Seametrics

LevelSCOUT

Level/Temperature
Smart Sensor and Datalogger

What is the LevelSCOUT?

The Seametrics LevelSCOUT Smart Sensor is an integrated datalogger and level/temperature sensor and is ideal for site assessments, tidal studies, environmental monitoring, surface water discharge measurement, and aquifer level monitoring, as well as aquifer storage and recovery. This sensor networks with all of the Seametrics Smart Sensor family.

This industry standard digital RS485 interface device records up to 50,000 records of level, temperature, and time data, operates with low power, and features easy-to-use software with powerful features. Constructed with 316 stainless steel, acetal, and Viton®, this sensor provides high-accuracy readings in rugged and corrosive field conditions.

The LevelSCOUT is an absolute sensor, requiring no vent tubes, desiccant, or bellows. It can be paired with a BaroSCOUT barometric sensor and used with the Aqua4Plus 2.0 Barometric Compensation Utility to adjust the LevelSCOUT readings for current atmospheric pressure.

A replaceable ½ AA 3.6v lithium battery powers the LevelSCOUT. The unit is programmed using Seametrics' easy-to-use Aqua4Plus 2.0 control software. Once programmed the unit will measure and collect data at the time interval programmed.

Replace your analog sensor/datalogger with the Seametrics LevelSCOUT as a stand-alone unit or network with other Seametrics Smart Sensors. While most will use the LevelSCOUT with Seametrics Aqua4Plus 2.0 software, it is by no means limited to that software. You can use your own Modbus® RTU software or logging equipment to read measurements via RS485, tying into your existing systems and data bases.

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 the device with care.

Do store the device in a dry, inside area when not in use.

Do install the device so that the cable connector is kept dry.

Don't support the device with the connector. Use a strain relief device to take the tension off the connectors.

Don't allow the device to free-fall down a well as impact damage can occur.

Don't bang or drop the device on hard objects.

How Pressure/Level 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 (Pg) can be expressed as the difference between the absolute pressure (Pa) and atmospheric pressure (Patm):

$$Pg = Pa - Patm.$$

The LevelSCOUT is an absolute sensor and will require an outside barometric reference to obtain "gauge" type readings.

General Specification

The Seametrics LevelSCOUT is a microprocessor based digital intelligent sensor designed to measure and record level, temperature, and time, utilizing state-of-the-art low power, battery operated circuitry.

Level is measured with an extremely rugged and stable piezo-electric media-isolated pressure element combined with an analog-to-digital converter. This provides extremely accurate and stable pressure input into the microprocessor on the circuit board. Temperature is measured with an epoxy bead thermistor. The data is stored in non-volatile memory. A serial communication link (RS485) provides communication to the host computer.

Length (cabled version)	6.6" (16.7 cm)
Length (cableless version)	5.1" (12.9 cm)
Diameter	0.875" (2.22 cm)
Body Material	316 stainless steel or titanium
Wetted Materials	316 stainless steel or titanium, acetal, fluoropolymer
Communication	RS485 Modbus® RTU
Direct Modbus Read Output	32-bit IEEE floating point
Internal Math	32-bit floating point
Operating Temp. Range	-20° C to 60° C
Storage Temp. Range	-40° C to 80° C

Logging

Memory	50,000 records
Logging Rate	1x per second
Software	Complimentary Aqua4Plus 2.0
File Formats	.csv / .a4d

Power

Internal Battery	One replaceable ½ AA 3.6 lithium battery
Expected Battery Life	3.25 years (depending on use)

Temperature

Element Type	Thermistor
Accuracy	± 0.1° C (from -20° C to 60° C)
Resolution	0.01° C
Units	Celsius, Fahrenheit, Kelvin

Level

Transducer Type	Silicon strain gauge
Transducer Material	316 stainless steel

Ranges
Absolute[1]

PSI	30, 50, 100, 300
FtH2O (max. depth)	35, 81, 196, 658
mH2O (max. depth)	10, 24, 59, 200

