



Minos-X User Manual



Version 1.88
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Revision History

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Version 1.86	2 May 2016	CT•Xchange updates	Jehan Zouak
Version 1.87	18 November 2016	Edited LED indicator section	Jehan Zouak
Version 1.88	13 April 2017	Added regulatory information and updated maintenance instructions	Andrew Beak-Taylor

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General Description of the Instrument

The 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 or a 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.

Minos•X is the mid-size logger of the X•Series family. It is designed primarily for small boat and hand deployed operations. It provides all the capabilities and accuracy of the larger Plus•X instruments, but trades off battery capacity and additional sensor channels in favour of reduced weight and size.

Minos•X comes in two sensor endcap configurations: the P1S2 is equipped with one primary Xchange™ sensor port (i.e. conductivity or sound speed) and two secondary Xchange™ sensor ports (i.e. temperature and pressure). Two additional analog ports can be added by the factory, if required. The P2S1 variant supports two primary sensors and one secondary, making Minos•X the smallest combined CTD/SVP on the market.

Minos•X is capable of logging continuously for 38 hours with a full battery charge. The actual life varies somewhat depending on the sensors installed. Sampling rates are programmable by time (25 Hz to every 24 hours), by pressure (0.1 dbar or greater increments), or by sound speed (0.1 m/s or greater increments). When logging at time intervals of 25 seconds or more, Minos•X powers down between samples to conserve the batteries.

Minos•X can be powered internally or externally, and supported communication protocols are RS-232 or RS-485. Minos•X can be equipped with Data•Xchange to add wireless capabilities and enhance data transfer rates.

Where Do I Start?

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

- An instrument manual (this Minos•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 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.

If you will be using Data•Xchange with your instrument, refer to its manual beforehand.

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
 - Minos•X instrument
 - Data•Xchange (if purchased)
 - Data/Power cable
 - Red shorting plug
 - Black dummy plug
 - One or two primary sensor blanking plugs
 - One or two secondary sensor blanking plugs
 - USB stick with manuals and documentation
 - Battery charger
- 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 with the data cable and perform a scan or monitor if using SeaCast. Check the battery voltage on the output (normally the last column of data, unless calculated parameters have been enabled). It should be between 7.2 and 8.4 volts.

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 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.

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 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.



Primary Xchange™ mount blanking plug



Secondary Xchange™ mount blanking plug

Supported Sensor Configurations



Secondary Port
 T•Xchange™
 P•Xchange™
 Tu•Xchange™

Primary Port
 C•Xchange™
 CT•Xchange™
 SV•Xchange™

Minos•X with cage removed and blanking plugs installed. The P1S2 version shown above has one primary and two secondary sensor ports.

Swappable sensors allow you to configure your instrument in a number of ways. Minos•X supports the following sensor combinations.

P1S2

Primary Port	Secondary Ports	
SV, C, CT	P, T	P, T, Tu*

*Note: Tu•Xchange will fit on either secondary port, but not both at once. Tu•Xchange is incompatible with C and CT•Xchange sensors on the Minos•X.

P2S1

Extended Primary Port	Face Primary Port	Secondary Port
SV, C, CT	SV	P, T

LED Indicator

The LED indicator is located next to the data/power connector on the instrument's top endcap.

- The LED indicator will be on whenever the data/power cable is plugged into the instrument.
- The LED indicator will turn on when the red shorting plug is inserted into the instrument. In air, it will stay on.
 - After logging data in water for more than 5 minutes, it will turn off to conserve power.
- When the instrument is logging and is brought back to the surface, the LED indicator will resume for 5 minutes so that the operator can see that the instrument is still functioning after the cast.



The LED indicator displays are as follows:

- **Constant green:** The instrument is on and the battery has more than 20% capacity remaining.
- **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.
- **Constant 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.
- **Off with the data/power cable attached:** The instrument is not working properly. Consult the Troubleshooting section of this manual or contact the service department.
- **Off with the red shorting plug attached:** The instrument is not working properly. Try using external power or charging the battery. If this does not resolve the issue, consult the Troubleshooting section of this manual or contact the service department.

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.

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.

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.

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 a connection is established, ensure the instrument is stationary and 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).
- 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).
- Insert the red shorting plug to power the instrument. Insertion of the shorting plug tells the instrument to begin logging data once it is submerged. The instrument determines whether or not it is submerged by looking for valid conductivity or sound speed readings.
 - The green LED light should illuminate on the top of the instrument indicating the battery has more than 20% capacity remaining and the instrument is ready to start logging.
 - If the LED light is red, the battery charge is less than 20% but the instrument is still ready to log.
 - If the LED light fails to illuminate, the instrument will not log. Refer to the Troubleshooting section of this manual if this occurs.
- Securely attach the lowering cable to the instrument shackle bar.
- 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.
- Send the instrument down to the desired depth and return it to the surface.
- Note that with Minos•X 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.

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 Minos•X, is about 2 volts per 100m of cable while sampling and 0 volts per 100m when in low power mode.
 - The instrument's low voltage warning triggers at 7.2 volts or less.
 - The instrument's auto shutdown triggers when supplied with 6.5 volts or less.
 - The instrument's maximum voltage is 26 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).
- Securely attach the lowering cable to the instrument shackle bar.
- 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.
- Note that with Minos•X in the typical, vertical orientation, the downcast is usually more accurate than the upcast data since the downcast measurements are not contaminated by the thermal shedding from the pressure case.

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 Pressure•Xchange sensor. Doing so may damage the sensitive pressure transducer diaphragm.**
- Remove the shorting plug or cable. Place dummy plug in 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. Alternately, use the following instructions to access the data manually.

