary Xchange™ sensor port (T•Xchange, P•Xchange, Tu•Xchange) and can accept any sensor in the X-Series family. The integrated shackle and cage allow for rapid turnaround from shipping case to deployment, as the instrument is stored 'ready to go.' The instrument is capable of logging continuously for up to 11 hours with a full battery charge and may be deployed up to a depth of 100 m or 500 m (depending on version chosen at time of order).

Communication with the Base•X<sub>2</sub> can be established in two ways, either via the integrated wireless (WiFi) capabilities or direct serial connection with RS-232. The instrument may be powered either internally or externally.

## Where Do I Start?

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

- An instrument manual (this Base-X<sub>2</sub> 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 (CT-Xchange, C-Xchange, SV-Xchange, P-Xchange, T-Xchange, and Tu-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 contains the following items:
  - Base•X<sub>2</sub> instrument
  - Connector and Charging Cable
  - Red shorting plug (attached to instrument with lanyard)
  - USB wireless adaptor
  - One primary sensor blanking plug
  - One secondary sensor blanking plug
  - USB with manuals and documentation
  - AC wall plug / DC socket adaptor / Power Supply adaptor.
- 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. The blue locking sleeve should be tight, and sitting less than 1 mm from the instrument end cap.
- Connect the instrument to a computer using WiFi and perform a scan or monitor using SeaCast.
- Check the battery voltage. A % *Battery Life* indicator is shown in SeaCast when the instrument is connected under the status window.

### Returning an Instrument to the Factory

- If shipping for repair or recalibration, obtain an RMA number from the service centre.
- Package 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 500m instrument equipped with a 6000 dBar (0-6000m) P•Xchange™ sensor is limited to deployments of 500m depth or less. Similarly, a 6000m instrument equipped with a 500 dBar (0-500m) P•Xchange™ sensor is also 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, Tu•Xchange sensor, or the instrument housing. Overpressure can result in damage to the sensors and the instrument.**

Base•X<sub>2</sub> is available in two different pressure ratings: 100 meter or 500 meter. The depth rating is dependent on the instrument housing selected at time of purchase. Refer to the instrument's decal or engraving on the top (adjacent to the shackle) to verify the pressure rating.

### Pre-Deployment Procedures

- Upon Receipt
  - Use the Shipping and 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 WiFi.
  - 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.
        - If using a Terminal Emulator, the instrument will need to be connected to the computer via the Data/Power Cable using serial communications.

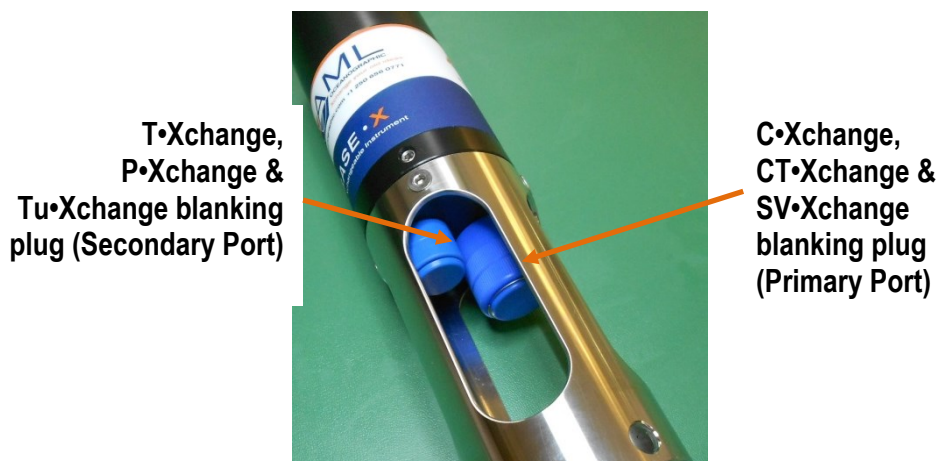
**Caution: Install blanking plugs in all unused sensor ports prior to deployment. Failure to install blanking plugs will result in damage to the connectors.**



Primary Xchange™ mount blanking plug



Secondary Xchange™ mount blanking plug



### Supported Sensor Configurations

Swappable sensors allow you to configure the instrument in a number of different ways. Base-X<sub>2</sub> supports the following sensor combinations:

Configuration	Primary Port	Secondary Port
1	SV•Xchange	P•Xchange
2	SV•Xchange	T•Xchange
3	SV•Xchange	Tu•Xchange
4	C•Xchange	P•Xchange
5	C•Xchange	T•Xchange
6	CT•Xchange	P•Xchange
7	CT•Xchange	T•Xchange

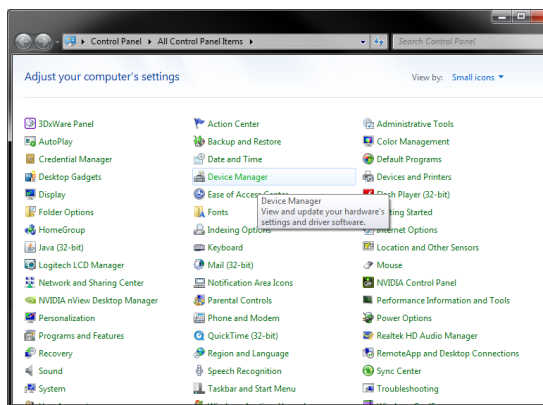


## USB Wireless Adaptor

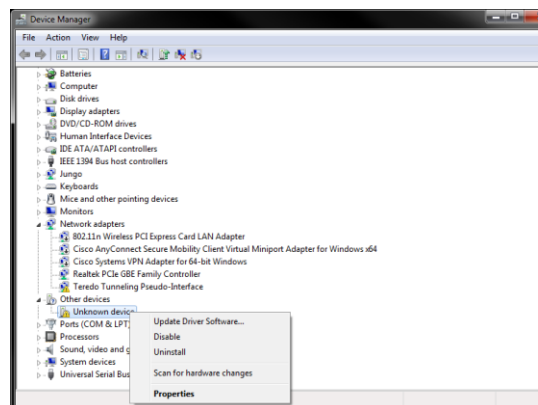
Since a wireless connection is required to connect to the Base•X<sub>2</sub> instrument, a wireless adaptor is included with every device for the user's convenience. If a computer – such as a laptop – already has an adaptor installed, it can connect to Base•X<sub>2</sub> without disrupting its existing network. It is recommended that the included wireless adapter always be used to connect to the instrument.

### Installation

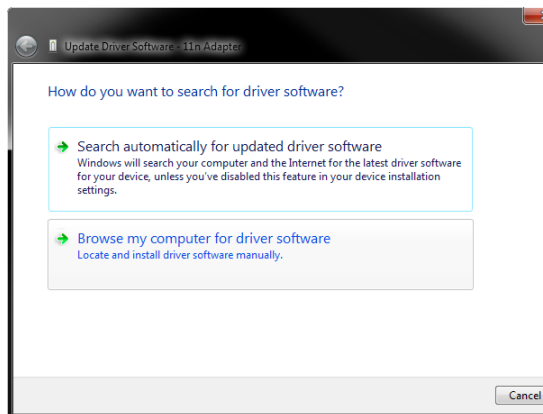
The drivers for the wireless adaptor are included with every installation of SeaCast 4 and on the AML USB stick. The wireless drivers should install automatically when first inserted into a PC. Alternatively, the drivers may be installed manually. The following instructions explain how to install them on a computer running Windows 7.



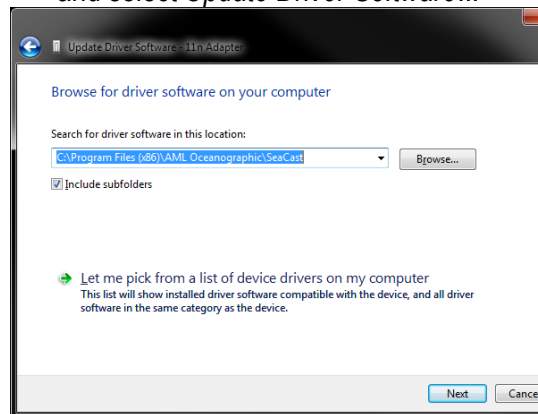
Control Panel > Device Manager



Right-click *Unknown device* in *Other devices* and select *Update Driver Software...*



Browse your computer.



Navigate to the SeaCast install folder or the AML USB stick. Ensure *Include subfolders* is ticked.

Select *Next* and the utility will find and install the driver.

For alternate computer operating systems please refer to the SeaCast 4 user manual.