Units	PSI, FtH2O, inH2O, cmH2O, mmH2O, mH2O, inHg, cmHg, mmHg, Bars, mBars, kPa
Accuracy	± 0.05% FS (@ 20° C) ± 0.10% FS (0° C to 40° C)
Resolution	0.0034% FS (typical)
Maximum Operating Pressure	1.1 x FS
Over Range Protection	3x FS (for >300 psi[2], 1.75 FS)
Burst Pressure	600 psi (approx. 1350 ft or 410 m)

[1]*Depth range has 15 PSI subtracted to give actual depth allowed.*
[2]*Approx. 658 feet or 200 meters*

Wiring and Component Information
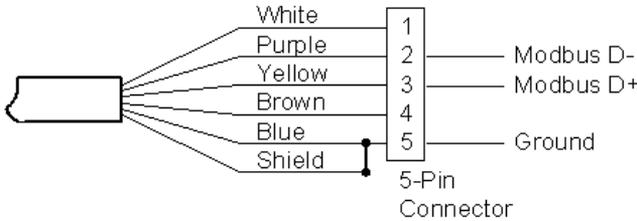
Power

The LevelSCOUT comes with a replaceable ½ AA 3.6v lithium battery.

Connecting the LevelSCOUT to a Computer

In its cabled configuration, the sensor cable is terminated with a weather-resistant connector. In its cableless configuration, the sensor is terminated with a weather-resistant connector inside a screw-cap. Connect the weather-resistant connector to your computer's USB port as shown below.
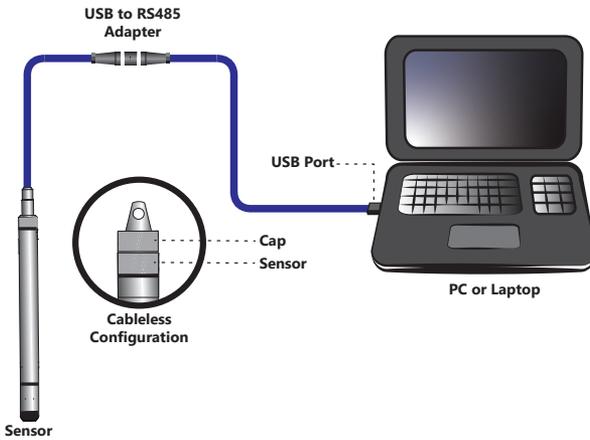
Connect the sensor to your PC using Seametrics' USB to RS485 adapter.

Installing the Aqua4Plus 2.0 Software

The LevelSCOUT 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 Aqua4Plus 2.0 software manual for details on installing and using the software. LevelSCOUT can also be used with the full Aqua4Plus 2.0 software.

Using the LevelSCOUT Without Aqua4Plus 2.0

Most users will use the LevelSCOUT with Seametrics Aqua4Plus 2.0 software. However, the LevelSCOUT is quite versatile, communicating via Modbus® RTU, allowing you to use your own software or logging equipment.

Installing the Sensor

The LevelSCOUT measures level. 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. The sensor should not be installed below its maximum depth. If the sensor is installed below its maximum depth, 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 the Barometric Compensation section before proceeding.

- Lower the sensor to the desired depth.
- Fasten the cable to the well head using tie wraps or a weather proof strain-relief system.
- 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.

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. 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.

Battery Life Calculator

The LevelSCOUT has a battery life calculator that is set at the factory when batteries are first put in the sensor. If you need to replace the batteries, see the Maintenance section for replacement information and for information on resetting the battery life calculator. *If the battery life calculator is not reset, the remaining life information will be incorrect.*