- 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:

```
Minos.X Version 4.09 SN:8221
AML Oceanographic Ltd.
968.5 MBytes installed
```

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

```
960 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	00.034	0998.724
02/24/10 14:45:10.69	1474.334	0000.015	17.449	008.20	00.046	0998.733
02/24/10 14:45:11.19	1474.332	0000.027	17.451	008.20	00.037	0998.726
02/24/10 14:45:11.69	1474.326	0000.027	17.451	008.20	00.032	0998.722
02/24/10 14:45:12.19	1474.319	0000.027	17.457	008.20	00.011	0998.705
02/24/10 14:45:12.69	1474.321	0000.034	17.459	008.20	00.005	0998.700
02/24/10 14:45:13.19	1474.318	0000.023	17.457	008.20	00.008	0998.702
02/24/10 14:45:13.69	1474.321	0000.019	17.458	008.20	00.010	0998.704
02/24/10 14:45:14.19	1474.427	0000.019	17.459	008.20	00.100	0998.773
02/24/10 14:45:14.69	0000.000	-0000.015	17.601	008.20	00.000	0000.000
02/24/10 14:45:15.19	0000.000	-0000.030	17.655	008.20	00.000	0000.000
02/24/10 14:45:15.69	0000.000	-0000.011	17.651	008.20	00.000	0000.000
02/24/10 14:45:16.19	0000.000	-0000.015	17.632	008.20	00.000	0000.000
02/24/10 14:45:16.69	0000.000	-0000.015	17.624	008.20	00.000	0000.000
02/24/10 14:45:17.19	0000.000	-0000.015	17.622	008.20	00.000	0000.000
02/24/10 14:45:17.69	0000.000	-0000.015	17.618	008.20	00.000	0000.000

[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	00.000	0998.671
02/24/10 14:45:21.95	1474.308	0000.019	17.451	008.20	00.017	0998.711
02/24/10 14:45:22.44	1474.301	0000.023	17.453	008.20	00.005	0998.701
02/24/10 14:45:22.94	1474.297	0000.011	17.453	008.20	00.003	0998.699
02/24/10 14:45:23.44	1474.294	0000.019	17.451	008.20	00.005	0998.702
02/24/10 14:45:23.94	1474.314	0000.019	17.453	008.20	00.019	0998.711
02/24/10 14:45:24.44	1474.310	0000.027	17.453	008.20	00.015	0998.709
02/24/10 14:45:24.94	1474.307	0000.015	17.451	008.20	00.016	0998.709
02/24/10 14:45:25.44	1474.307	0000.027	17.453	008.20	00.009	0998.704
02/24/10 14:45:25.94	1474.308	0000.023	17.454	008.20	00.008	0998.703
02/24/10 14:45:26.44	1474.313	0000.023	17.451	008.20	00.021	0998.714
02/24/10 14:45:26.94	1474.294	0000.023	17.452	008.20	00.002	0998.699
02/24/10 14:45:27.44	1474.313	0000.023	17.453	008.20	00.015	0998.709
02/24/10 14:45:27.94	1474.303	0000.023	17.454	008.20	00.004	0998.700
02/24/10 14:45:28.44	1474.312	0000.023	17.453	008.20	00.015	0998.708
02/24/10 14:45:28.94	1474.319	0000.030	17.453	008.20	00.019	0998.712
02/24/10 14:45:29.44	1474.336	0000.027	17.450	008.20	00.045	0998.732
02/24/10 14:45:29.94	1474.314	0000.027	17.450	008.20	00.023	0998.715
02/24/10 14:45:30.44	1474.326	0000.027	17.451	008.20	00.032	0998.722
02/24/10 14:45:30.94	1474.320	0000.027	17.451	008.20	00.027	0998.718
02/24/10 14:45:31.44	1474.305	0000.023	17.454	008.20	00.006	0998.701
02/24/10 14:45:31.94	1474.312	0000.030	17.451	008.20	00.020	0998.713
02/24/10 14:45:32.44	1474.311	0000.034	17.453	008.20	00.014	0998.708

