PT2X

Pressure/Temperature Smart Sensor and Data Logger Instructions

For PSIG sensors, refer to page 23 regarding desiccant use!

⚠️ **IF USING ALKALINE BATTERIES—PREVENT BATTERY LEAKAGE!**

PT2X sensors are typically shipped with lithium batteries. If, however, you are using alkaline batteries, be aware that under some circumstances alkaline batteries can leak, causing damage to the sensor. To prevent leakage, the following is recommended. **(Does not apply to lithium batteries.)**
- Change the batteries at least every 18 months.
- If the sensor will not be deployed for 3 months or more, remove the batteries.

The **Seametrics PT2X** Smart Sensor is an integrated data logger and pressure/temperature sensor and is ideal for monitoring groundwater, well, tank, and tidal levels, as well as for pump and slug testing. This sensor networks with all of the Seametrics Smart Sensor family. IThe PT2X is a microprocessor based digital intelligent sensor designed to measure and record pressure, temperature, and time, using low power, battery operated circuitry.

Pressure is measured with an extremely rugged and stable piezo-electric media-isolated pressure element combined with a 16-bit analog-to-digital converter. This provides extremely accurate and stable pressure input into the microprocessor on the circuit board.
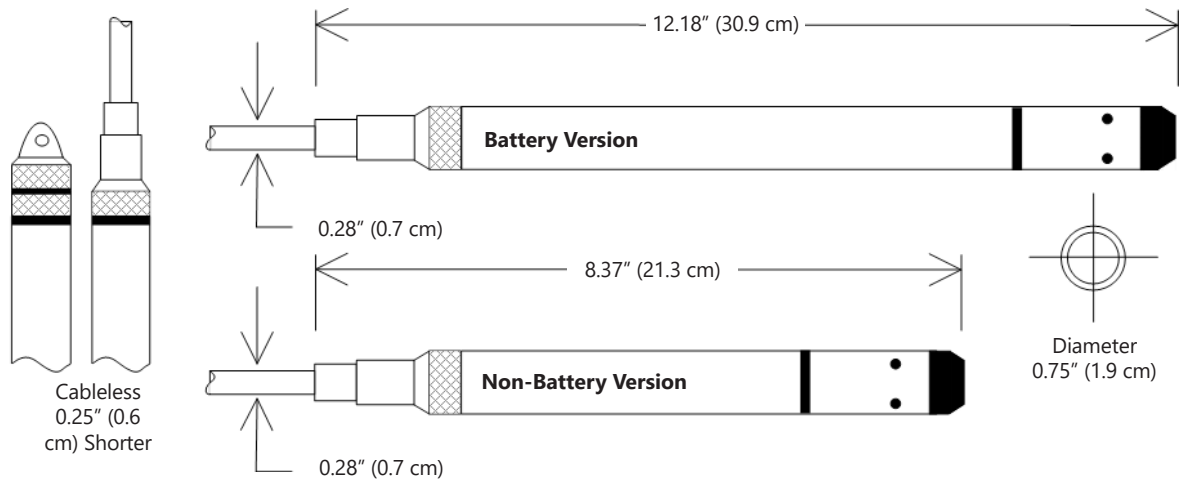
This industry standard digital RS485 interface device records up to 520,000 records of pressure/level, temperature, and time data, operates with low power, and features easy-to-use software with powerful features. Constructed with 316 stainless steel or titanium, PTFE, and fluoropolymer, this sensor provides high-accuracy readings in rugged and corrosive field conditions.

Two internal 1.5V AA batteries power the PT2X. (Auxiliary power supplies are available for data intensive applications.) The unit is programmed using Seametrics' easy-to-use Aqua4Plus 2.0 control software. Once programmed the unit will measure and collect data on a variety of time intervals.

Several PT2Xs, or a combination of PT2Xs and other Seametrics Smart Sensors, can be networked together and controlled directly from a single computer.

While most will use the PT2X with our free, easy-to-use Aqua4Plus 2.0 software, it is by no means limited to that software. You can use your own Modbus® RTU or SDI-12 software or logging equipment to read measurements, thus tying into your existing systems and databases.

Dimensions

12.18" (30.9 cm)

Battery Version

0.28" (0.7 cm)

8.37" (21.3 cm)

Diameter
0.75" (1.9 cm)

Non-Battery Version

0.28" (0.7 cm)

Cableless
0.25" (0.6 cm) Shorter

Specifications*

Housing & Cable	Weight	0.8 lb. (0.4 kg)		
	Body Material	Acetal & 316 stainless or titanium		
	Wire Seal Material	Fluoropolymer and PTFE		
	Cable	Submersible: polyurethane, polyethylene, or ETFE (4 lb./100 ft., 1.8 kg/30 m)		
	Desiccant	1-3 mm indicating silica gel		
	Field Connector	Standard		
Temperature	Operating Range	Recommended: -15˚ to 55˚C (5˚ to 131˚F) Requires freeze protection kit if using pressure option in water below freezing.		
	Storage Range	Without batteries: -40˚ to 80°C (-40˚ to 176˚F)		
Power	Internal Battery	Two lithium 'AA' batteries - Expected battery life: 18 months at 15 min. polling interval (may vary do to environmental factors)		
	Auxiliary	12 Vdc - Nominal, 6-16 Vdc - range		
Communication	Modbus®	RS485 Modbus® RTU, output=32bit IEEE floating point		
	SDI-12	SDI-12 (ver. 1.3) - ASCII		
Logging	Memory	4MB - 520,000 records		
	Logging Types	Variable, user-defined, profiled		
	Logging Rates	8x/sec maximum, no minimum		
	Baud Rates	9600, 19200, 38400		
	Software	Complimentary Aqua4Plus 2.0		
	Networking	32 available addresses per junction (Address range: 1 to 255)		
	File Formats	.a4d and .csv		
Output Channels		**Temperature**	**Depth/Level[1]**	
	Element	Digital IC on board	Silicon strain gauge transducer, 316 stainless or Hastelloy	
	Accuracy	±0.5°C — 0˚ to 55˚C (32˚ to 131˚F) ±2.0°C — below 0°C (32˚F)	±0.05% FSO (typical, static) ±0.1% FSO (maximum, static) (B.F.S.L. 20˚C)	
	Resolution	0.1˚C	0.0034% FS (typical)	
	Units	Celsius, Fahrenheit, Kelvin	PSI, FtH_2O, inH_2O, mmH_2O, mH_2O, inH_2O, cmHg, mmHg, Bars, Bars, kPa	
	Range	-15˚ to 55˚C (5˚ to 131˚F)	Gauge	PSI: 12, 5, 7, 15, 30, 50, 100, 300 FtH_2O: 2.32, 12, 35, 69, 115, 231, 692 mH_2O: 0.72, 3.5, 5, 10.5, 21, 35, 70, 210
			Absolute[3]	PSI: 30, 50, 100, 300 FtH_2O: 35, 81, 196, 658 mH_2O: 10, 24, 59, 200
	Compensated	---	0˚ to 40˚C (32˚ to 104˚F)	
Max operating pressure		1.1 x full scale		
Over pressure protection		3x full scale up to 300psi - for > 300psi (650 ft or 200 m) contact factory		
Burst pressure		1000 psi (approx. 2000 ft or 600 m)		
Environmental		IP68, NEMA 6P		

*Specifications subject to change. Please consult out web site for the most current data (seametrics.com).
Modbus is a registered trademark of Schneider Electric.

1 Higher pressure ranges available upon request
2 ±0.25% accuracy FSO (max) at this range
3 Depth range for absolute sensors has 14.7 PSI subtracted to give actual depth allowed.

How Pressure Sensors Work

Liquids and gasses do not retain a fixed shape. Both have the ability to flow and are often referred to as fluids. One fundamental law for a fluid is that the fluid exerts an equal pressure in all directions at a given level. Further, this pressure increases with an increasing depth of "submergence". If the density of a fluid remains constant (noncompressible...a generally good assumption for water at "normal" pressures and temperatures), this pressure increases linearly with the depth of "submergence".

We are all "submerged" in the atmosphere. As we increase our elevation, the pressure exerted on our bodies decreases as there is less of this fluid above us. It should be noted that atmospheric pressure at a given level does vary with changes in the weather. One standard atmosphere (pressure at sea level at 20º C) is defined to be 14.7 PSI (pounds per square inch).

There are several methods to reference a pressure measurement. Absolute pressure is measured with respect to an ideal vacuum (no pressure). Gauge pressure is the most common way we express pressure in every day life and is the pressure exerted over and above atmospheric pressure. With this in mind, gauge pressure (P_g) can be expressed as the difference between the absolute pressure (P_a) and atmospheric pressure (P_{atm}):
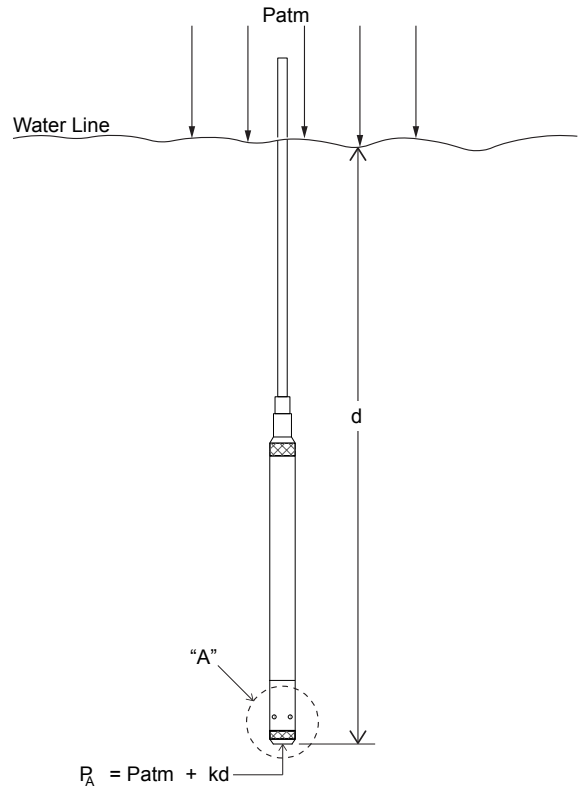
$$Pg = Pa - Patm.$$

To measure gauge pressure, atmospheric pressure is subjected to one side of the system and the pressure to be measured is subjected to the other. The result is that the differential (gauge pressure) is measured. A tire pressure gauge is a common example of this type of device.