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.
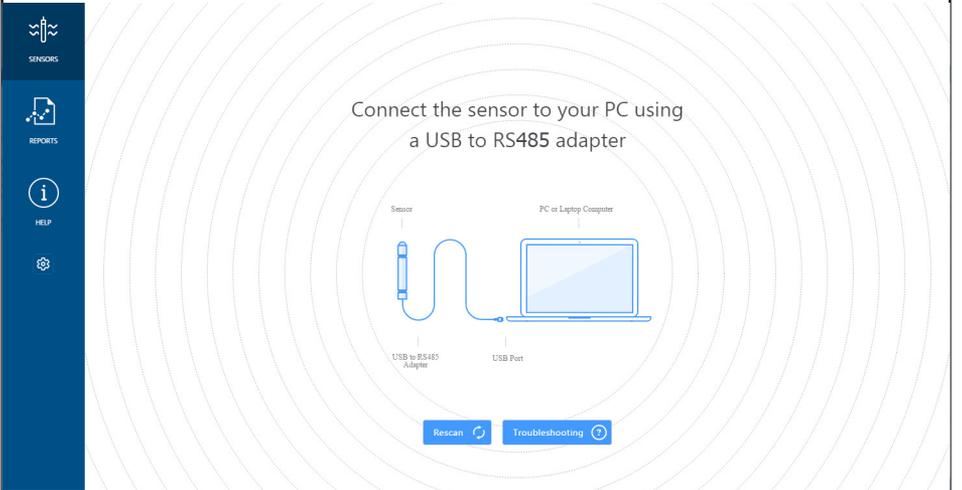
If your cable and sensor were not connected before opening Aqua4Plus 2.0 simply connect and click Rescan. While scanning is active you'll see a green dot flash in the upper right corner of the program. Scanning is complete when this dot stops flashing.
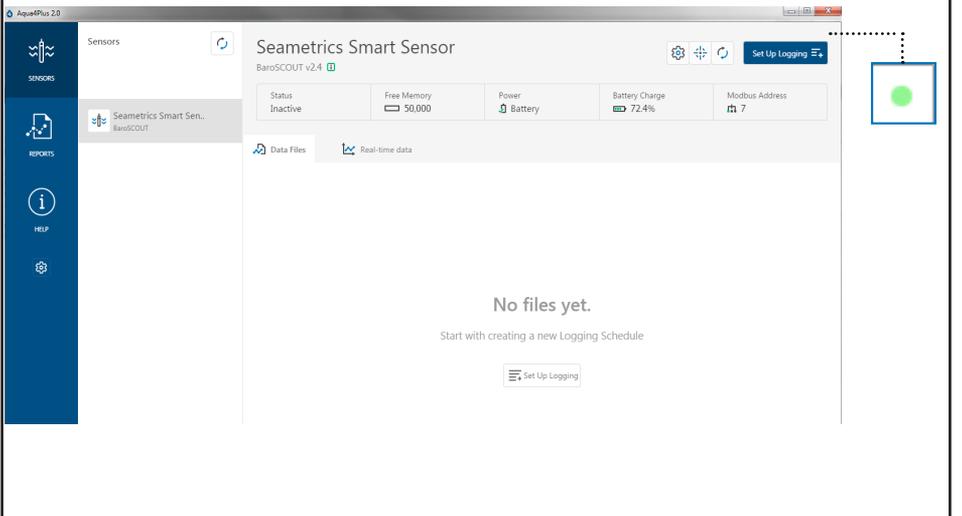
Connecting to Sensors

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.

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 program settings.

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:
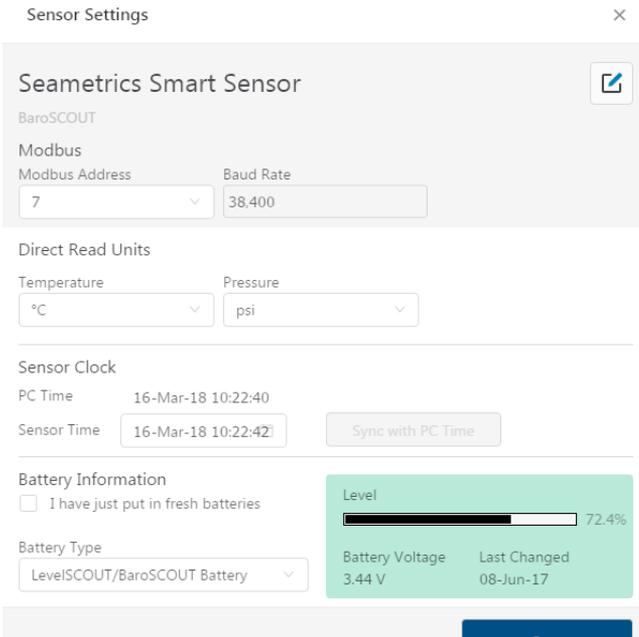
Click 🖉 to rename the sensor

To change the Modbus address, simply select the desired address from the drop-down menu and the sensor will automatically reconnect at the new selection.