## LED Indicators

The large LED indicator located next to the data/power connector on the instrument's top endcap is used to communicate the instrument's status. In general, the LED:

- will be on whenever the data/power cable is plugged into the instrument.
- will turn on when the red shorting plug is inserted into the instrument. It will turn off after 5 minutes to conserve power.
- Will, when the instrument is logging and is brought back to the surface, turn on for 5 minutes to show that the instrument is still functioning after the cast.

When the red shorting plug is inserted into the connector the LED indicator will briefly turn solid green to acknowledge instrument power-on. It will then begin to slowly blink while the instrument boots up. When the LED turns solid green the instrument is armed and ready to log. **Never deploy the instrument unless the indicator LED is solid green.**



Other flash/color patterns indicate the following:

- **Solid green:** The instrument is on and the battery has more than 20% capacity remaining. The instrument is ready to log.
- **Flashing green:** The instrument is logging data and the battery has more than 20% capacity remaining.  
Note:
  - The LED will turn off after 5 minutes to conserve power.
  - The instrument will not start logging until it is immersed in water and it takes its first sample at the programmed sampling rate.
- **Solid red:** The instrument is on and the battery has less than 20% capacity remaining.
- **Flashing red:** The instrument is logging data and the battery has less than 20% capacity remaining.  
Note:
  - The LED will turn off after 5 minutes to conserve power.
  - The instrument will not start logging until it is immersed in water and it takes its first sample at the programmed sampling rate.
- **Solid amber:** The instrument is charging.
- **Off with data/power cable attached:** The instrument is not working properly. Consult the Troubleshooting section of this manual or call the service department.
- **Off with the red shorting plug inserted:** If the shorting plug was inserted less than 5 minutes ago, the instrument is not working properly. Consult the Troubleshooting section or call the service department. If the LED was on for the first 5 minutes after inserting the shorting plug, the instrument is functioning correctly and the LED has turned off to conserve power.

The smaller LED indicator located next to the shackle on the instrument's top endcap indicates the status of the instruments WiFi and GPS operations. In general, it will:

- be on whenever the data/power cable is plugged into the instrument.
- turn on whenever the red shorting plug is inserted into the instrument.

The small LED indicator displays are as follows:

- **Single amber flash:** The instrument WiFi is on and the GPS has locked.
- **Double amber flash:** The instrument WiFi is on and there is no GPS lock.

While the large LED will cease flashing after 5 minutes of inactivity to conserve power, the small LED will remain active as long as the red shorting plug is inserted or the data/power cable is attached.

### **Configuring Sampling Parameters Using SeaCast**

SeaCast is free software provided for use with AML Oceanographic instruments. It can be used to set up an instrument for profiling or monitoring data, as well as downloading, graphing, and exporting the collected data.

Full details on the instrument configuration process and the software's capabilities can be found in the SeaCast manual. It is highly recommended that the SeaCast manual be reviewed prior to instrument usage.

### **Configuring Sampling Parameters through the Terminal**

Instruments can also be configured for deployment using a terminal emulation program like *HyperTerminal*, *RealTerm*, or *Tera Term*. 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.

**Note:** The user must select a **baud rate of 38400 or 115200** if connecting via serial cable, including serial connection via SeaCast. The factory default is 115200.

In general, it is recommended that the instrument be configured with SeaCast. However, if connected via terminal emulation the steps listed below 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.

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

Refer to the SeaCast User Manual for instructions on enabling "Zero Depth."

#### 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

While there are many variations to profiling workflow based on user requirements, the typical procedure is as follows:

1. Ensure the pre-deployment procedures have been completed.
2. **With the instrument out of water**, plug the red shorting plug into the connector and wait for the instrument status indicator to turn solid green. The red shorting plug must remain installed while the instrument is in use. There are two LEDs on the instrument, the patterns and colours for these LEDs are listed on the instrument shackle. The instrument will go to sleep after 5 minutes of inactivity, and be awoken by selecting *Wake* on the Status tab.
3. Start SeaCast and set it to *Wireless*. It will automatically use your adaptor to find every wireless instrument nearby. Wireless connection can be made the default mode in the Settings menu. (Refer to the SeaCast manual for complete instructions).
4. If required, wait until a GPS lock is acquired. Under nominal conditions, this may take 1-5 minutes outside.
5. Prior to conducting a cast, choose the preferred sampling mode in SeaCast. Log file names are created automatically. This configures the instrument to either log by depth, time, SV reading, etc., and sets the sampling rate.
6. With the instrument in air (NOT submerged), use the *ZERO* command to zero the barometric pressure offset (P•Xchange only).
7. Securely attach the lowering cable to the instrument shackle bar.
8. Lower the instrument until it is just submerged. 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.
9. The instrument uses readings from either the SV, Cx, or CT sensor to determine if it's in water. If the instrument determines that it is in water the instrument status indicator will begin to flash green and the instrument will begin to automatically log data.
10. Leave SeaCast running and perform a cast. When the instrument is fully submerged the WiFi connection will be lost and the signal broadcast will be terminated, which SeaCast will acknowledge. Once the instrument returns to the surface and is removed completely from the water it will reactivate the signal and SeaCast will detect and reconnect with it automatically.
11. Note that with Base•X<sub>2</sub> in the typical, vertical orientation, the downcast data is usually more accurate than the upcast data since the downcast measurements are not contaminated by the thermal shedding from the pressure case.
12. Upon reconnection, the cast file will be downloaded automatically and appear in the *Cast Folder*. The file can also be opened directly from the instrument using the *Choose cast file* dropdown menu under the *View Data* tab. Complete details are found in the SeaCast user manual.
  - a. Note: If conducting a test cast in the lab where the WiFi connection is not lost, the test data may not download automatically. Should this occur, select 'reconnect' in the SSID dropdown box on the front panel. Once reconnected, the file will automatically download.
  - b. If the latest cast file does not download automatically, it may be because the 'automatically download cast files' option is not turned on. Navigate through the *Settings* menu in SeaCast to ensure that this option is set to 'on' (located in the *Preferences* tab).

## Monitoring Real Time Data

Real time data may be monitored (or logged) through either the WiFi connection or Serial cable. If using the WiFi connection, the connector-end of the instrument must remain out of the water to maintain signal.

**To begin, ensure the instrument is out of water.** Connect to the instrument via SeaCast (either via serial cable or WiFi) and navigate to the *View Data* tab. Press the *Monitor* button at the bottom of the panel to begin live streaming of sensor data. Note that there will be a delay of a few seconds between pressing the button and streaming of the data due to initialization time of the sensors. Data will begin to populate the table. The instrument may now be lowered into the water.

Data is streamed at whatever sample rate the instrument is set to. For example, if the instrument is set to log at 1/second, then the table will update at 1 Hz. The instrument's sample rate can be adjusted using the *Sample Mode* button on the *Status* panel in SeaCast.

Data may also be monitored using a terminal emulator (when connected via serial cable). Issuing the command '*monitor*' will begin instrument data streaming. This must be done with the instrument in Instrument Mode (refer to the Command Addressing section of this manual).

## Post-Deployment Procedures

- When the instrument is pulled from the water it should be rinsed in 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 PressureXchange™ sensor. Doing so may damage the sensitive pressure transducer diaphragm.**
- Remove the shorting plug or cable. Place the red cap over the connector to protect it.
- Dry the instrument and stow it securely.

## Viewing your Data

You may download and view data directly through the terminal, or automatically using SeaCast. The SeaCast manual has more information. The recommended method is to connect the instrument via the wireless communication.

Alternately, use the following instructions to access the data manually via a terminal window.

- Connect the instrument to the computer using the data/power cable.
- With the terminal, use the *DIR* command to list all the files on memory, then the *DUMP* command to retrieve the file of interest. For example (the bolded text represent issued commands):

```
Base.X V2 Version 4.22 SN:2501
AML Oceanographic Ltd.
942.8 MBytes installed

>dir
test .raw 5598 02/24/10 14:41:55.00
data .txt 3987 02/24/10 14:45:08.00

935 MBytes free
7 MBytes Used
2 File(s) listed
>dump data.txt

[cast header]
InstrumentSN=08221
Date=02/24/10
Time=14:45:10.55
PressureOffset=0.09
UsePressureOffset=yes
```

Slot1Sensor1=SV-C.Xchange SV.X SN 131197 01/22/10  
Slot2Sensor1=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09

[Data]