Recall that as the level of submergence increases (in a noncompressible fluid), the pressure increases linearly. Also, recall that changes in weather cause the absolute atmospheric pressure to change. In water, the absolute pressure (P_a) at some level of depth (d) is given as follows:
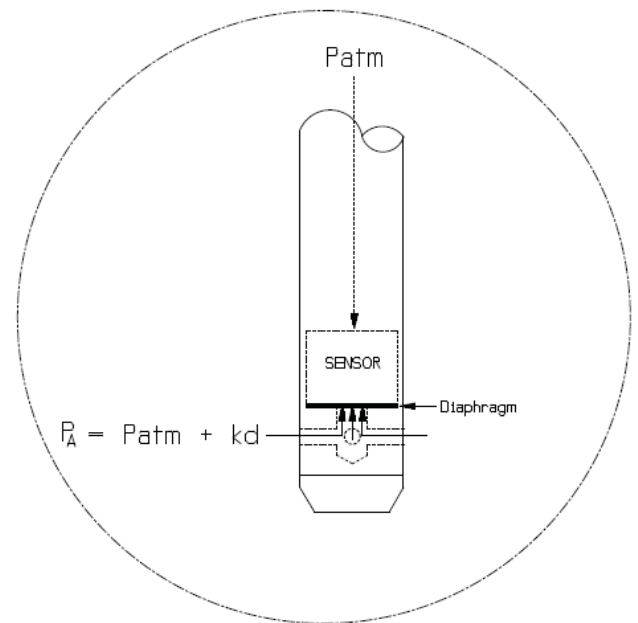
$$Pa = Patm + kd$$

where k is simply a constant
(i.e.: 2.307 feet of water = 1 PSI)

Seametrics' standard gauge submersible pressure devices utilize a vent tube in the cable to allow the device to reference atmospheric pressure. The resulting gauge pressure measurement reflects only the depth of submergence. That is, the net pressure on the diaphragm is due entirely to the depth of submergence.


Pressure Diagram: See Detail A.

*Absolute pressure is given as Pa = Patm + kd
(where k is 2.307 feet of water)*

Initial Inspection and Handling

Upon receipt of your smart sensor, inspect the shipping package for damage. If any damage is apparent, note the signs of damage on the appropriate shipping form. After opening the carton, look for concealed damage, such as a cut cable. If concealed damage is found, immediately file a claim with the carrier.

Check the etched label on the sensor to be sure that the proper range and type were provided. Also check the label attached to the cable at the connector end for the proper cable length.
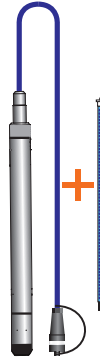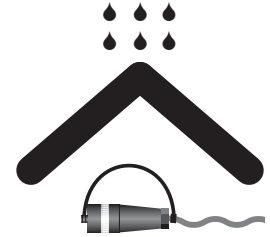
Do's and Don'ts
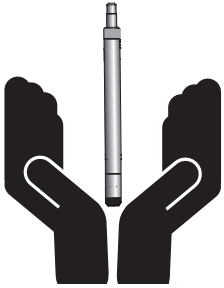
Do handle sensor with care
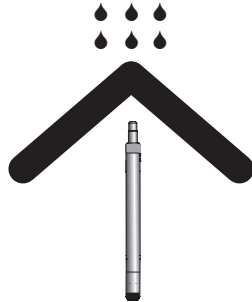
Do store sensor in a dry, inside area when not in use
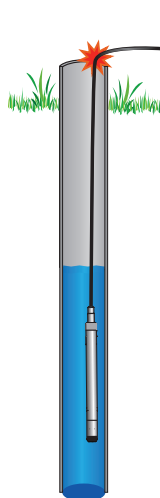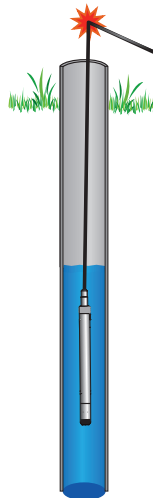
Do install a desiccant tube if using a gauge sensor

Do install sensor so the connector end is kept dry
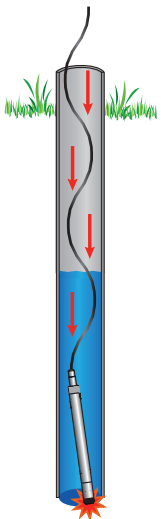
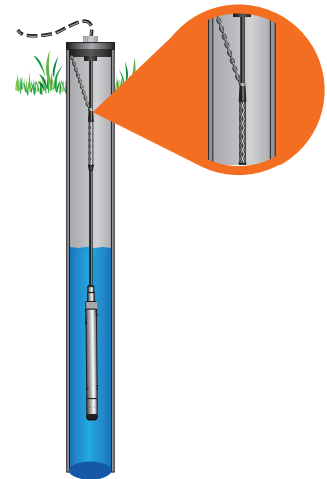**Don't drop into well**
Lower gently to prevent damage

Don't scrape cable over edge of well
May nick or fray the cable

Don't bend cable sharply
May close off vent tube and/or weaken internal wires

Don't support sensor with the connector
Use a strain relief device

Connecting External Power

The PT2X comes with two 1.5V AA internal batteries.

If auxiliary power is desired, you can use a 6–16 VDC supply that can provide 15 mA. Connect to Vaux++ (pin 1 - white) and Ground (pin 5 - blue) or contact Seametrics for auxiliary power supplies.

Connecting the PT2X to a Computer

Cabled sensors are terminated with a weather-resistant connector. Cableless sensors are terminated with a weather-resistant connector that is inside a screw-cap. Connect the weather-resistant connector to your computer's USB port as shown below.
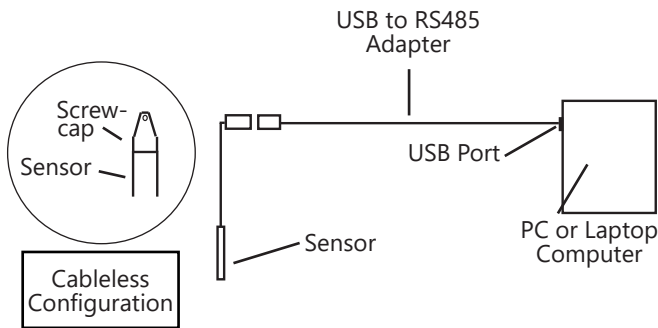
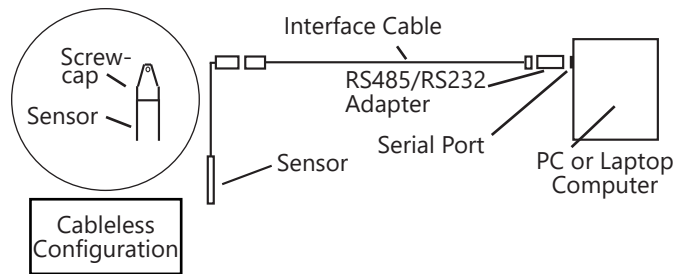*Connecting sensor to your computer using Seametrics' USB to RS485 adapter.*

Aqua4Plus 2.0 communicates with the sensor using the USB to RS485 adapter cable. This cable requires drivers to be installed on your computer. If you are connected to the Internet when you first plug in the cable, it will normally obtain and install the correct drivers automatically.

Alternate Connection Options

Seametrics recommends connecting the sensor to your computer using the Seametrics USB cable. However, when using Aqua4Plus 2.0, the sensor can also be connected using an RS232 serial port or a USB-to-Serial cable, as described below.

Connecting via RS232 Serial Port

Connect the weather-resistant connector to your computer's serial port as shown below.

Connecting sensor to your computer using an RS485/RS232 adapter and an interface cable.

Connecting with a USB/Serial Adapter

USB-to-Serial cables are readily available from many electronics and computer stores, as well as numerous sites on the Internet. Seametrics has tested and recommends the Keyspan USA-19HS. Install as follows:

- Plug into USB port.
- Install the drivers provided with the particular unit.
- Once drivers are installed connect to sensor
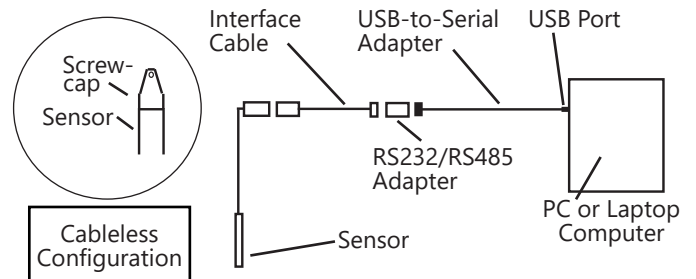
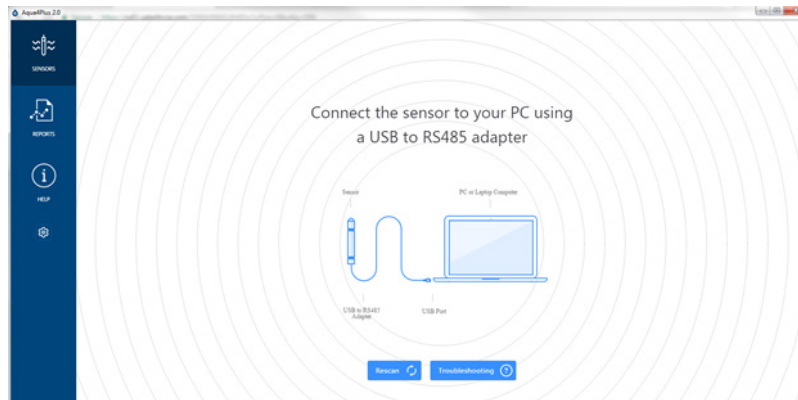*Connecting sensor to your computer using a USB to Serial adapter and an interface cable.*

Connecting to Sensors

Aqua4Plus 2.0 is designed to automatically detect your communication cable and scan for sensors. It is recommended you connect your USB/RS485 cable to your PC and have the sensor connected before opening Aqua4Plus 2.0.