```
02/24/10 14:45:32.94 1474.312 0000.030 17.450 008.20 00.021 0998.714
02/24/10 14:45:33.44 0000.000 -0000.011 17.459 008.20 00.000 0000.000
02/24/10 14:45:33.94 0000.000 -0000.019 17.569 008.20 00.000 0000.000
02/24/10 14:45:34.44 0000.000 -0000.015 17.548 008.20 00.000 0000.000
02/24/10 14:45:34.94 0000.000 -0000.023 17.515 008.20 00.000 0000.000
02/24/10 14:45:35.44 0000.000 -0000.015 17.498 008.20 00.000 0000.000
02/24/10 14:45:35.94 0000.000 -0000.023 17.487 008.20 00.000 0000.000
02/24/10 14:45:36.44 0000.000 -0000.019 17.485 008.20 00.000 0000.000
>
```

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 10/S* (sets the desired sampling rate)
 - *SET DETECT 07* (sets fixed 38400 baudrate)

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.
- 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 10/S* (selects the desired sampling rate)
 - *SET DETECT A7* (sets 10 autobaud attempts then defaults to 38400 baud)

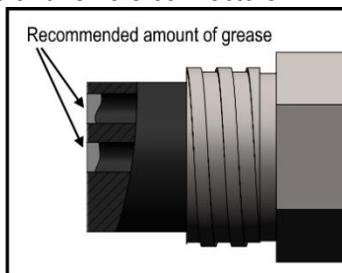
Note: Details on the *SET DETECT* command can be found in the Appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.

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.

Battery Care

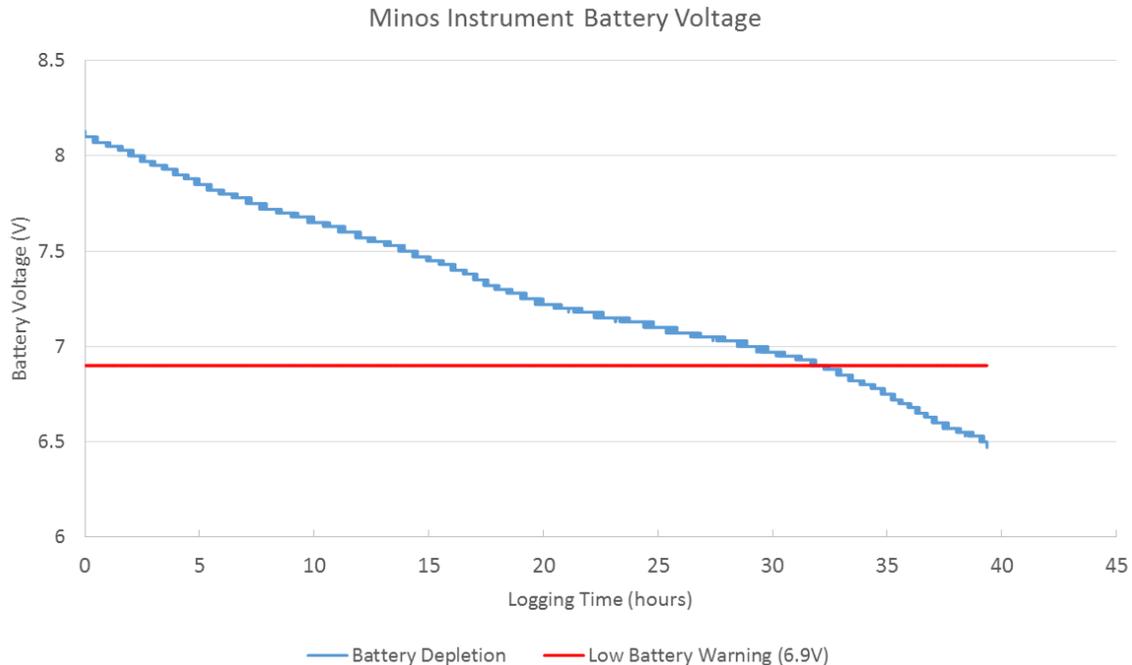
Incorrect care can reduce the life of the batteries. Below are some guidelines to prevent damage to the batteries:

- 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

The 5.3 Amp hour, 7.2 volt, lithium ion battery pack will power the instrument for approximately 38 hours of continuous use when using SV•Xchange or C•Xchange with P•Xchange and T•Xchange. If using CT•Xchange with SV•Xchange and P•Xchange, the battery pack will provide for approximately 25 hours of continuous use. The instrument's LED will turn red when the battery is low (6.9V), and will shut down when it has been depleted to the voltage cut-off (6.5V). A graph of the battery

discharge curve for a Minos•X sampling continuously with a full sensor load (SV•Xchange, P•Xchange, and T•Xchange) is shown below.



Charging the Lithium-Ion Batteries

- Ensure the instrument is dry.
- Plug the data cable into the instrument.
- Plug the charger into the data cable.
- Plug the charger into a 120 or 240 volt AC outlet and allow the instrument to charge until the green flashing light on the charger turns solid green. A full charge requires approximately 5 hours, however, the battery will reach 80% capacity within 2 hours.
 - If no light shows on the charger, the battery is not attached correctly.
 - If the light on the charger is solid yellow, the battery is on standby.
 - If the light on the charger is flashing red, an error has occurred.

The charger should be connected to the battery **before** plugging the charger into the AC outlet for proper operation of the charger and charging light.

- Turn the instrument off after charging (unplug the data/power cable) to maintain a full charge after charging.
- If instrument is left turned on after the battery has been charged to 8.3 volts, the charger will turn off and the instrument will start drawing on the battery. When the battery voltage drops below 8 volts the charger will automatically turn on and start charging the battery up to 8.3 volts. The charger can be restarted by manually resetting it (refer to procedure below).

- It is possible to use the instrument while charging the battery, however, instrument use causes the power consumption to fluctuate which can confuse the charger and cause it to stop charging prematurely. The charger monitors the charging power to detect when the battery is charged; fluctuating power from the instrument can corrupt the algorithm. To ensure proper charging, manually reset the charger when you have stopped using the instrument (refer to procedure below).
- **To manually reset the charger:** Unplug the charger from the wall and then back in. This will reset the charger and start charging the battery.

Changing the Lithium-Ion Battery Pack

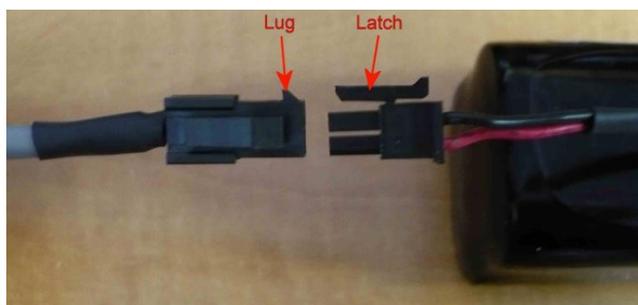
To optimize efficiency, it is best to have a spare battery to replace the depleted one. To facilitate this, a spare battery and charge connector can be ordered with the product code CSE-0018.



CSE-0018 - Spare battery and charge connector

To change the battery pack:

- Charge the spare battery.
 - Plug the charge connector into the battery. **Ensure the correct polarity.** The latch on the connector will engage.



- Plug the charger into the charge connector.
- Plug the charger into a 120 or 240 volt AC outlet and allow the instrument to charge until the red charging light on the charger turns green. A full charge requires approximately 5 hours, however, the battery will reach 80% capacity within 2 hours.

The charger should be connected to the battery before plugging the charger into the AC outlet for proper operation of the charger and charging light.



Charging the spare battery

- Dry the instrument.
- Open the battery compartment on the instrument.
 - Remove the three ¼-20 cap screws in the instrument using a 3/16 inch hex driver.



- Grasp the shackle bar and slowly wiggle the end cap out of the instrument until it reaches the soft stop.

DO NOT twist or attempt to unscrew the endcap; this will twist the internal cable harness and can damage the wires.



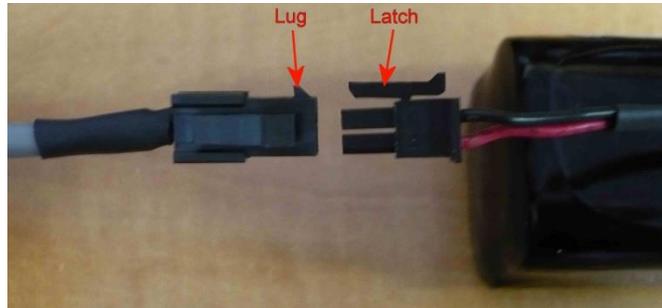
- Slowly pull the battery compartment just clear of the instrument.



- Undo the Velcro retainer, remove the battery pack, and disconnect the battery connector.



- Connect the new battery connector. **Ensure the correct polarity.** The latch on the connector will engage.



- Place the battery pack into the holder and secure the Velcro strap. Tuck the battery connector into the endcap.



- Re-insert the endcap into the instrument. **DO NOT twist the endcap more than ¼ turn each way. Excessive twisting of the endcap will damage the internal wiring of the instrument.**
- Replace the three ¼-20 cap screws.
- Connect the instrument to a computer to perform a scan and check the battery voltage. A fully charged battery will be approximately 8.3 volts.

Communications

PC Settings

Minos•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, Minos•X will wait for an ASCII carriage return. The instrument will automatically detect the baud rate, and whether communications are RS-232 or RS-485.

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 Minos•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
Turbidity•Xchange™	NTU	1234.56

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

SV, P, T sensors

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

SV,P, Turbidity sensors

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

C, P, T sensors

Date	Time	Conductivity	Pressure	Temperature	Battery	Density	Salinity	Sound velocity
mm/dd/yy	hh:mm:ss.ss	mS/cm	dbar	C	volts	kg/m ³	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.