02/24/10 14:45:10.66 1474.313 0000.015 17.447 008.18  
02/24/10 14:45:10.69 1474.334 0000.015 17.449 008.20  
02/24/10 14:45:11.19 1474.332 0000.027 17.451 008.20  
02/24/10 14:45:11.69 1474.326 0000.027 17.451 008.20  
02/24/10 14:45:12.19 1474.319 0000.027 17.457 008.20  
02/24/10 14:45:12.69 1474.321 0000.034 17.459 008.20  
02/24/10 14:45:13.19 1474.318 0000.023 17.457 008.20  
02/24/10 14:45:13.69 1474.321 0000.019 17.458 008.20  
02/24/10 14:45:14.19 1474.427 0000.019 17.459 008.20  
02/24/10 14:45:14.69 0000.000 -0000.015 17.601 008.20  
02/24/10 14:45:15.19 0000.000 -0000.030 17.655 008.20  
02/24/10 14:45:15.69 0000.000 -0000.011 17.651 008.20  
02/24/10 14:45:16.19 0000.000 -0000.015 17.632 008.20  
02/24/10 14:45:16.69 0000.000 -0000.015 17.624 008.20  
02/24/10 14:45:17.19 0000.000 -0000.015 17.622 008.20  
02/24/10 14:45:17.69 0000.000 -0000.015 17.618 008.20

[cast header]

InstrumentSN=08221

Date=02/24/10

Time=14:45:21.85

PressureOffset=0.09

UsePressureOffset=yes

Slot1Sensor1=SV-C.Xchange SV.X SN 131197 01/22/10

Slot2Sensor1=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09

[Data]

02/24/10 14:45:21.92 1474.309 -0000.019 17.598 008.20  
02/24/10 14:45:21.95 1474.308 0000.019 17.451 008.20  
02/24/10 14:45:22.44 1474.301 0000.023 17.453 008.20  
02/24/10 14:45:22.94 1474.297 0000.011 17.453 008.20  
02/24/10 14:45:23.44 1474.294 0000.019 17.451 008.20  
02/24/10 14:45:23.94 1474.314 0000.019 17.453 008.20  
02/24/10 14:45:24.44 1474.310 0000.027 17.453 008.20  
02/24/10 14:45:24.94 1474.307 0000.015 17.451 008.20  
02/24/10 14:45:25.44 1474.307 0000.027 17.453 008.20  
02/24/10 14:45:25.94 1474.308 0000.023 17.454 008.20  
02/24/10 14:45:26.44 1474.313 0000.023 17.451 008.20  
02/24/10 14:45:26.94 1474.294 0000.023 17.452 008.20  
02/24/10 14:45:27.44 1474.313 0000.023 17.453 008.20  
02/24/10 14:45:27.94 1474.303 0000.023 17.454 008.20  
02/24/10 14:45:28.44 1474.312 0000.023 17.453 008.20

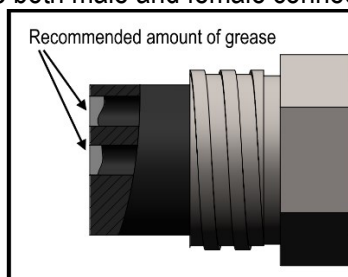
>

## 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.

### Battery Care

Incorrect care can reduce the life of the batteries. Below are some guidelines to prevent damage to the batteries:

- Do not leave either the data cable or the red shorting plug installed in the instrument. This turns the instrument on and depletes the battery.
- Before storing the instrument for several months, fully charge the battery. The battery will self-discharge at a rate of 2% per month so extended storage durations can require recharging to protect the battery from fully depleting.

### Battery Life

Base•X<sub>2</sub> will provide approximately 11 hours of battery life with continuous sampling, however actual life varies somewhat depending on the sensors installed.

The instrument will indicate low battery life when the battery voltage is equal to or lesser than the low voltage threshold, which is factory-set to a default 6.9 V.



## Charging the Lithium-Ion Batteries

- Ensure the instrument is dry.
- Plug the data/power cable into the instrument.
- Plug one of the power adapters (flying leads, wall wart, 12V cigarette lighter) into the data/power cable.
- Apply power and allow the instrument to charge until the large LED on the instrument turns from yellow to solid green. A full charge requires approximately 3 hours. If the large LED is:
  - off, the battery is charged.
  - solid yellow, the battery is on standby.
  - flashing red, an error has occurred.

The connections should be made to the instrument **before** plugging the charger into the AC outlet for proper charging operation.

- Turn the instrument off after charging (unplug the data/power cable) to maintain a full charge after charging.

## Communications

### PC Settings / WiFi

Base•X<sub>2</sub> communicates via the wireless connection established using the SeaCast software. All instrument operations can be set / controlled via this method.