If your cable and sensor were not connected before opening Aqua4Plus 2.0 simply connect and click Rescan. While scanning is active you'll see a green dot flash in the upper right corner of the program. Scanning is complete when this dot stops flashing.
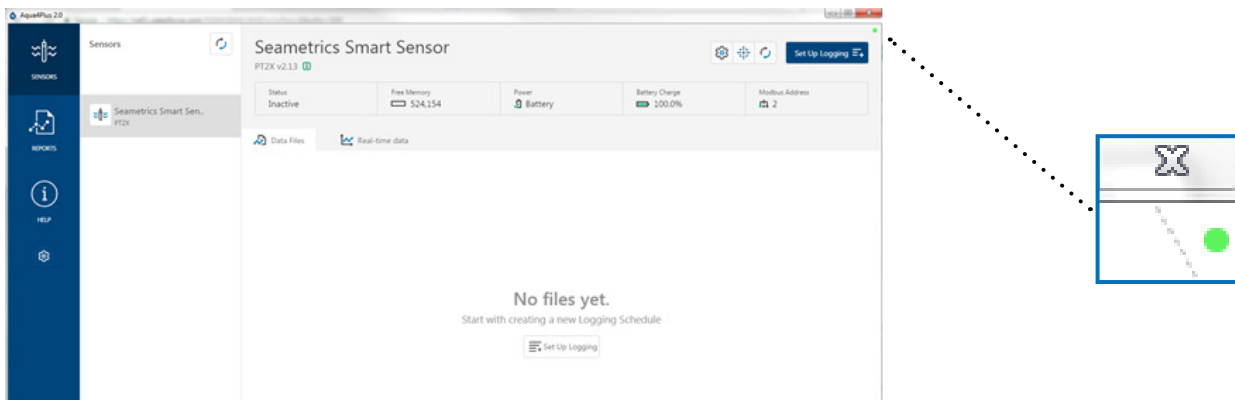
If your sensor still won't connect you can expand the Modbus address range under program settings here:
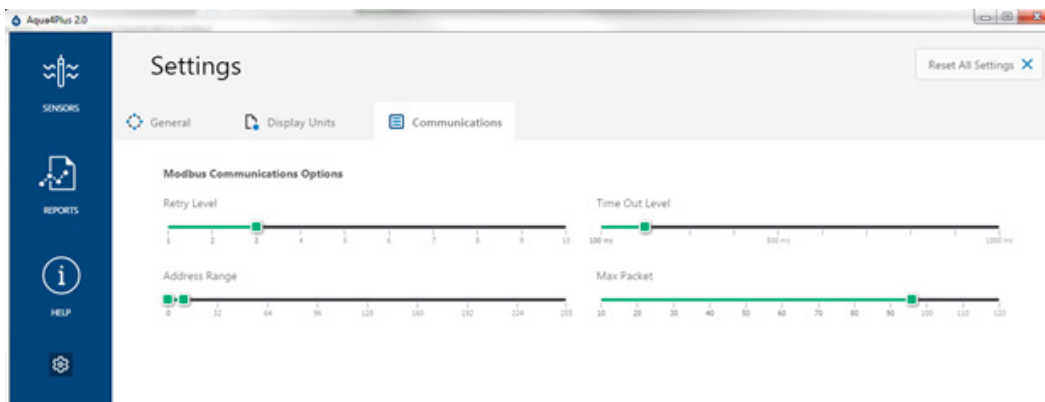
Simply drag the Address Range slider higher up to increase the maximum Modbus address scanned. If you've scanned all the way up through address 255 and still have no connection click Troubleshooting for further troubleshooting or contact Seametrics Tech Support for assistance.

Click ⟳ at any time to refresh sensor information.

Cable Wiring

If you buy your cabled sensor with a connector installed (the normal configuration), no further wiring is needed. For reference purposes, the first three diagrams below show the pinout from the connector for various scenarios. The final diagram shows the pinout if you bought your sensor without a connector for use with SDI-12.

White	1	12 VDC+ (Vaux)
Purple	2	Modbus D-
Yellow	3	Modbus D+
Brown	4	Digital I/O (Not used)
Blue	5	12 VDC- (GND)
Shield		

5-Pin Connector

For Modbus® with firmware lower than 2.0 — with 5-pin connector

White	1	12 VDC+ (Vaux)
Purple	2	Modbus D-
Yellow	3	Modbus D+
Brown	4	SDI-12 (Not used)
Blue	5	12 VDC- (GND)
Shield		

5-Pin Connector

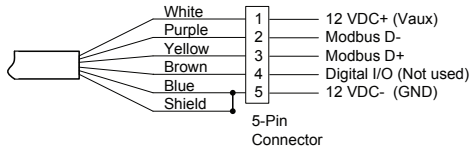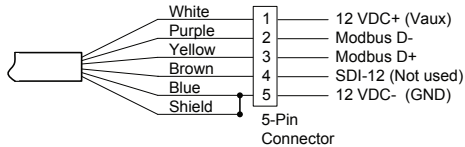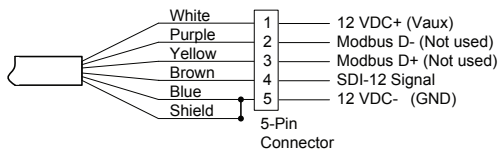*For Modbus® with firmware 2.0 or higher — with 5-pin connector*

White	1	12 VDC+ (Vaux)
Purple	2	Modbus D- (Not used)
Yellow	3	Modbus D+ (Not used)
Brown	4	SDI-12 Signal
Blue	5	12 VDC- (GND)
Shield		

5-Pin Connector

For SDI-12 with firmware 2.0 or higher — with 5-pin connector

White	12 VDC+ (Vaux)
Purple	Modbus D- (Not used)
Yellow	Modbus D+ (Not used)
Brown	SDI-12 Signal
Blue	12 VDC- (GND)
Shield	Earth ground

For SDI-12 with firmware 2.0 or higher — without connector

Installing Aqua4Plus 2.0

The PT2X comes with the Aqua4Plus 2.0 host software that is installed on your PC or laptop. Use this software to program the datalogger, to retrieve data from the logger, to view collected data, and to export data to external files for use with spreadsheets or databases.

Refer to the software manuals for details on installing and using Aqua4Plus 2.0.

Using the PT2X Without Aqua4Plus 2.0

Most users will use the PT2X with Seametrics' Aqua4Plus 2.0 software. However, the PT2X is quite versatile, communicating via either Modbus® or SDI-12 interfaces, allowing you to do the following:

- Read a PT2X via Modbus® using your own software.
- Read a PT2X via SDI-12 protocol.
- Display readings from a PT2X on a panel meter.

If you want to use one of these methods, see page 20.

Installing the Sensor

The PT2X measures pressure. The most common application is measuring liquid levels in wells and tanks. In order to do this, the sensor must be installed below the water level at a fixed depth. The installation depth depends on the range of the sensor. One (1) PSI is equal to approximately 2.31 feet of water. If you have a 5 PSI sensor, the range is 11.55 feet of water and the sensor should not be installed at a depth below 11.55 feet. If the sensor is installed below its maximum range, damage may result to the sensor and the output reading will not be correct.

> ⚠ **Note: If you are using an absolute sensor and you want to enter a depth-to-water reference after data is collected, then see page 19 before proceeding.**

- Lower the sensor to the desired depth.
- Fasten the cable to the well head using a weather proof strain-relief system. When securing a vented cable, make sure not to pinch the cable too tightly or the vent tube inside the cable jacket may be sealed off.
- Take a measurement to insure the sensor is not installed below its maximum range.

Be sure the supplied cap is securely placed on the weather-resistant connector at the top of the cable. Do not install such that the connector might become submerged with changing weather conditions. The connector can withstand incidental splashing but is not designed to be submerged.

For vented sensors, install the sensor so that the desiccant tube will not flood or lie in water.

The sensor can be installed in any position; however, when it leaves the factory it is tested in the vertical position. Strapping the sensor body with tie wraps or tape will not hurt it. Seametrics can provide an optional 1/4" NPT input adapter which is interchangeable with the standard end cone for those applications where it is necessary to directly attach the sensor to a pipe, tank, or other pipe port. If the sensor is being installed in a fluid environment other than water, be sure to check the compatibility of the fluid with the wetted parts of the sensor.

Desiccant Use

On vented sensors a desiccant tube prevents moisture in the air from being sucked into the vent tube, which can cause erratic readings and sensor damage.

The desiccant tube is filled with blue silica gel beads. A locking barb and a hydrophobic water filter are attached to the end of the desiccant tube. This filter prolongs the life of the desiccant as much as three times over a desiccant tube without the filter.

Install the sensor so that the desiccant tube and cable connector will not flood or lie in water.

The desiccant is a bright blue color when active and dry. See Maintenance section for care and changing of desiccant.

Grounding Issues

It is commonly known that when using electronic equipment, both personnel and equipment need to be protected from high power spikes that may be caused by lightning, power line surges, or faulty equipment. Without a proper grounding system, a power spike will find the path of least resistance to earth ground—whether that path is through sensitive electronic equipment or the person operating the equipment. In order to ensure safety and prevent equipment damage, a grounding system must be used to provide a low resistance path to ground.

When using several pieces of interconnected equipment, each of which may have its own ground, problems with noise, signal interference, and erroneous readings may be noted. This is caused by a condition known as a Ground Loop. Because of natural resistance in the earth between the grounding points, current can flow between the points, creating an unexpected voltage difference and resulting erroneous readings.

The single most important step in minimizing a ground loop is to tie all equipment (sensors, dataloggers, external power sources, and any other associated equipment) to a single common grounding point. **Seametrics recommends connecting the shield to ground at the connector end.**

Sensor Settings

Once connected you'll see the Sensor screen appear and display the connected sensor(s) details. Mousing over icons will provide tool-tips, mouse over to view sensor firmware and serial number details.

To change general sensor settings click in the sensor screen. This allows you to change the following:
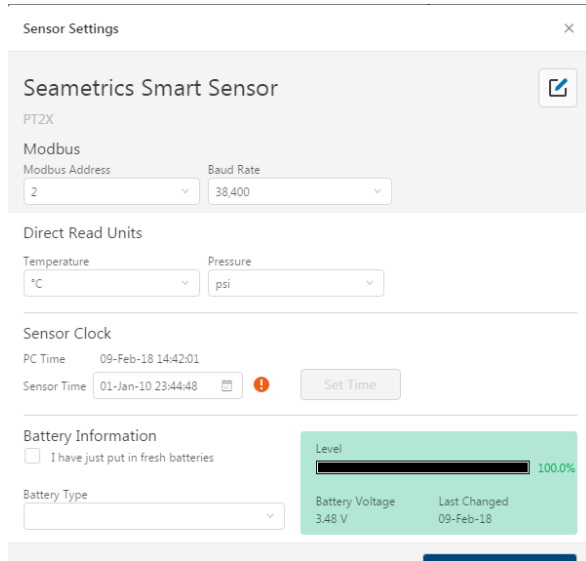
Click to rename the sensor

To change Modbus address and/or Baud Rate simply select the desired address and/or Baud Rate from the drop down menus. Sensor will automatically reconnect at new address and/or Baud Rate

To change the Direct Read output units (for direct Modbus or SDI12 integration) simply select the desired output units from the drop down menus. To change Aqua4plus 2.0 display units scaling see Program Settings.

Sensor Clock can be synced with your PC time or set manually if desired. To set manually enter your desired date/time and click Set Time.

When batteries are changed out make sure to reset the battery information here, simply check the I have just put in new batteries box and select the battery type that was installed from the drop down menu.

Program Settings

To view/change Aqua4Plus 2.0 settings click in the blue side-bar menu
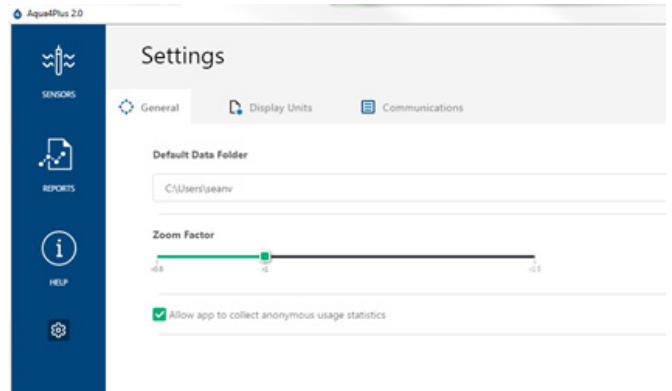
Under the General Settings tab you can change the default data folder location. This is where your Reports are saved to on your PC.