Note that on LevelSCOUTs and BaroSCOUTs, the baud rate is not selectable and is locked to 38400.

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.
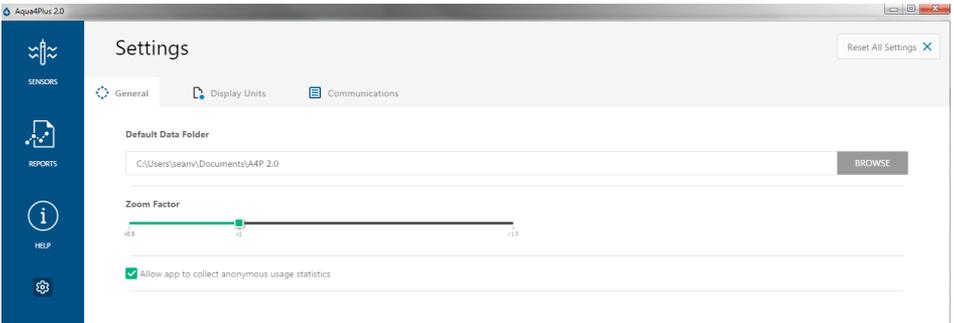
Under the Display Units tab you can select your desired display units for the supported channels. These may be changed at any time and associated Real-Time readings and Reports will rescale to the currently selected display unit. To change Direct Read units scaling see Sensor Settings.
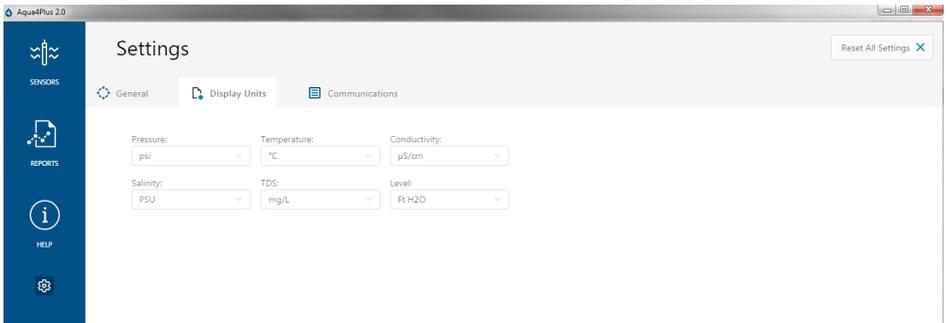
Under the Communications tab you can change your Modbus communication settings. Typically you will only need to change the address range to connect to sensors outside of Modbus address 1-10. In certain cases we may need to change the Retry and Timeout settings to overcome communication issues on very long, or corroded cabling. See Troubleshooting section or contact Seametrics Tech Support for details.

To restore factory default settings click   Reset All Settings ✕

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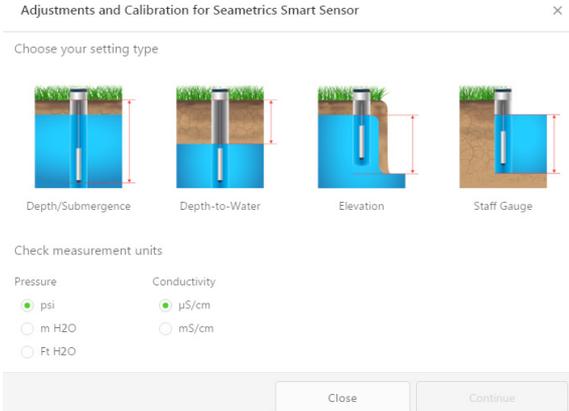
Next select the calibration setup you'd like to perform:

Confirm 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 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.
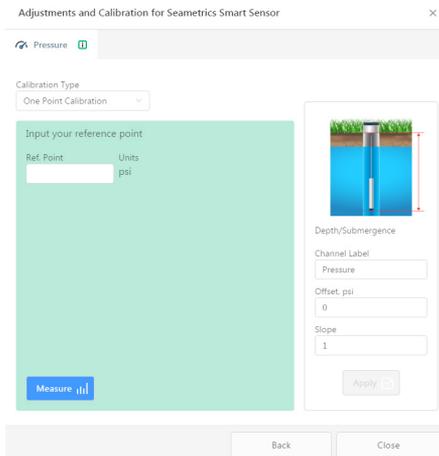
Aqua4Plus 2.0 will take 10 readings and display the average. Watch for stability while the software is measuring to ensure an accurate calibration.
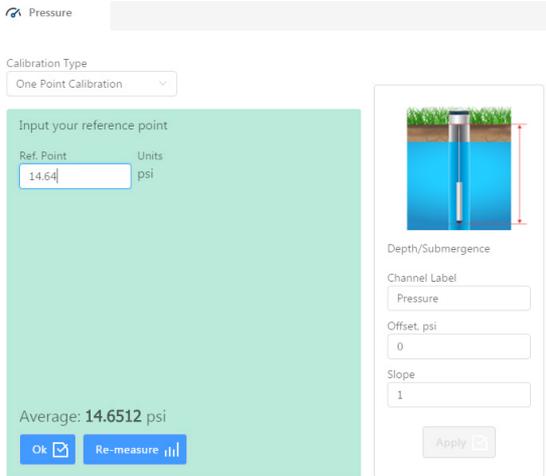
Click Ok to accept the reading and Aqua4Plus 2.0 will calculate a new pressure offset. Click Apply to confirm the new offset value and Aqua4Plus 2.0 will provide a real time reading to verify calibration was successful:
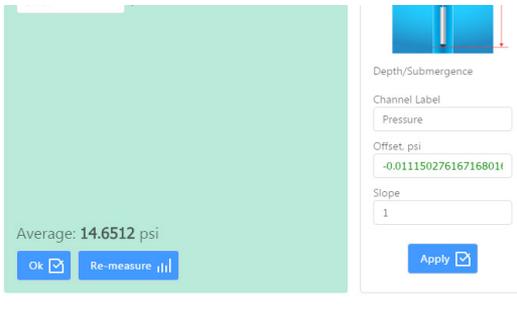
2 Point submergence calibration **ONLY RECOMMENDED IF YOU HAVE AN ACCURATE PRESSURE REFERENCE.** Our Smart Sensors rarely change slope during normal use, however if you have an accurate pressure source it is possible to perform a 2 point calibration on the pressure channel.

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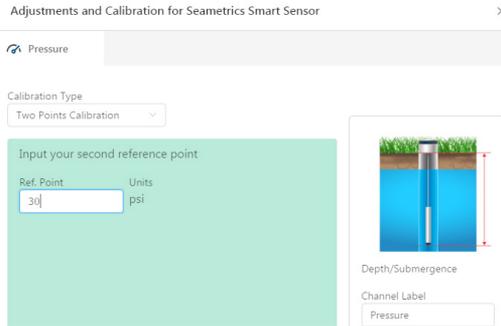
Aqua4Plus 2.0 will take 10 measurements and display the average. Watch for stability while the software is measuring to ensure an accurate calibration.

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 the software 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 the software 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 the software is measuring to ensure an accurate calibration.

Click Accept and it 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:
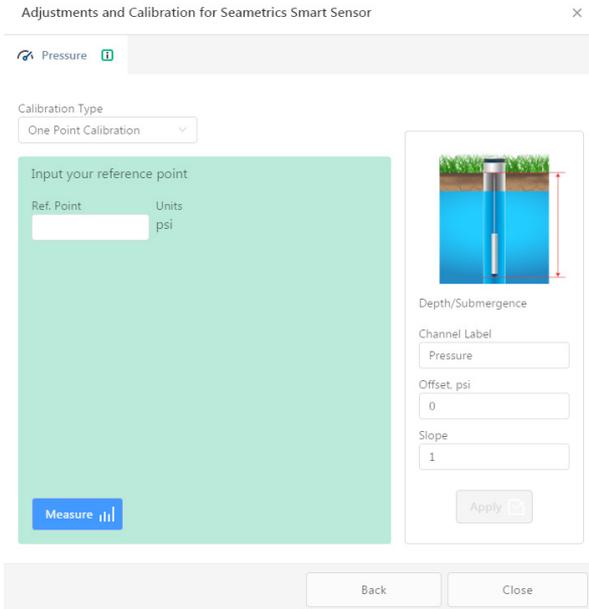
Click Apply to confirm settings and Aqua4Plus 2.0 will provide a real time reading to confirm.