```
Minos.X Version 4.09 SN:8221
AML Oceanographic Ltd.
968.5 MBytes installed
```

```
>scan
```

```
02/24/10 14:59:20.90 1474.372 0000.098 17.470 008.15 00.018 0998.708
```

```
>monitor
```

```
02/24/10 14:59:25.10 1474.374 0000.102 17.472 008.18 00.014 0998.705
```

```
02/24/10 14:59:25.60 1474.354 0000.106 17.474 008.18 00.000 0998.694
```

```
02/24/10 14:59:26.10 1474.386 0000.110 17.474 008.18 00.018 0998.708
```

```
02/24/10 14:59:26.60 1474.374 0000.102 17.473 008.18 00.010 0998.702
```

```
>dis options
```

```
[Instrument]
Type=Minos.X
EmulationMode=disabled
UseCustomHeader=yes
SN=8221
Firmware=V4.09
SampleUnits=/ second
SampleInterval=2
PressureInc=0.00
SoundInc=0.00
LogFile=data.txt
Date=02/24/10
Time=14:59:36
MemorySize=968.5 MB
MemoryUsed=7.6 MB
DisplayTime=yes
DisplayDate=yes
DisplaySalinity=yes
DisplayDensity=yes
DisplaySoundVelocity=no
DisplayBattery=yes
RelayMode=auto detection
RealtimeLogging=no
LoggingTimeout=0
```

```

StartupDelay=10
DisplayHeader=yes
StartupMode=prompt
CharacterReception=yes
LoggingBreakMode=no
DetectionMode=A5
BatteryACoefficient=+3.500000E-01
BatteryBCoefficient=+2.500000E-02
ShutDownVoltage=6.5
WarningVoltage=7.2
PressureOffset=0.00
UsePressureOffset=no
SoundVelocityThreshold=1375.00
DelimiterMode=Space
SensorDetectionMode=Once
Traceability=yes
SkipPowerOff=no

```

```

[Slot 1]
SensorName=SV-C.Xchange SV.X SN 131197 01/22/10
BoardSN=65535

```

```

[Slot 2]
SensorName=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09
BoardSN=65535

```

>**dir**