The Zoom Factor slider can be used to adjust the font size within Aqua4plus 2.0.

Uncheck the Allow app to collect anonymous usage statistics box if you would like to opt out. This information is used to track Aqua4plus 2.0 reliability across different system configurations.
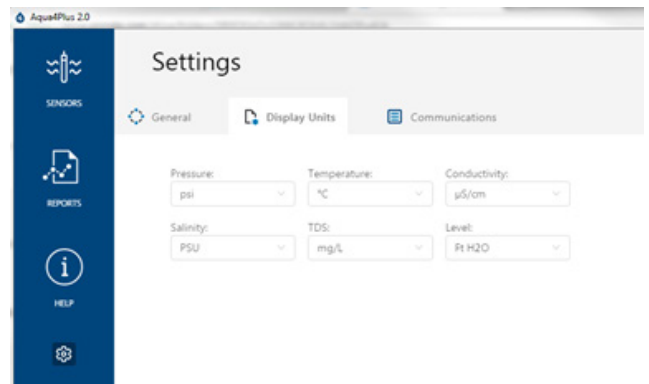
Under the Display Units tab you can select your desired display units for the supported channels. These may be changed at any time and associated Real-Time readings and Reports will rescale to the currently selected display unit. To change Direct Read units scaling see Sensor Settings.
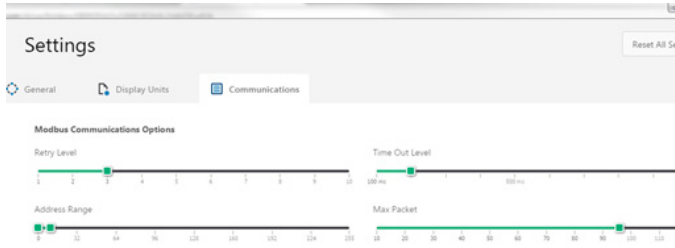
Under the Communications tab you can change your Modbus communication settings. Typically you will only need to change the address range to connect to sensors outside of Modbus address 1-10. In certain cases w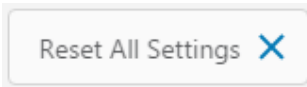e may need to change the Retry and Timeout settings to overcome communication issues on very long, or corroded cabling. See Troubleshooting section or contact Seametrics Tech Support for details.

To restore factory default settings click

Pressure Calibration

To perform a calibration setup on the pressure channel first connect to the sensor and ensure all data has been uploaded and erased from the sensor. Next select the calibration button (example images can be found under conductivity calibration page 12).

Next select the calibration setup you'd like to perform:

Comfirm desired measurement units and click Continue.

Submergence:

One Point/Zero Point Calibration:

To zero pressure output to atmospheric pressure position the sensor in air in its desired installation position (typically vertical, if sensor will be installed horizontally position as such during 0 point calibration). Select 1 point Calibration under Calibration Type.

For PSIG sensors use 0 as the reference value and click Measure.

For PSIA sensors enter current barometric pressure from a known accurate barometer set to matching units. Enter your reference value in the Ref. Point box and click Measure.
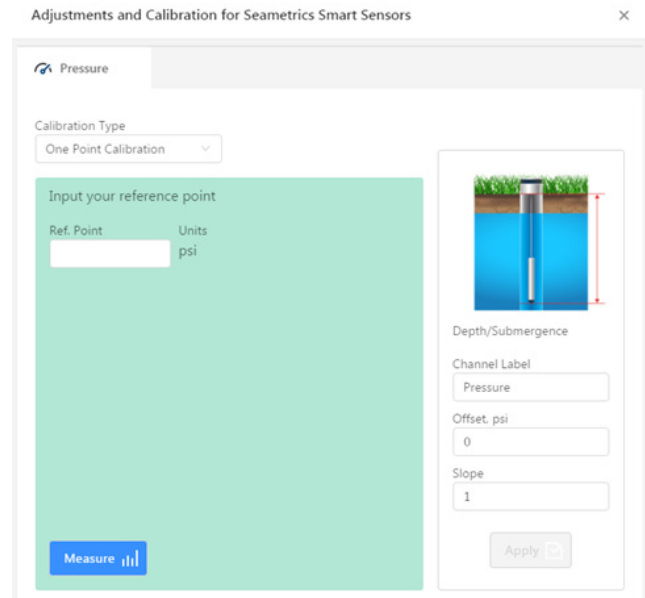
Aqua4Plus 2.0 will take 10 readings and display the average. Watch for stability while Aqua4Plus 2.0 is measuring to ensure an accurate calibration.

Click Ok to accept the reading and Aqua4Plus 2.0 will calculate a new pressure offset. Click Apply to confirm the new offset value and Aqua4Plus 2.0 will provide a real time reading to verify calibration was successful:

2 Point submergence calibration **ONLY RECOMMENDED IF YOU HAVE AN ACCURATE PRESSURE REFERENCE**. Our Smart Sensors rarely change slope during normal use, however if you have an accurate pressure source it is possible to perform a 2 point calibration on the pressure channel.
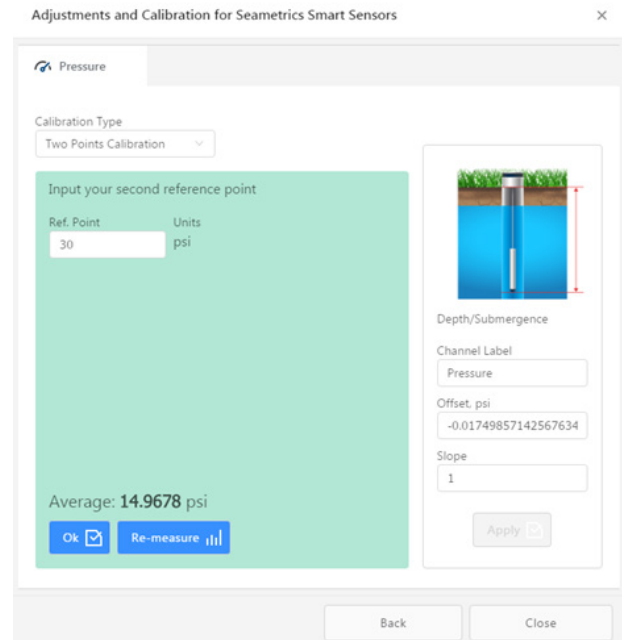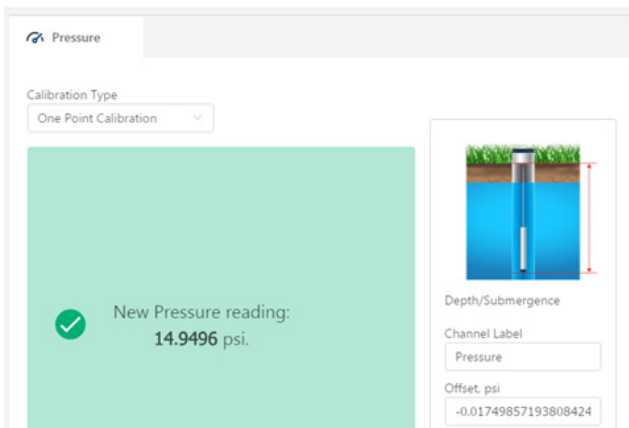
Select 2 point Calibration under Calibration Type

Perform first point calibration as listed above and click Next

Enter known pressure value in matching units in the Ref. Point box for second point measurement

Aqua4Plus 2.0 will take 10 measurements and display the average. Watch for stability while Aqua4Plus 2.0 is measuring to ensure an accurate calibration.

Click Ok and Aqua4Plus 2.0 will calculate the new slope and offset values. Click Apply to confirm the new slope and offset values and Aqua4Plus 2.0 will provide a real time reading to verify calibration was successful.

Depth to water (for PSIG sensors only, see Barometric Compensation Utility for PSIA sensors)

Position the sensor in its desired location and ensure all data has been uploaded and erased from the sensor before proceeding with calibration.

Once positioned connect to sensor and select the calibration button, followed by selecting the Depth to Water option. Double check measurement units selection before proceeding.

Enter your current depth to water (Typically obtained from a water level indicator) value in the Ref. Point box, making sure to match measurement units.

Click Measure and Aqua4Plus 2.0 will take 10 readings and display the average. Watch for stability while Aqua4Plus 2.0 is measuring to ensure an accurate calibration.

Click Accept and Aqua4Plus 2.0 will calculate a new slope and offset, click Apply to accept the new slope and offset and Aqua4Plus 2.0 will provide a real time reading to verify calibration was successful.

Groundwater Elevation

Position the sensor in its desired location and ensure all data has been uploaded and erased from the sensor before proceeding with calibration.

Once positioned connect to sensor and select the calibration button, followed by selecting the Groundwater Elevation option. Double check measurement units selection before proceeding.

Enter your current Groundwater Elevation reading in the Ref. Point box, making sure to match measurement units.

Click Measure and Aqua4Plus 2.0 will take 10 readings and display the average. Watch for stability while Aqua4Plus 2.0 is measuring to ensure an accurate calibration.

Click Accept and Aqua4Plus 2.0 will calculate a new offset, click Apply to accept the new offset and Aqua4Plus 2.0 will provide a real time reading to verify calibration was successful.

Staff Gauge

Position the sensor in its desired location and ensure all data has been uploaded and erased from the sensor before proceeding with calibration.

Once positioned connect to sensor and select the calibration button, followed by selecting the Staff Gauge option. Double check measurement units selection before proceeding.

Enter your current Staff Gauge reading in the Ref. Point box, making sure to match measurement units.

Click Measure and Aqua4Plus 2.0 will take 10 readings and display the average. Watch for stability while Aqua4Plus 2.0 is measuring to ensure an accurate calibration.

Click Accept and Aqua4Plus 2.0 will calculate a new offset, click Apply to accept the new offset and Aqua4Plus 2.0 will provide a real time reading to verify calibration was successful.