Adjusting for specific gravity

You may enter the Inverse (1/SG) 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
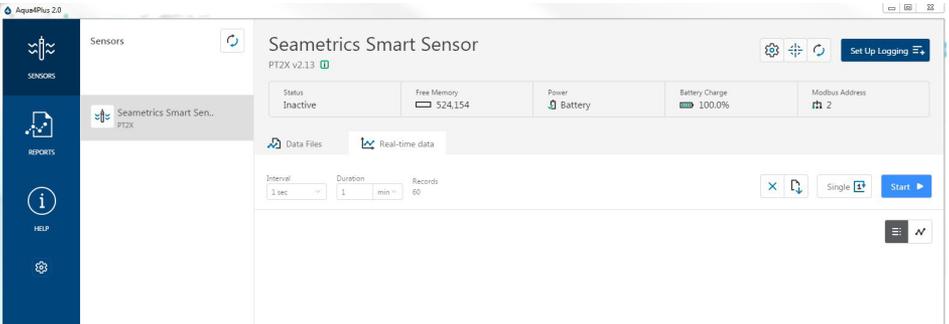
To start real-time readings click Start, readings default to table view. To switch to Real-time graphing view click the graph icon
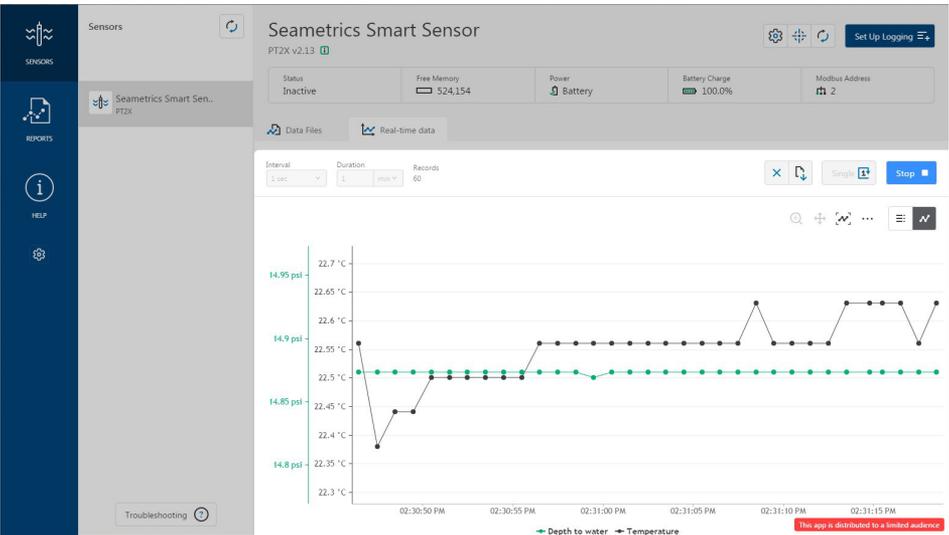
Real-time readings default to a 1 second interval for 1 minute, to adjust enter your desired settings here:
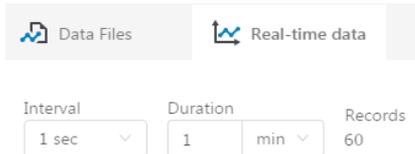
To save this data to the Reports section click the button located next to the Single button in the Real-Time tab. This will permanently save this real-time data set to your Reports database.