```

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

```

```

 960 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 00.034 0998.724
02/24/10 14:45:10.69 1474.334 0000.015 17.449 008.20 00.046 0998.733
02/24/10 14:45:11.19 1474.332 0000.027 17.451 008.20 00.037 0998.726
02/24/10 14:45:11.69 1474.326 0000.027 17.451 008.20 00.032 0998.722
02/24/10 14:45:12.19 1474.319 0000.027 17.457 008.20 00.011 0998.705
02/24/10 14:45:12.69 1474.321 0000.034 17.459 008.20 00.005 0998.700
02/24/10 14:45:13.19 1474.318 0000.023 17.457 008.20 00.008 0998.702
02/24/10 14:45:13.69 1474.321 0000.019 17.458 008.20 00.010 0998.704
02/24/10 14:45:14.19 1474.427 0000.019 17.459 008.20 00.100 0998.773
02/24/10 14:45:14.69 0000.000 -0000.015 17.601 008.20 00.000 0000.000
02/24/10 14:45:15.19 0000.000 -0000.030 17.655 008.20 00.000 0000.000
02/24/10 14:45:15.69 0000.000 -0000.011 17.651 008.20 00.000 0000.000
02/24/10 14:45:16.19 0000.000 -0000.015 17.632 008.20 00.000 0000.000
02/24/10 14:45:16.69 0000.000 -0000.015 17.624 008.20 00.000 0000.000
02/24/10 14:45:17.19 0000.000 -0000.015 17.622 008.20 00.000 0000.000
02/24/10 14:45:17.69 0000.000 -0000.015 17.618 008.20 00.000 0000.000
[cast header]
InstrumentSN=08221

```

User Manual for AML Oceanographic Minos•X

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	00.000	0998.671
02/24/10	14:45:21.95	1474.308	0000.019	17.451	008.20	00.017	0998.711
02/24/10	14:45:22.44	1474.301	0000.023	17.453	008.20	00.005	0998.701
02/24/10	14:45:22.94	1474.297	0000.011	17.453	008.20	00.003	0998.699
02/24/10	14:45:23.44	1474.294	0000.019	17.451	008.20	00.005	0998.702
02/24/10	14:45:23.94	1474.314	0000.019	17.453	008.20	00.019	0998.711
02/24/10	14:45:24.44	1474.310	0000.027	17.453	008.20	00.015	0998.709
02/24/10	14:45:24.94	1474.307	0000.015	17.451	008.20	00.016	0998.709
02/24/10	14:45:25.44	1474.307	0000.027	17.453	008.20	00.009	0998.704
02/24/10	14:45:25.94	1474.308	0000.023	17.454	008.20	00.008	0998.703
02/24/10	14:45:26.44	1474.313	0000.023	17.451	008.20	00.021	0998.714
02/24/10	14:45:26.94	1474.294	0000.023	17.452	008.20	00.002	0998.699
02/24/10	14:45:27.44	1474.313	0000.023	17.453	008.20	00.015	0998.709
02/24/10	14:45:27.94	1474.303	0000.023	17.454	008.20	00.004	0998.700
02/24/10	14:45:28.44	1474.312	0000.023	17.453	008.20	00.015	0998.708
02/24/10	14:45:28.94	1474.319	0000.030	17.453	008.20	00.019	0998.712
02/24/10	14:45:29.44	1474.336	0000.027	17.450	008.20	00.045	0998.732
02/24/10	14:45:29.94	1474.314	0000.027	17.450	008.20	00.023	0998.715
02/24/10	14:45:30.44	1474.326	0000.027	17.451	008.20	00.032	0998.722
02/24/10	14:45:30.94	1474.320	0000.027	17.451	008.20	00.027	0998.718
02/24/10	14:45:31.44	1474.305	0000.023	17.454	008.20	00.006	0998.701
02/24/10	14:45:31.94	1474.312	0000.030	17.451	008.20	00.020	0998.713
02/24/10	14:45:32.44	1474.311	0000.034	17.453	008.20	00.014	0998.708
02/24/10	14:45:32.94	1474.312	0000.030	17.450	008.20	00.021	0998.714
02/24/10	14:45:33.44	0000.000	-0000.011	17.459	008.20	00.000	0000.000
02/24/10	14:45:33.94	0000.000	-0000.019	17.569	008.20	00.000	0000.000