Removing calibration setup values

To return to factory default simply enter an offset of 0 and slope of 1 in the Offset and Slope boxes:
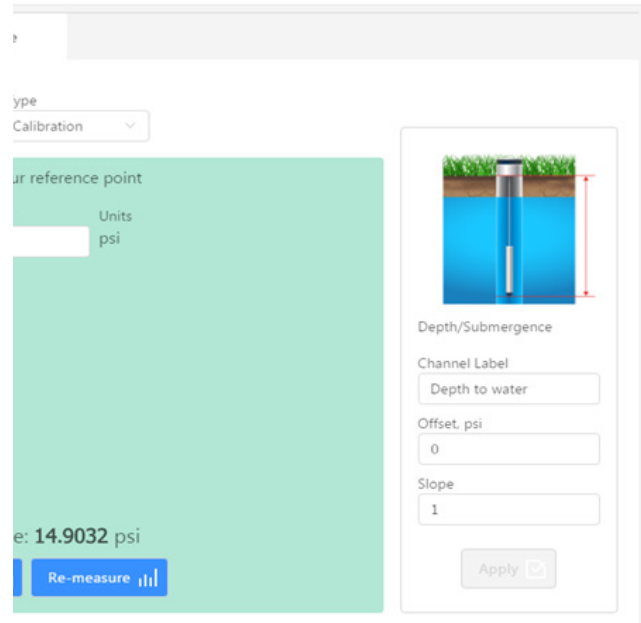
Click Apply to confirm settings and Aqua4Plus 2.0 will provide a real time reading to confirm.

Adjusting for specific gravity

You man enter the specific gravity of your fluid in the Slope field to adjust for specific gravity when needed. Click Apply to confirm settings and Aqua4Plus 2.0 will provide a real time reading to confirm.

Real-time Data

Connect to sensor and select the Real-time data tab

To start real-time readings click Start, readings default to table view

To switch to Real-time graphing view click the graph icon

Real-time readings default to a 1 second interval for 1 minute, to adjust enter your desired settings here:
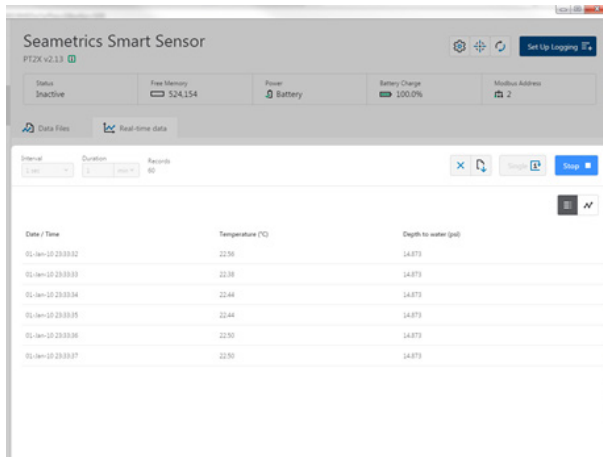
Note: *Currently this data is not saved and is for viewing current conditions only. To save the data to sensor memory see Data Logging section. You can run Real-time Data while logging is active.*

Data Logging

Select Set Up Logging from the sensor screen

If there are no files currently on the sensor you'll see the Set Up Logging button active under the Data Files tab as well as in the upper menu. Once files have been started/ logged on the sensor they will be displayed under the Data Files tab.

Setting Up Logging Window

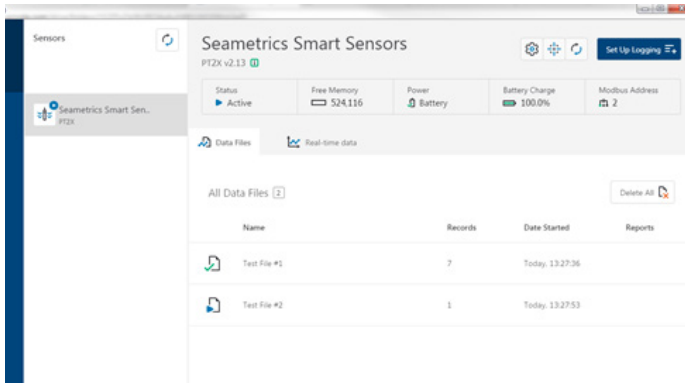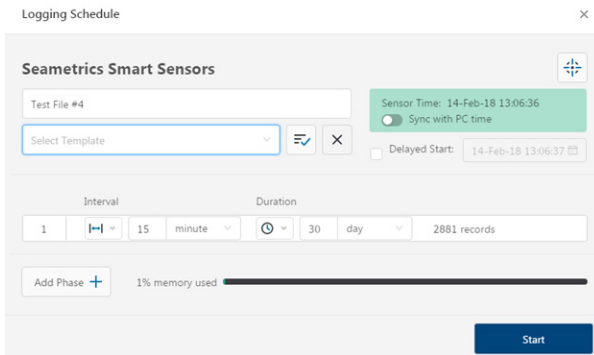Here you will name your data file and set up the recording interval and duration of each logging phase. Select your desired recording interval and duration for each phase, Aqua4Plus will display the available memory at the bottom of the window.

Click to switch between interval and continuous data recording (PT2X & CT2X only) Select your continuous rate from the drop down box here.
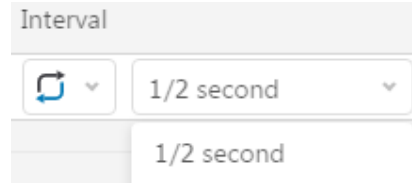
Duration can be set by either number of records

Or by setting a duration time
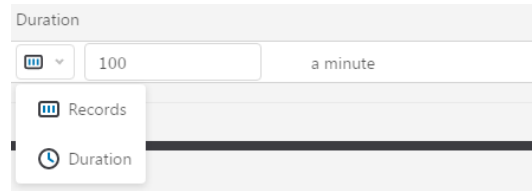
When set by number of records the time of the recording phase will be displayed detailing how long that phase will run. When set by time, the total number of records for that phase will be displayed.

If you need to check settings or perform a calibration click before proceeding with logging setup to switch to the Settings and Calibration screen.

You may sync the sensor clock with the PC clock when starting logging by clicking the slider here.
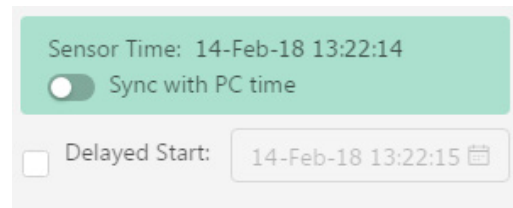
Check the Delayed Start box and enter the desired date/ time you would like logging to start. This is useful for syncing data when setting up multiple sensors on a site. Data will start logging at the set date/time rather than immediately when Start is pressed.

Data file name defaults to Test File # and may be re-named here.
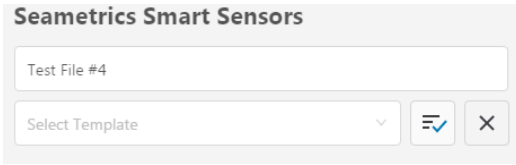
The 3 previous Logging Schedules that were programmed to a sensor will be listed under the Select Template drop down menu. There you will also find pre-programmed logging schedules such as 24 hour pump test, along with any custom logging schedules saved by the user.

To save a logging schedule as a template enter desired settings and click ⎘ This will add your custom schedule to the Select Template menu.

Once all the desired settings are made simply click Start to begin logging.
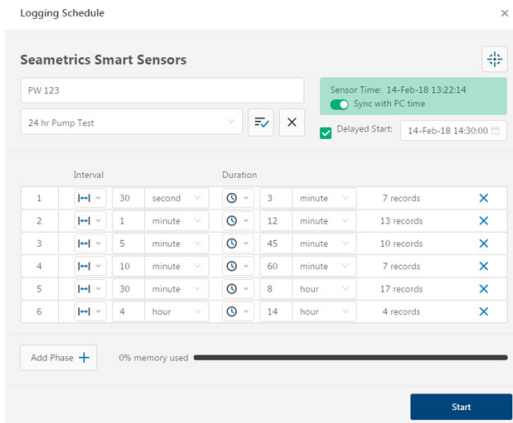
This will return you to the Sensor screen and your status will change to Active with the data file displayed under the Data Files tab. Mouse over an active file to pause, terminate, download, or view logging setup details.
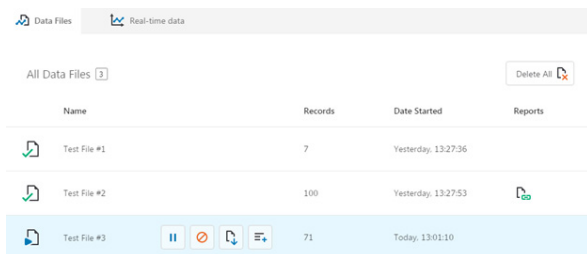
Data files already downloaded will show ⎘ in the Reports column, clicking here will bring you to the reports screen to view the data. See Reports section for details.

You may only have 1 active data file recording on each sensor, however you can store multiple files in memory if desired.
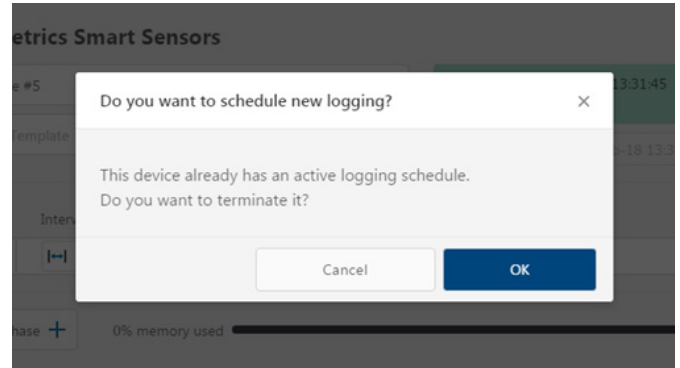
Starting a new file will automatically terminate the active logging and begin the new logging schedule. Real-time data is available during active logging.
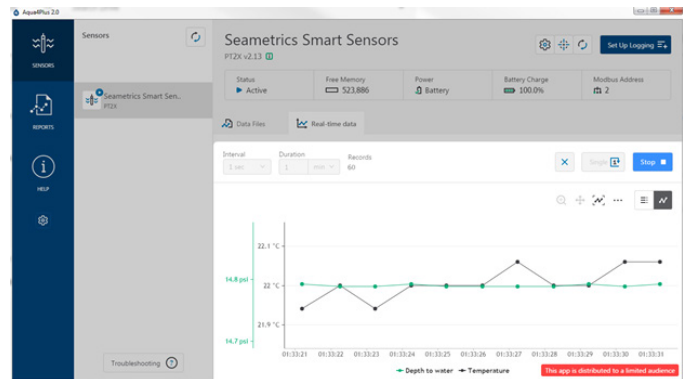
To delete files from memory make sure they have all been downloaded to Reports. Files are removed from memory all at once rather than individually.
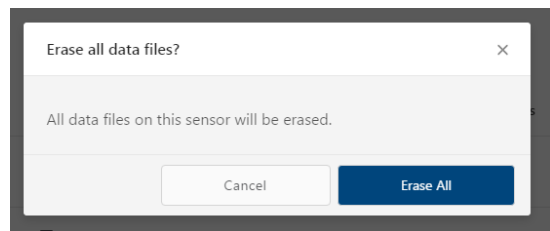
Once confirmed files are permanently deleted from the sensor memory.

Reports

Data downloaded from your sensor is stored in the Reports section of Aqua4Plus 2.0 for viewing and editing. The files will be saved to default data folder on your PC as well. See Program Settings for default data folder location.