### PC Settings / Serial

Base•X<sub>2</sub> communicates using an RS-232 serial connection. 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 115200

After power up, Base•X<sub>2</sub> will wait for an ASCII carriage return. **Baud rate must be 38400 or 115200.**

### 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 Base•X<sub>2</sub> 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
Turbidity•Xchange™	NTU	1234.56

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

**SV, P sensors**

Date	Time	Sound velocity	Pressure	Battery	Density	Salinity
mm/dd/yy	hh:mm:ss.ss	m/s	dbar	volts	kg/m <sup>3</sup>	ppt

**SV, Turbidity sensors**

Date	Time	Sound velocity	Turbidity	Battery
mm/dd/yy	hh:mm:ss.ss	m/s	NTU	volts

**CT, C, T sensors**

Date	Time	Conductivity	Temperature	Battery	Density	Salinity	Sound velocity
mm/dd/yy	hh:mm:ss.ss	mS/cm	C	volts	kg/m <sup>3</sup>	ppt	m/s

**Note:** These are examples of the default configurations. Your data channel outputs will be entirely dependent on which Xchange™ sensors are installed.

**Default Example Outputs:**

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

```
>Base.X V2 Version 4.22 SN:0002
AML Oceanographic Ltd.
942.8 MBytes installed

>scan
06/25/13 15:56:40.99 0000.000 0000.22 007.63
>monitor
06/25/13 15:56:47.03 0000.000 0000.14 007.63
06/25/13 15:56:47.53 0000.000 0000.13 007.63
06/25/13 15:56:48.03 0000.000 0000.16 007.63
06/25/13 15:56:48.53 0000.000 0000.22 007.63
06/25/13 15:56:49.03 0000.000 0000.24 007.63
06/25/13 15:56:49.53 0000.000 0000.26 007.63
>dis options
[Instrument]
Type=Base.X V2
EmulationMode=disabled
UseCustomHeader=yes
SN=2
Firmware=V4.22
SampleUnits=/ second
SampleInterval=2
PressureInc=0.00
SoundInc=0.00
LogFile=data.txt
Date=2016-01-27
Time=15:56:58
MemorySize=942.8 MB
MemoryUsed=3.8 MB
DisplayTime=yes
DisplayDate=yes
DisplaySalinity=no
DisplayDensity=no
DisplaySoundVelocity=no
DisplayBattery=yes
RelayMode=RS232 mode
RealtimeLogging=yes
LoggingTimeout=0
StartupDelay=10
DisplayHeader=yes
StartupMode=prompt
CharacterReception=yes
```

```
LoggingBreakMode=no
DetectionMode=A3
BatteryACoefficient=+3.500000E-01
BatteryBCoefficient=+2.500000E-02
ShutDownVoltage=6.5
WarningVoltage=6.9
PressureOffset=0.00
UsePressureOffset=no
SoundVelocityThreshold=1375.00
DelimiterMode=Space
SensorDetectionMode=Once
Traceability=yes
SkipPowerOff=no
AnalogChannels=2
Latitude=48.6570
Longitude=-123.4137
AutoMonitorSeconds=0
FixedPressure=0.0000
UseFixedPressure=no
BiofoulingPwrAlways=no
LedTimeoutSecs=300
DisplayIncrement=no

[Slot 1]
SensorName=SV-C-CT.Xchange SV.X SN 204907 09/22/15
BoardSN=03511

[Slot 3]
SensorName=P-T-TU-DO-UV.Xchange P.X SN 304977 10/23/15
BoardSN=02640
>dir
```

## Support

### Troubleshooting

#### Device fails to connect over wireless:

- Is the device powered?
  - Is the connector fully seated?
  - Is the attached X•Series instrument charged?
  - The amber endcap light will blink when powered, using the patterns on the label.
- Is your computer connected to the ad-hoc network the device generates?
  - See which wireless networks are available to your computer. If using SeaCast, a network called “Data•Xchange” will appear. If not, the SSID with the device’s serial number included indicates that it is broadcasting.

#### Connection is spotty, or device wakes up from sleep mode without prompting:

- Is there a powerful wireless transmitter or microwave emitter nearby?
  - Interference from such sources can cause a momentary loss of connection that can cause Base•X<sub>2</sub> to awaken.
  - It may be necessary to relocate either Base•X<sub>2</sub> or the source of interference if the problem persists.
  - In some cases, it is possible to solve this problem by changing the wireless channel of either Base•X<sub>2</sub> or the source of interference. The command to set device channel is explained in the appendix.