02/24/10	14:45:34.44	0000.000	-0000.015	17.548	008.20	00.000	0000.000
02/24/10	14:45:34.94	0000.000	-0000.023	17.515	008.20	00.000	0000.000
02/24/10	14:45:35.44	0000.000	-0000.015	17.498	008.20	00.000	0000.000
02/24/10	14:45:35.94	0000.000	-0000.023	17.487	008.20	00.000	0000.000
02/24/10	14:45:36.44	0000.000	-0000.019	17.485	008.20	00.000	0000.000

>

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.
- 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 Ω , resistor across pins 1 and 4 of the cable. The voltage must be above 7 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 red shorting plug. The LED indicator should show solid green indicating the instrument is charged and ready. **Note: If neither a SV•Xchange, CT•Xchange, nor Conductivity•Xchange sensor is 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 charger connected to the data/power cable?
- If the instrument is used while charging the battery, the changes in power consumption can cause the charger to stop charging prematurely. The charger monitors the charging power to detect when the battery is charged; fluctuating power from the instrument can corrupt the algorithm. To ensure proper charging, manually reset the charger when you have stopped using the instrument (refer to procedure below).
- If the charger light is green but the battery voltage is less than 8 volts, manually reset the charger (refer to procedure below).
- If the charger light is green and the battery voltage is between 8 and 8.3 volts, this is normal. The charger will charge the battery up to 8.3 volts. However, if the data/power cable is left plugged in to the instrument, the instrument will remain on and draw on the battery. When the battery voltage drops below 8 volts, the charger will automatically begin charging the battery up to 8.3 volts. The charger can be restarted at any time by manually resetting the charger (refer to procedure below).
- To stop the battery from draining down to 8 volts, unplug the data/power cable from the instrument as soon as the red light on the charger turns green. This will turn off the instrument.
- **To manually reset the charger:** Unplug the charger from the wall and plug the charger back in. This will reset the charger and start charging the battery.

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 data does not match CTD-calculated SV:

- Owing to the error associated with each individual sensor and Chen and Millero's equation¹, 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.

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.

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 DISPLAY 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 DISPLAY 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 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 hbe 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 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

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 ON	Corrects the barometric offset to set zero pressure at surface for current barometric pressure.	P•X