In the main view you'll see a list of reports sorted by date, size, or file name as selected here
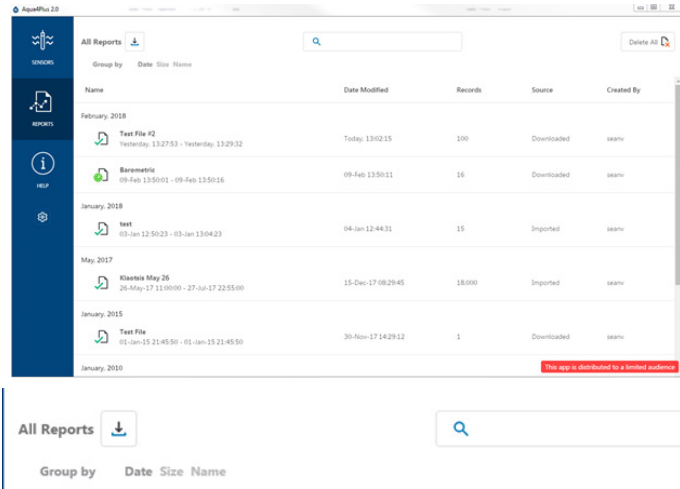
You can also search reports by keyword using the search box

Click on a report to bring up the report details

Reports are displayed in graphing view by default. You can zoom to specific sections by selecting a section with you mouse or by adjusting the slider below the graph, shown below.
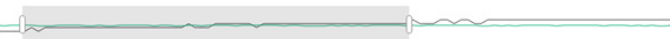
Click ⛶ to switch to full screen graphing view

Graph saving and export options are available here
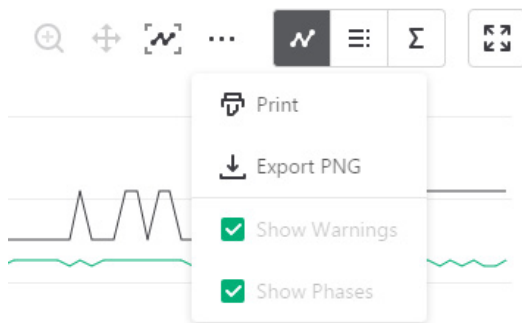
Click ☰ to view data as a table

Click Σ to view data statistics
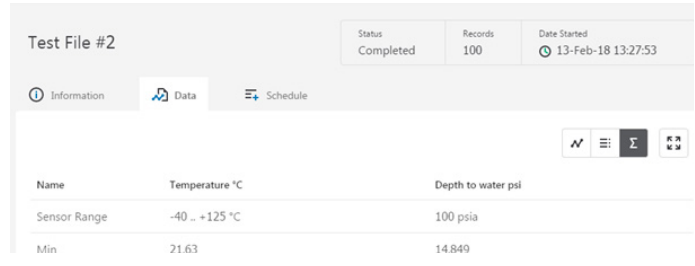
The Information tab is a new feature allowing users to add metadata to their reports such as site location, field notes, or comments.
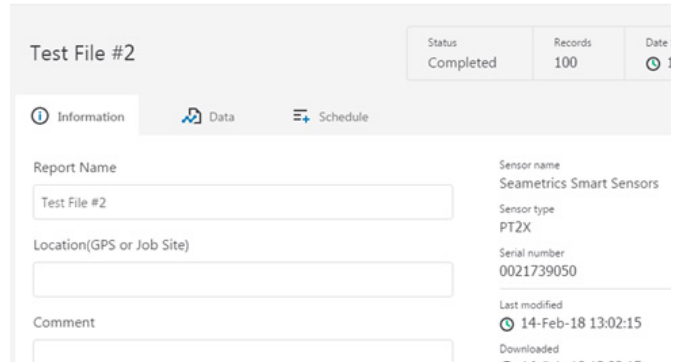
The Schedule tab will display the logging setup details for the report

Click Export to export the report as a .csv file or .a4d file for distribution or use in 3rd party software.

Click Delete to delete the report from Aqua4Plus 2.0

You can also import .a4d files from compatible sensors into Aqua4Plus 2.0 by clicking ⬇ at the top of the Reports screen.
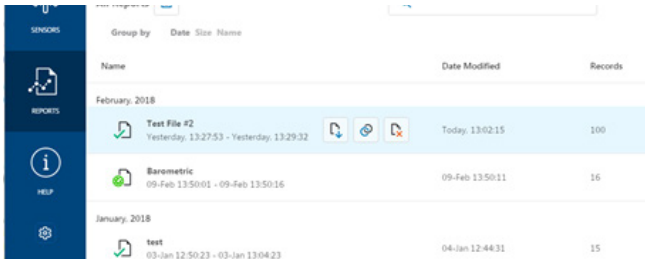
A Word About Units

Readings from the PT2X Smart Sensor can be displayed in various units, such as PSI, Ft. H2O, or mm H2O for pressure, or degrees Celsius or degrees Fahrenheit for temperature. Select the units you want from the Options | Display Units menu or from the Configure Menu | Program Configuration | Set Computer Display Units.

Barometric Compensation

For PSIA sensors we've built a new barometric compensation utility into the Reports section. Click ⊘ on a report to compensate the data for barometric pressure.

Corresponding barometric files are filtered by date/time and displayed to the left. Select the barometric file you would like to use to compensate the report, select either the Submergence or Depth To Water tab, then click Continue.

If compensating for Depth to Water enter your depth to water reference measurement and the date/time the measurement was taken (typically taken with a water level indicator before data is uploaded from the sensor) before clicking Continue.

Aqua4Plus 2.0 will perform the barometric compensation and create a new compensated report. Original reports are retained as uploaded.

Compensated report can then be viewed and exported as needed.
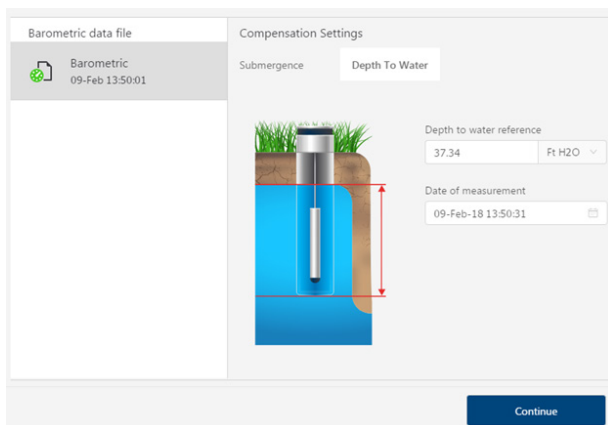
Direct Read (Modbus® or SDI-12)

While the PT2X comes with Seametrics' easy to use Aqua4Plus 2.0, you can also use standard Modbus® RTU or SDI-12 equipment to easily take readings, so as to tie into your existing equipment or networks.

You may need to use Aqua4Plus 2.0 to make a few settings prior to directly reading the PT2X with your equipment. These might include the units for the returned values and/or the Modbus baud rate. These are described in the following sections.

For Modbus direct read, you must have PT2X firmware 1.5 or higher. For SDI-12, you must have firmware 2.0 or higher.

Setting Units for Direct Read

By default, the PT2X uses the following units:

Temperature   Degrees Celsius
Pressure   PSI

If you want to change to different units, for example, degrees Fahrenheit for temperature or feet of water for pressure, set these units using Aqua4Plus 2.0. See sensor settings.

Power Consideration

If your sensor does not have internal batteries and is not powered continuously by an auxiliary power supply, then you must turn power on to the sensor at least two seconds before a reading is to be taken to allow the sensor to warm up.

Reading Via Modbus® RTU

Setting Baud Rate

Your PT2X comes configured to communicate at 38,400 baud, with 8 data bits, one stop bit, and no parity. The sensor can also be set to 19,200 or 9600 baud, if needed for your application. You must use Aqua4Plus 2.0

If needed, set your PT2X to the desired baud rate as follows:

- Click on the Configure menu, and then select Advanced.
- From the flyout menu, select Sensor Baud Rate. (You may be asked for a password. Enter admin.)
- On the popup box, click the down-arrow, select the baud rate you need, and then click OK.

Once you have changed the baud rate on the PT2X, you will not be able to talk to it with Aqua4plus 2.0 until you change the baud rate for Aqua4Plus 2.0, as follows:

- Click the Options menu, and then select Baud Rate.
- On the popup box, click the down-arrow, select the baud rate you need, and then click OK.

The current Aqua4plus 2.0 baud rate is displayed in the lower right corner of the main Aqua4plus 2.0 window.

Taking Measurements

Reading Registers

Read measurements using Modbus function 03 – Read Holding Registers. Readings are located in two registers each, starting at address 62592. (PT2X register addressing is zero based, i.e., starts at zero. If your equipment uses one based addressing, you will need to add one to the register addresses.)

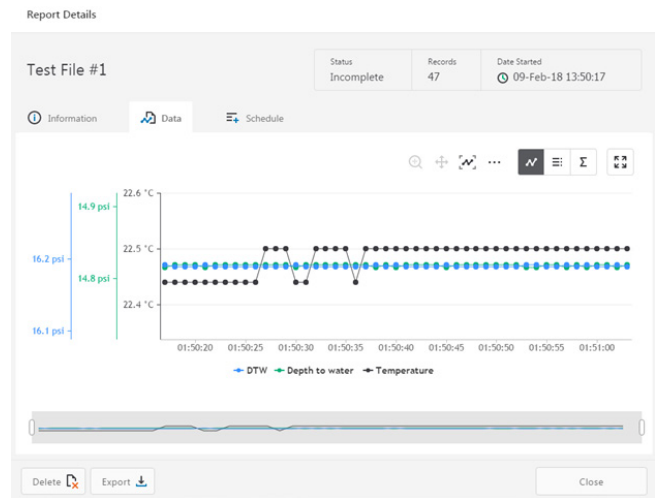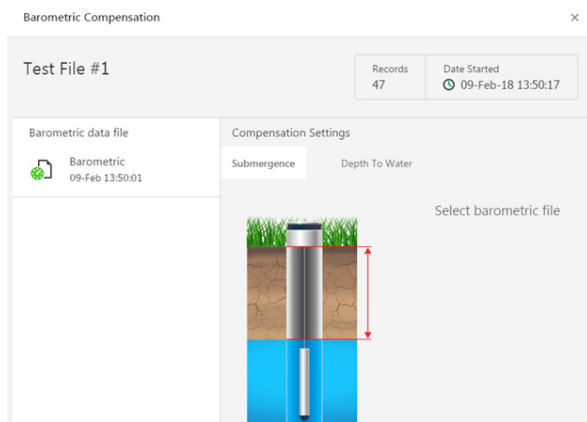| Addresses for PT2Xs with firmware lower than 2.0		
	Zero based	One based
Pressure	62592	62593
Temperature	62594	62595

Addresses for PT2Xs with firmware 2.0 or higher		
	Zero based	One based
Temperature	62592	62593
Pressure	62594	62595

Measurement Timing

When you request a reading via Modbus, the sensor wakes up, returns the current values in the registers, and then starts taking new readings and updating the registers. After approximately 10 seconds, if no more readings have been requested, the sensor goes back to sleep.