**Device fails to acquire a GPS lock, or takes longer than expected:**

- Is the device oriented vertically?
- Is there a significant obstruction around the device?
- Is it cloudy, overcast, or raining, especially on the horizon?

**Device is nonresponsive:**

- Was the wireless network disrupted during a firmware version upload?
- Reset the firmware as described in Resetting to Factory Firmware earlier in this manual.

**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.
- Are the batteries dead? Try using external power.
- If using external power over a long cable, check the voltage drop over the cable. Measure the voltage across a 10 watt, 27 $\Omega$ , resistor across pins 1 and 4 of the cable. The voltage must be above 8 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 set at 115200
- Are the communication settings in the instrument correct?
  - Is the instrument set at a baud rate of either 38400 or 115200?
  - 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 red shorting plug. The LED indicator should show solid green indicating the instrument is charged and ready. **Note: If SV•Xchange, CT•Xchange, or C•Xchange sensors are not installed, the instrument will begin logging in air.**
  - Place the instrument's sensors in water. The LED indicator should remain green and begin flashing, indicating the instrument is charged and logging.
    - If the indicator shows red, charge the battery.
    - 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.
- Is the red shorting plug firmly seated in the instrument?
- Are the batteries dead (LED light does not illuminate when shorting plug is installed)?
- 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, 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 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?

#### **Battery fails to fully charge:**

- Is the power adaptor connected to the data/power cable?

#### **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.

## Contact AML Oceanographic

### Service

To request an RMA or technical support

Email: [service@AMLOceanographic.com](mailto: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](mailto: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 appropriate Xchange™ sensors.

## IP Address

The IP address of the WiFi board internal to the Base•X<sub>2</sub> instrument is auto-generated in the ad-hoc range based on its serial number. The first two blocks will always be 169.254. The calculation for the third and fourth block is as follows:

Third block:

$$\text{abs}((\text{SN} - 15001) / 256)$$

Fourth block:

$$(\text{SN} - 15001) - (\text{third block}) * 256$$

Examples:

Serial Number	IP Address
25032	169.254.39.47

## Command Addressing (WiFi vs Instrument Mode)

Commands sent to the instrument are received and interpreted by the installed WiFi board, rather than a typical AML logging board. This means that the standard AML command set may not be directly applicable. To bypass the installed WiFi board and access the underlying logging boards, use the “---” command to enter Instrument Mode. Once in Instrument Mode, the instrument logger board can be addressed directly and typical AML instrument commands are applicable (refer to Command Listing table). To return to the WiFi board, enter “+++”. This resets the instrument, so it will be inaccessible for the next few seconds as it reboots.

## Command Listing

For a complete command listing, input *HELP* when communicating by terminal. Some common commands have been provided below. Note: Not all of these commands are accessible via the Advanced Instrument Control window on the *Status* tab of SeaCast when in WiFi.

### General Commands (must be communicating with WiFi board)

Command	Description
VERSION	Displays device firmware version, device serial number, and available memory.
DISPLAY OPTIONS	Displays configuration settings, including GPS, power-saving, and wireless information.
IDENTIFY	Flashes the WiFi LED.
HELP	Displays the main command listing. - This is accessed at the top level prior to entering Instrument Mode
?	Displays the internal file system commands. - This is accessed at the top level prior to entering Instrument Mode
DISPLAY and SET CHANNEL	Allows the user to set the WiFi channel used by Base•X <sub>2</sub> . After a new channel has been set, all computers must be disconnected and Base•X <sub>2</sub> restarted for the change to take effect. Default channel is 10.
REBOOT	Reboots the device.
---	Enter Instrument Mode.
+++	(While in Instrument Mode) Return to WiFi board. Resets the instrument.



**Communications Commands (must be in instrument mode)**

Command	Description	Requires
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 (must be in instrument mode)**

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 (must be in instrument mode)**

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.	CT•X and P•X or SV•X, T•X, and P•X
SET SCAN DENSITY	Turns the calculated density channel on.	CT•X and P•X or SV•X, T•X, and P•X
SET SCAN NOSALINITY	Turns the calculated salinity channel off.	CT•X and P•X or SV•X, T•X, and P•X
SET SCAN SALINITY	Turns the calculated salinity channel on.	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 DISPLAY SCAN.	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 DISPLAY SCAN. This is only available when CT and P sensors are attached.	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 (must be in instrument mode)**

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 DISPLAY STARTUP.	