ZERO OFF	Disables barometric offset.	P•X
DISPLAY 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	
DISPLAYDATE	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 <i>DETECT</i> command.	
CTRL+C	Press CTRL key and C key at same time to exit sensor board talk mode and return to logger communications.	

Technical Specifications

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 ²	0.5 m/s	---

Electrical

- Mother Board
 - Flash, non-volatile data memory (Minimum 1 GB)
 - Two dedicated slots
 - Primary Xchange™ sensor slot
 - Secondary Xchange™ sensor slot
 - One expansion slot
- Sensor Boards
 - Sound Velocity, CT or Conductivity Xchange™ sensor board
 - Pressure, Temperature, and Turbidity Xchange™ sensor board
- Auto detect RS232 or RS485 (½ duplex ASCII)
- Autobaud to 38,400

Power

- External Power Supply: 8 to 26 VDC
- Internal Power Supply
 - Standard: Lithium Ion
 - Capacity: 5.3 Ahrs
 - Voltage: 7.2 Volts
- Current Draw
 - 50 mA in standby mode
 - 60 µA when in low power mode

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

Current Draw at 12VDC			
Primary Sensor	Secondary Sensor	Secondary Sensor	Current Draw (mA)
C•X*	-	-	126
SV•X	-	-	125
-	T•X	-	140
-	P•X	-	131
-	Tu•X	-	135
C•X	T•X	-	143
SV•X	T•X	-	141
C•X	P•X	-	133
SV•X	Tu•X	-	134
SV•X	P•X	T•X	133
C•X	T•X	P•X	150
SV•X	T•X	P•X	150
SV•X	Tu•X	P•X	150
SV•X	Tu•X	T•X	155

* CT•X draws about the same current as the C•X

- Battery Voltage Limits
 - 8.3 volts: Full Charge
 - 6.9 volts: Low battery warning (red light on instrument activates)
 - 6.5 volts: Auto shutdown

Pressure Case

- 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	Delrin	1000 m	76mm (2.98")	597mm (23.5")	0.7 Kg (1.5 lbs)	2.2 Kg (4.8 lbs)
Optional	Titanium	6000 m			3.1 Kg (6.8 lbs)	4.6 Kg (10.1 lbs)

Bulkhead Connectors					
Type	Status	Pins	Sex	Material	Manufacturer
Bulkhead	Delrin housings	Micro 8	Female	SS316	Subconn
Bulkhead	Titanium housings	Micro 8	Female	Titanium	Subconn

Sampling Capabilities

- Frequency
 - Time: Sample rates 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

- Minos•X instrument
- Data•Xchange (if purchased)
- 2m Data/Power Pigtail
- Red shorting plug
- Black dummy plug
- One or two primary sensor blanking plug
- One or two secondary sensor blanking plugs
- USB stick with manuals and documentation
- Battery charger
- Sensor protection cage

Software

- SeaCast

Ordering Codes

Instruments

PDC-MNX-P1S2-10	Minos•X, 1000 dbar, Delrin pressure housing, P1S2
PDC-MNX-P2S1-10	Minos•X, 1000 dbar, Delrin pressure housing, P2S1
PDC-MNX-P1S2-60	Minos•X, 6000 dbar, Titanium pressure housing, P1S2
PDC-MNX-P2S1-60	Minos•X, 6000 dbar, Titanium pressure housing, P2S1

For Xchange™ sensor ordering codes, see Xchange™ brochure or user manuals, or AML website.

Accessories

DTX-MC8M-WG-10	Data•Xchange, wireless & GPS device
CSE-0023	Minos•X shackle extender for Data•Xchange
MBR-MNX-STD	Mounting clamps, incl. 2
DFR-MNX-2PT-PL	2-point suspension bar assembly with plate and clamps
DFR-MNX-4PT	4-point protection frame with instrument clamp
EHW-0015	Charger for battery pack