Because of this, the first reading you get will be old. If you are taking readings at intervals of less than 10 seconds, simply ignore the first reading — all remaining readings will be current. On the other hand, if you are taking readings at intervals of greater than 10 seconds, take a reading, ignore it, wait one second, take another reading. Record this second reading.

Data Format

The data is returned as 32-bit IEEE floating-point values, highword first, also referred to as big-endian or float inverse.

For further information and detailed Modbus examples, see Seametrics' Technical Bulletin, available on www.seametrics.com.

Reading Via SDI-12

Note: The default units setting for pressure is PSI. The default units setting for temperature is Celsius.
To change these, use the Direct Read Units in the Aqua4Plus 2.0 Control Software.

Addressing

Default SDI-12 Address: 0

SDI-12 Command Nomenclature

<a> = Sensor address

{crc} = SDI-12 compatible 3-character CRC

<cr> = ASCII carriage return character

<lf> = ASCII line feed character

highlighted values indicate variable data

All SDI-12 requests consist of a command followed by a request for values. Some software or equipment may combine these, making the second one unnecessary. Refer to your software or equipment documentation for details.

```
        Request              Response        Carriage Return
                                                Linefeed
       <a>M1!              <a>0021<cr><lf>

  Address            Address
         Command            Time until      # of values to
                            response        be returned
                            (in seconds)
```

```
        Request              Response        Carriage Return
                                                Linefeed
       <a>D0!             <a>+7.15863<cr><lf>

  Address            Address
         Request for        Returned
         values read        value(s)
```
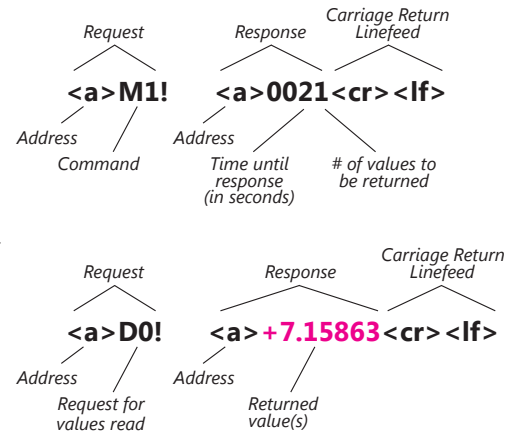
SDI-12 Commands

Sensor Identification

    <a>I! <a>13 INWUSA PT2X **213sssssssss**<cr><lf>   Note: **213** will change to reflect current firmware version.
sssssssss = device serial number

Acknowledge Active, Address Query

    <a>! <a><cr><lf>

    ?! <a><cr><lf>

Change Address

    <a>A<b>! <b><cr><lf>   Change address to <b>

Request Measurement

    <a>M! <a>0022<cr><lf>   Request all measurements

    <a>D0! <a>**+22.0512+12.0512**<cr><lf>   Read temperature and pressure

    <a>M1! <a>0021<cr><lf>   Request temperature measurement only

    <a>D0! <a>**+22.0512**<cr><lf>   Read temperature

    <a>M2! <a>0021<cr><lf>   Request pressure measurement only

    <a>D0! <a>**12.0512**<cr><lf>   Read pressure

Request Measurement with CRC

      \<a\>MC! \<a\>0022\<cr\>\<lf\>   Request all measurements with CRC

      \<a\>D0! \<a\>**+22.0512+12.0512**{**crc**}\<cr\>\<lf\>   Read temperature and pressure

      \<a\>MC1! \<a\>0021\<cr\>\<lf\>   Request temperature measurement only with CRC

      \<a\>D0! \<a\>**+22.0512**{**crc**} \<cr\>\<lf\>   Read temperature

      \<a\>MC2! \<a\>0021\<cr\>\<lf\>   Request pressure measurement only with CRC

      \<a\>D0! \<a\>**12.0512**{**crc**} \<cr\>\<lf\>   Read pressure

Concurrent Measurement

      \<a\>C! \<a\>0022\<cr\>\<lf\>   Request all measurements

      \<a\>D0! \<a\>**+22.0512+12.0512**\<cr\>\<lf\>   Read temperature and pressure

      \<a\>C1! \<a\>0021\<cr\>\<lf\>   Request temperature measurement only

      \<a\>D0! \<a\>**+22.0512**\<cr\>\<lf\>   Read temperature

      \<a\>C2! \<a\>0021\<cr\>\<lf\>   Request pressure measurement only

      \<a\>D0! \<a\>**12.0512**\<cr\>\<lf\>   Read pressure

Concurrent Measurement with CRC

      \<a\>CC! \<a\>0022\<cr\>\<lf\>   Request all measurements with CRC

      \<a\>D0! \<a\>**+22.0512+12.0512**{**crc**}\<cr\>\<lf\>   Read temperature and pressure

      \<a\>CC1! \<a\>0021\<cr\>\<lf\>   Request temperature measurement only with CRC

      \<a\>D0! \<a\>**+22.0512**{**crc**} \<cr\>\<lf\>   Read temperature

      \<a\>CC2! \<a\>0021\<cr\>\<lf\>   Request pressure measurement only with CRC

   \<a\>D0! \<a\>**12.0512**{**crc**} \<cr\>\<lf\>   Read pressure

For further information and SDI-12 examples, see Seametrics application note, "*PT2X SDI-12 Interface Specification*" available from our web site at www.seametrics.com.

Removing Debris from End Cone

At times mud, silt, or other debris may foul the water inlets to the pressure element. The end cone can be removed to clean out the debris.

Twist Open Housing

1. Gently twist off end cone portion only - do not twist off pressure element!
2. Remove debris. **Do not poke anything into the sensor**. This can damage the sensor element and void the warranty.
3. Replace and retighten the end cone.

— Pressure element

— Water inlet
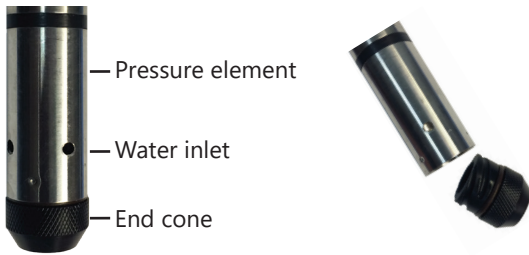
— End cone

Gently twist off the end cone and carefully remove debris

Set Screw Housing

1. Remove the two set screws at the bottom of the housing tube, using a 1/16" allen wrench.
2. Gently remove the end cone.
3. Remove debris. **Do not poke anything into the sensor.** This can damage the sensor element and void the warranty.
4. Replace the end cone and secure with set screws.

Pressure element

Water inlet
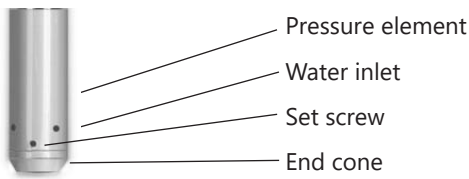
Set screw

End cone

*Remove end cone by removing set screws.
Gently clean out debris.*

Desiccant Tubes

On vented sensors, inspect the desiccant tube at least once every two months. The desiccant tube prevents moisture in the air from being sucked into the vent tube, which can cause erratic readings and sensor damage.

The desiccant tube is filled with blue silica gel beads. A locking barb and a hydrophobic water filter are attached to the end of the desiccant tube. This filter prolongs the life of the desiccant as much as three times over a desiccant tube without the filter.

Install the sensor so that the desiccant tube and cable connector will not flood or lie in water.

The desiccant is a bright blue color when active and dry. As moisture is absorbed the color will begin to fade, becoming a light pink, which indicates full saturation and time to replace. Replacement desiccant and hydrophobic filters can be purchased from Seametrics.

To Change the Desiccant:

- Pulling gently remove the black tube fitting from the clear desiccant tube.
- Using needle-nose pliers, remove the dark gray foam plug. Do not discard the plug.
- Dump out the old desiccant beads and refill with new desiccant beads – tapping desiccant tube frequently during refilling to ensure that the beads are fully seated in tube.
- Push the foam plug back into the tube.
- Reinsert the black fitting.

Desiccant Tube

Black Tube Fitting

Desiccant Tube   Foam Plug

Black Tube Fitting
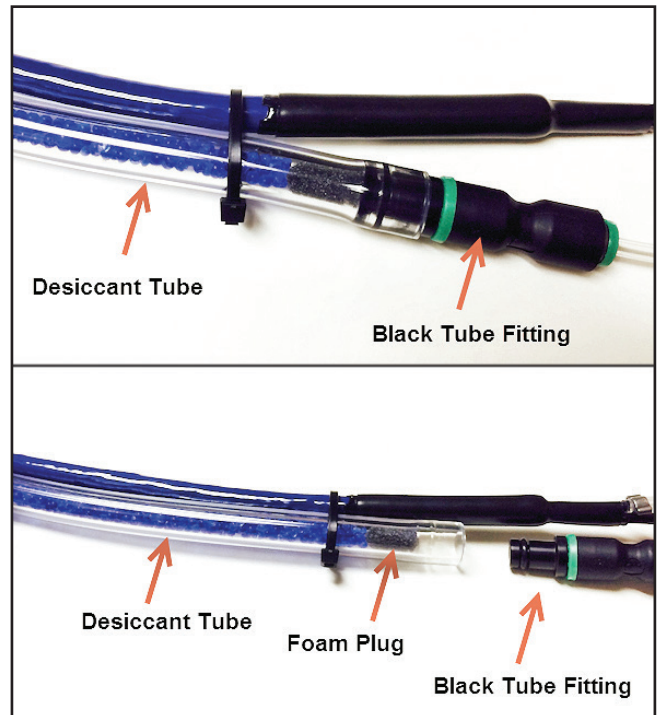
Sensor

There are no user-serviceable parts, other than the batteries. If problems develop with sensor stability or accuracy, contact Seametrics. If the transducers have been exposed to hazardous materials, do not return them without notification and authorization.

Cable

Cable can be damaged by abrasion, sharp objects, twisting, crimping, crushing, or pulling. Take care during installation and use to avoid cable damage. If a section of cable is damaged, it is recommended that you send your sensor back to replace the cable harness assembly.

End Connections

The contact areas (pins & sockets) of the connectors will wear out with extensive use. If your application requires repeated connections other types of connectors can be provided. The connectors used by Seametrics are not submersible, but are designed to be splash-resistant.