LOG	Puts unit into logging mode from real-time mode. It will remain in logging mode until power is turned off.	
SET LOG ttttttt.ttt	Sets new log file name. ttttttt.ttt = log file name. Name can have up to 8 characters in length and 3 characters for file extension.	
INIT	Clears the instruments logging memory.	
DIRECTORY	Displays list of files in instrument memory and memory status including amount of memory space free and used.	
DUMP ttttttt.ttt	Dumps the data of the specified logged file defined by ttttttt.ttt in REAL or RAW format depending on the current instrument mode.	
DELETE ttttttt.ttt	Erases specified logged file defined by ttttttt.ttt Maximum 8 character name with 3 character extension.	
DISPLAY LOG	Displays current log file name.	

**General Commands (must be in instrument mode)**

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
DISPLAYTIME	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	
DISPLAY 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 at same time to exit sensor board talk mode & return to logger communications.	

## Technical Specifications

### Electrical

- WiFi Board
- Mother Board
  - Flash, non-volatile data memory (Minimum 1 GB)
  - Two dedicated slots
    - Primary Xchange™ sensor slot
    - Secondary Xchange™ sensor slot
- Sensor Boards
  - Sound Velocity, CT or Conductivity Xchange™ sensor board
  - Pressure, Temperature, and Turbidity Xchange™ sensor board
- RS232 communications)

### Power

- External Power Supply: 9 to 28 VDC
- Internal Power Supply
  - Standard: Lithium Ion
    - Capacity: 3 Ah
    - Voltage: 7.2 Volts
- Battery voltage limits
  - 8.3 volts: Full Charge
  - 6.9 volts: Low battery warning
  - 6.5 volts: Auto shutdown

### Pressure Case

- Environmental Limits
  - Storage: -40°C to 60°C
  - Usage: -20°C to 45°C

Housing					
Type	Depth Rating	Diameter	Length	Weight (in water)	Weight (in air)
Delrin	100 m	2.7" [69 mm]	15.3" [390 mm]	1.1 lb [0.5 kg]	2.6 lb [1.2 kg]
Delrin (with internal aluminum sleeve)	500 m				

Bulkhead Connector				
Type	Pins	Sex	Material	Manufacturer
Bulkhead	Micro 8	Male	SS316	Subconn

### Sampling Capabilities

- Frequency
  - Time: From 25 per second to 1 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

- Base•X<sub>2</sub> instrument
- USB wireless adaptor
- 2m Data/Power Pigtail
- Red shorting plug
- Black dummy plug
- One primary sensor blanking plug
- One secondary sensor blanking plug
- USB stick with manuals and documentation
- Battery charger

### Software

- SeaCast

## Ordering Codes

PDC-BSX2-P1S1-01	Base•X <sub>2</sub> , 100 dBar, Delrin pressure housing
PDC-BSX2-P1S1-05	Base•X <sub>2</sub> , 500 dBar, Delrin pressure housing

Ordering codes for sensors and accessories can be found at  
<http://www.amloceanographic.com/>

## Regulatory Information

This product is compliant within the requirements of CE standards.



The Qualcomm Atheros AR4100 WiFi adaptor used in this instrument is a certified radio module under the following regulatory bodies:

1. FCC Part 15.247 Intentional Radiator Certification		FCCID: PPD-AR410
2. Industry Canada RSS-210		IC ID: 4104A-AR4100
3. R&TTE CE Marking		DoC: AR4100 Europe DoC 2011-6-21.pd
4. Japan Certificates		003GZA110921, July 7, 2011 003WWA110920, July 7, 2011

## Warranty

AML 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 prove to be defective. The warranty applies only to the original purchaser of the instruments and only to instruments and sensors manufactured by AML Oceanographic. The warranty of third party sensors will apply as per the specific vendor's warranty policy. 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 other than authorized personnel.

This warranty is the only warranty for new product 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.

## DISCLAIMER

AML reserves the right to make any changes in design or specifications at any time without incurring any obligation to modify previously delivered instruments. Manuals are produced for information and reference purposes and are subject to change without notice.

## **Technical Overview Drawings**