CSE-0018	Spare battery and charging adaptor

Regulatory Information

This product is compliant within the requirements of CE standards.



Warranty

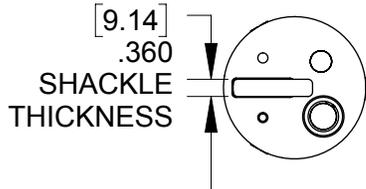
AML warrants the instrument for a period of TWO YEARS from the date of delivery. AML will repair or replace, at its option and at no charge, components which prove to be defective. The warranty applies only to the original purchaser of the instruments and only to instruments and sensors manufactured 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

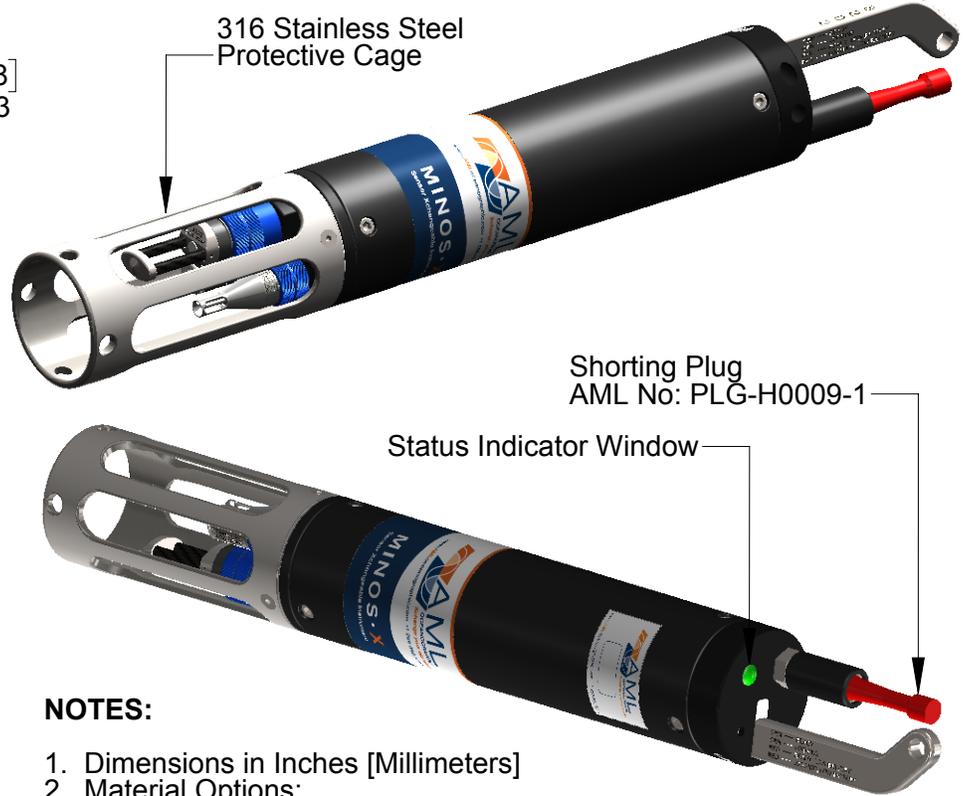
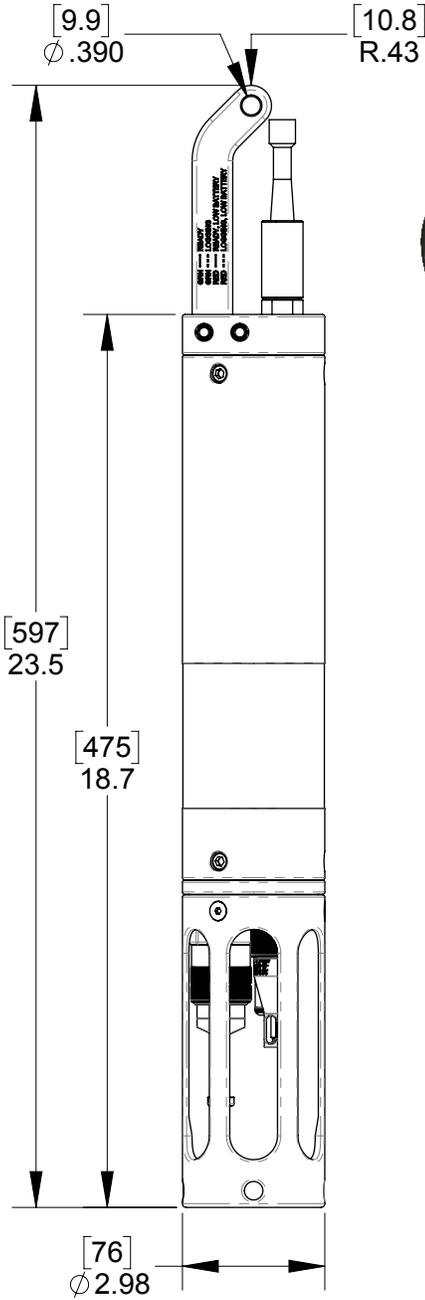
AML reserves the right to make any changes in design or specifications at any time without incurring any obligation to modify previously delivered instruments. Manuals are produced for information and reference purposes and are subject to change without notice.

Technical Overview Drawings



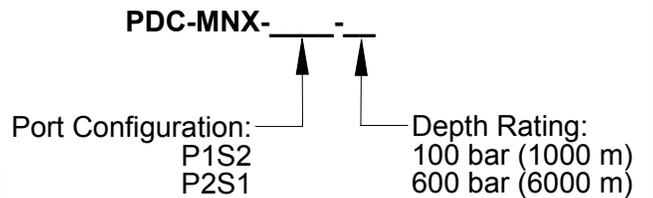
PDC-MNX-P1S2-10

- 1 slot for an SV, C, or CT•Xchange sensors
- 2 slots for P, T, or Tu•Xchange sensors



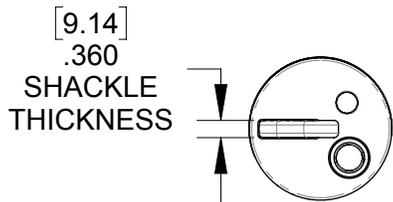
NOTES:

1. Dimensions in Inches [Millimeters]
2. Material Options:
 - Delrin (Acetal Copolymer)
Depth Rating: 1000m
Weight: 2.23kg (Air), 0.73kg (Water)
 - Grade 5 Titanium (6Al/4V)
Depth Rating: 6000m
Weight: 4.67kg (Air), 3.14kg (Water)
3. X•Series allows flexible, interchangeable use of the following sensors in multiple ranges:
 - C•Xchange
 - CT•Xchange
 - SV•Xchange
 - P•Xchange
 - T•Xchange
 - Tu•Xchange



REV	DESCRIPTION	BY	DATE
F	REMOVED FIXED, ADDED P2S1	ABT	13JAN2016

TITLE Minos•X Mechanical Overview	
SYSTEM Minos•X	AML PART NO. VARIOUS
DATE 20JULY2011	SLDRW NO. MC4-GA-03231-F



PDC-MNX-P2S1-60

- 2 slots for SV, C, or CT•Xchange sensors
- 1 slot for P or T•Xchange



NOTES:

1. Dimensions in Inches [Millimeters]
2. Sensor shown equipped with SV•Xchange, CT•Xchange, and P•Xchange for a SVCTD configuration.
3. Protection cage omitted for clarity.

REV	DESCRIPTION	BY	DATE
F	REMOVED FIXED, ADDED P2S1	ABT	13JAN2016



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www.AMLoceanographic.com

TITLE

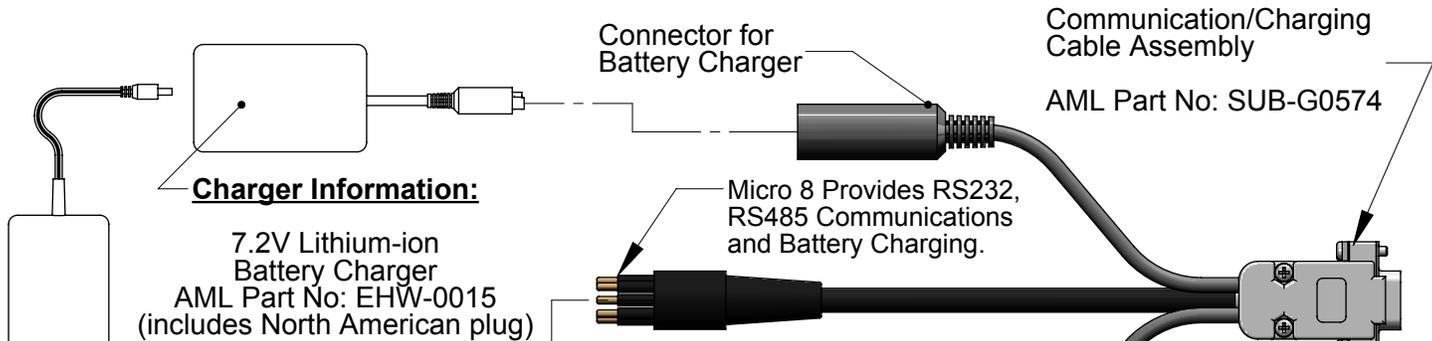
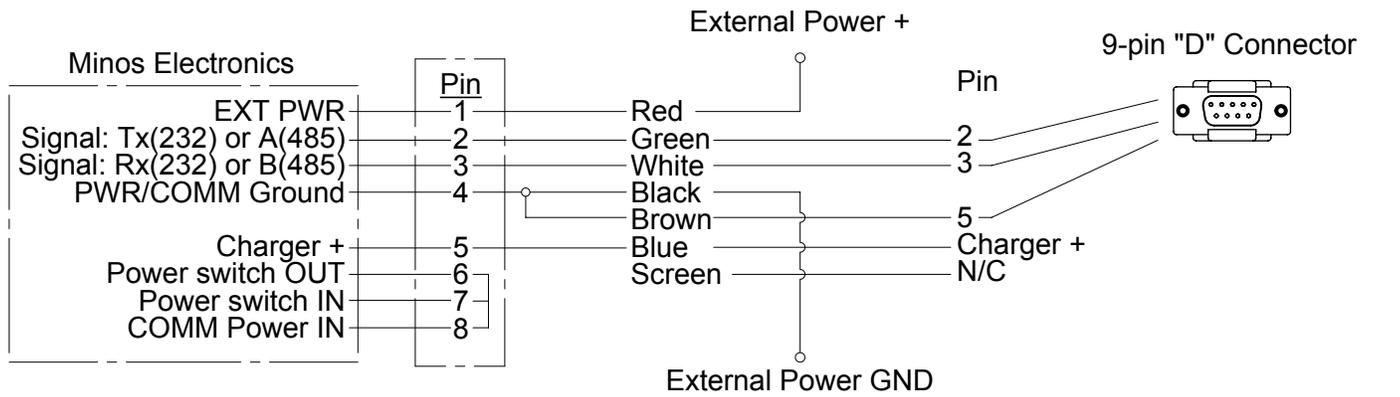
Minos•X Mechanical Overview

SYSTEM
Minos•X

AML PART NO.
VARIOUS

DATE
20JULY2011

SLDRW NO.
MC4-GA-03231-F



Charger Information:

7.2V Lithium-ion Battery Charger
 AML Part No: EHW-0015
 (includes North American plug)

CAUTION: NO SUBSTITUTIONS PERMITTED.

Power Supply (24V DC)

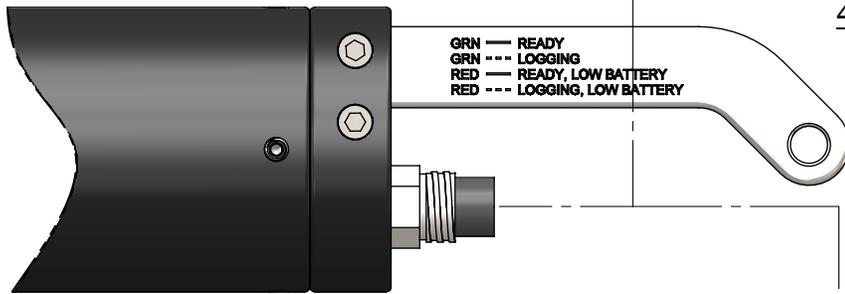
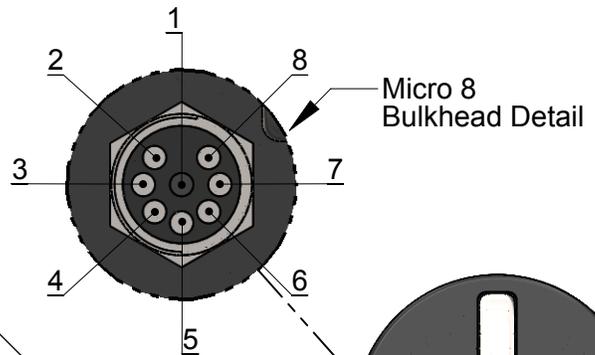
Wall Plug

AML Part No:

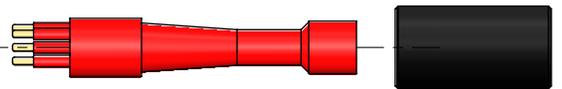
AUS: EHW-0016
 UK: EHW-0018
 EU: EHW-0017

External Power GND (BLACK)

External Power + (RED)
 RANGE: 6.5 - 28 VDC



Shorting Plug
 AML No: PLG-H0009-1



REV	DESCRIPTION	BY	DATE
F	REMOVED FIXED, ADDED P2S1	ABT	13JAN2016

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TITLE Minos•X Communications and Charging Interface	
SYSTEM Minos•X	AML PART NO. VARIOUS
DATE 20JULY2011	SLDRW NO. MC4-GA-03231-F