Changing Batteries

Battery Type: Two 1.5V AA batteries—Lithium or Alkaline (lithium recommended)

> ⚠ **IMPORTANT!**
> Because changing the batteries involves opening the water-tight seal, this must be done in a clean, dry environment to avoid contamination or moisture damage to the circuitry.
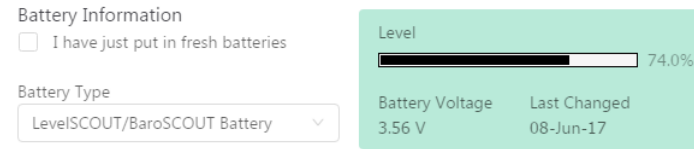
> ⚠ **IF USING ALKALINE BATTERIES —PREVENT BATTERY LEAKAGE!**
>
> PT2X sensors are typically shipped with lithium batteries. If, however, you are using alkaline batteries, be aware that under some circumstances alkaline batteries can leak, causing damage to the sensor. To prevent leakage, the following is recommended. **(Does not apply to lithium batteries.)**
> - Change the batteries at least every 18 months.
> - If the sensor will not be deployed for 3 months or more, remove the batteries.

Battery Life Calculator (Firmware 2.13 or higher)

When changing batteries, it is important to reset the Battery Life Calculator. **If the battery life calculator is not reset, the remaining life information will be incorrect.** Access the Battery Life Calculator from the Configure Menu - Battery Information and Reset. If you have put in new batteries, checkmark the box "I have just put in fresh batteries." Click Save and Close. See sensor settings.

Battery Information
☐ I have just put in fresh batteries

Battery Type
LevelSCOUT/BaroSCOUT Battery ▼

Level
▐▬▬▬▬▬▬▬▬▬▬▬▬▬▬ 74.0%

Battery Voltage   Last Changed
3.56 V   08-Jun-17

Tips

- Never place a tool on the sensor body, it is very thin and will deform causing leaks at o-ring seals and potentially crushing the circuit board!
- Always twist the sensor body off the top cap assembly rather than twisting the top cap assembly off of the sensor body.
- For cabled sensors, always clamp the sensor on the swaged area when applicable, the shoulder above it will allow you to press down without the worry of the sensor slipping out of the clamping device.
- If the sensor body is slippery or you are unable to grip it hard enough to twist, try a piece of rubber cabinet liner for additional friction.

There is a black, compressible square ring near the top of the sensor. This ring acts as a spring to lock the cable in. This needs to be compressed in order to allow removal of the top cap. Once this ring is compressed, a gentle counterclockwise twist is all that is needed to remove the cable from the sensor body. Compressing the black square ring does take force, **twisting does not.**

Top cap   Housing

Swage   Knurling   Black square ring
Cabled Sensor

Top cap   Housing

Knurling Black square ring
Cableless Sensor
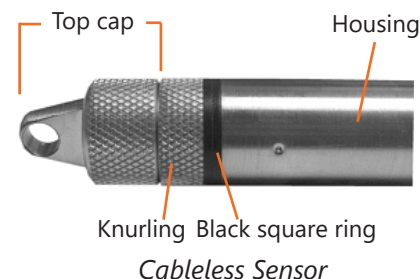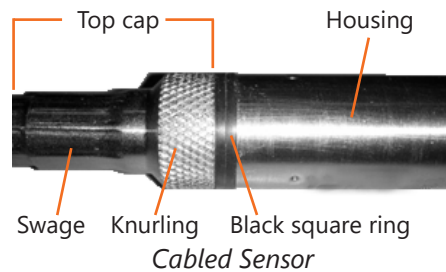
Care must be taken to compress the black square ring before attempting to twist the housing. **Forceful twisting of the housing can permanently damage the sensor**.

Securing the Sensor

In order to compress the black square ring, the sensor must be secured so that you can apply downward pressure to compress the ring. This can be done by holding in your hand, using a vise, or using pliers, as follows.

By Hand—cabled version only

1. Tightly grasp the top cap in one hand.
2. Brace your hand against something such as a table or the ground. (Do not allow the cable to be pinched against the brace.)

Continue to **Removing the Housing on the next page**.

With Vise—recommended method

Cabled Sensor

1. If possible, use a set of soft jaws as shown to prevent marring the surfaces of the top cap assembly.
2. Place the sensor in a vise clamping gently on the swaged area. You do not need to clamp the vise very hard.

Continue to **Removing the Housing on the next page**.

Cabled Sensor—gripping on swage

Cableless Sensor

1. If possible, use a set of soft jaws as shown to prevent marring the surfaces of the top cap assembly.
2. Remove the cableless top cap.
3. Place the sensor in a vise clamping gently on the knurled area. You do not need to clamp the vise very hard.

Continue to **Removing the Housing on the next page.**

Cableless Sensor—gripping on knurled area

With Pliers or Vise Grips—good for field use

Cabled Sensor

1. Grasp the pliers on the swaged area (do not grab the knurled diameter).
2. Find a hard edge and place the tips or side of the jaws of the pliers onto this edge as shown. This will allow you to press down with your weight to compress the square ring.

Continue to **Removing the Housing in on the next page**.

Cabled Sensor

Cableless Sensor

1. Leave the cableless cap on in order to protect the pins inside.
2. Grasp the pliers on the knurled area tightly being careful to avoid grabbing the knurled cap.
3. Find a hard surface and place the cableless cap down onto it. This will allow you to press down with your weight to compress the square ring.

Continue to **Removing the Housing below**.

Cableless Sensor

Removing the Housing

1. With your free hand, grasp the sensor body. Press down to compress the square ring. Twist gently. Once the body begins to twist, you can stop the compression action.

2. Finish gently twisting until the sensor body is removed.

3. Carefully disconnect the wiring connector inside from the circuit board in the top cap.

Replacing Batteries and Resealing Sensor

1. Gently pull wiring to one side in order to allow batteries to fall out. Shake gently if needed.

2. Replace batteries with button (+) facing open end.

3. Reinstall wiring connector — it only goes in one way, so make sure not to force it.

Pull wires gently to the side to allow battery removal

Connector connected properly

4. Hold the top cap assembly at 90° to the housing opening as shown. Depress the spring with your fingertip and tuck the wiring into the cutaway on the circuit board with your thumb to protect it while being installed back into the housing.
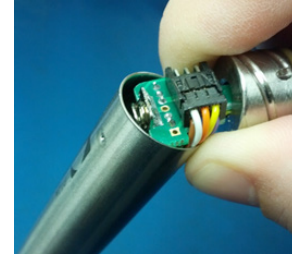
Wires tucked into slot and spring tucked into housing

5. Rotate the top cap assembly into the opening in the housing being very careful not to nick or pinch any wires.

Push top cap in before twisting and locking

6. Gently press down until the assembly stops and then twist it into place. It will click in and decompress the gasket when it is fully engaged.

Properly completed—black ring uncompressed

Problem	Probable Causes	Things to try...
Software will not communicate with sensor	Loose cable	Make sure all cable connections are secure
	Contacts in connector loose	Be sure all wires are securely fastened inside the round connector
	USB driver not installed	See Connecting the PT2X to a Computer in the Installation section or see the USB/RS485 Adapter Installation application note on our web site.
	Incorrect USB or COM port selected	If using Aqua4Plus, be sure USB is selected in the dropdown box on the tool bar or the correct COM port if using an alternate connection method. (Aqua4Plus Lite automatically uses only the USB connection.)
	SEE ALSO ERRATIC READINGS BELOW	
Erratic readings	Poor connection due to moisture between contacts in connector	Dry thoroughly. Be sure desiccant is fresh (see Maintenance section).
	Loose or broken wires in connector	Repair or return for evaluation and repair
	Damaged cable, cracked or fraying	Replace cable
	Moisture in the unit	Return for evaluation and repair
	Damaged transmitter	Return for evaluation and repair
Oscillating readings over time (usually 0.5 to 1.5 feet of water)	Plugged vent tube (if using a vented unit)	Be sure desiccant tube is installed. Test by gently applying a small amount of pressure to the end of the desiccant tube and seeing if this affect the transmitter reading. If it does not, then the vent tube is plugged. Return for evaluation and repair.
	Actual water level changes in the aquifer itself in response to barometric pressure changes. This effect can occur in tight formations where the transmitter will immediately pick up barometric changes but the the aquifer will not.	You will need to record barometric pressure as well as the water level pressure and compensate the data
Zero readings when pressurized	Poor connection due to moisture between contacts in connector	Dry thoroughly. Be sure desiccant is fresh (see Maintenance section).
	Loose or broken wires in connector	Repair or return for evaluation and repair
	Damaged cable, broken, cracked, or fraying	Replace cable
	No apparent damage upon visual inspection	Return for evaluation and repair

SEAMETRICS LIMITED WARRANTY

The limited warranty set forth below is given by Seametrics, with respect to Seametrics branded purchases in the United States of America.

Seametrics warrants that products manufactured by Seametrics, when delivered to you in new condition in their original containers and properly installed, shall be free from defects in material and workmanship. **Seametrics products are warranted against defects for a period of two (2) years from date of installation, with proof of install date. If no proof of install date can be provided, warranty period will be two (2) years from date of shipment from Seametrics, as defined on Seametrics' invoice.** Seametrics' obligation under this warranty shall be limited to replacing or repairing the part or parts, or, at Seametrics' option, the products, which prove defective in material or workmanship. The following are the terms of Seametrics' limited warranty:

a. Buyer must give Seametrics prompt notice of any defect or failure and satisfactory proof thereof.

b. Any defective part or parts must be returned to Seametrics' factory or to an authorized service center for inspection.

c. Buyer will prepay all freight charges to return any products to Seametrics' factory, or another repair facility. as designated by Seametrics.

d. Defective products, or parts thereof, which are returned to Seametrics and proved to be defective upon inspection, will be repaired to factory specifications.

e. Seametrics will deliver repaired products or replacements for defective products to the buyer (ground freight prepaid) to the destination provided in the original order.

f. Products returned to Seametrics for which Seametrics provides replacement under this warranty shall become the property of Seametrics.

g. This limited warranty covers all defects encountered in normal use of Seametrics products, and does not apply to the following cases:

   i. Loss of or damage to Seametrics product due to abuse, mishandling, or improper packaging by buyer

   ii. Failure to follow operating, maintenance, or environmental instructions prescribed in Seametrics' instruction manual

   iii. Products not used for their intended purpose

   iv. Alterations to the product, purposeful or accidental

   v. Electrical current fluctuations

   vi. Corrosion due to aggressive materials not approved for your specific product

   vii. Mishandling, or misapplication of Seametrics products

   viii. Products or parts that are typically consumed during normal operation

   ix. Use of parts or supplies (other than those sold by Seametrics) which cause damage to the products, or cause abnormally frequent service calls or service problems

h. A new warranty period shall not be established for repaired or replaced material, products, or supplied. Such items shall remain under warranty only for the remainder of the warranty period on the original materials, products, or supplies.

i. In the event that equipment is altered or repaired by the buyer without prior written approval by Seametrics, all warranties are void. Damage caused by equipment or accessories not manufactured by Seametrics may void the product's warranty.

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