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.
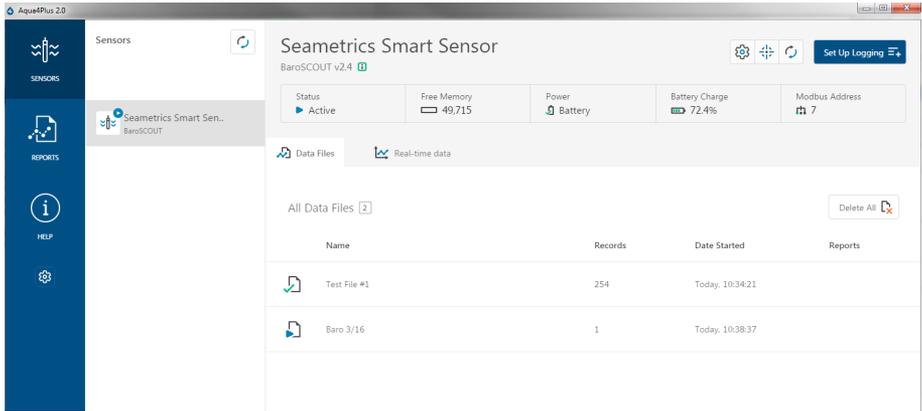
Set Up Logging Window

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 2.0 will display the available memory at the bottom of the window.
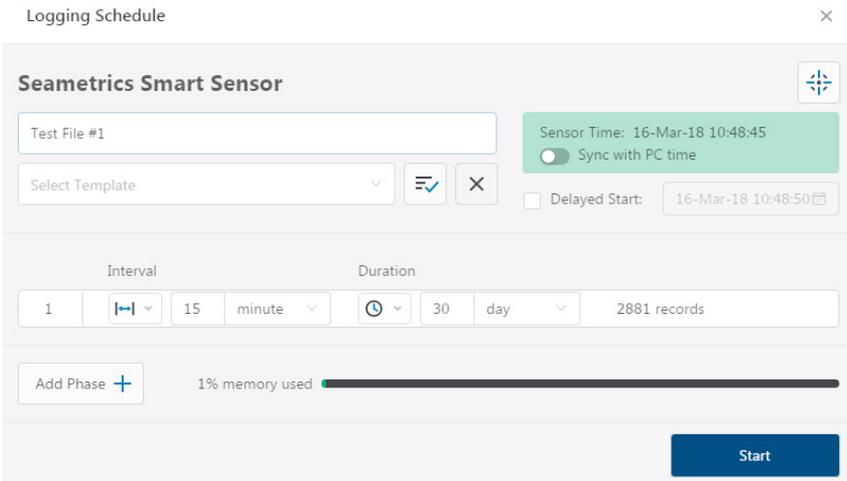
Click ⊢⊣ ˅ to switch between interval and continuous data recording (PT2X & CT2X only) Select your continuous rate from the drop down box (on the right).
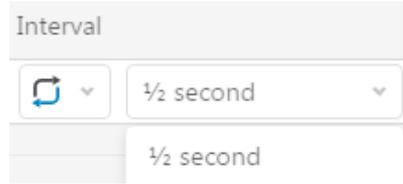
Duration can be set by either number of records or by setting a duration time, as shown on the right.
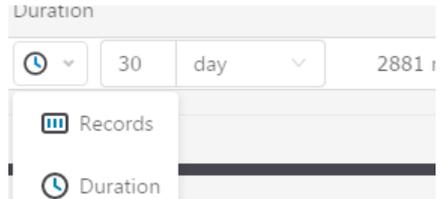
When set by number of records the time of the recording phase will be displayed detailing how long that phase will run. When set by time, the total number of records for that phase will be displayed.

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 shown on the right.
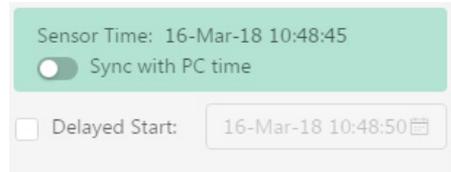
Check the Delayed Start box and enter the desired date/time you would like logging to start. This is useful for syncing data when setting up multiple sensors on a site. Data will start logging at the set date/time rather than immediately when Start is pressed.

Data file name defaults to Test File # and may be re-named here, like on the right.

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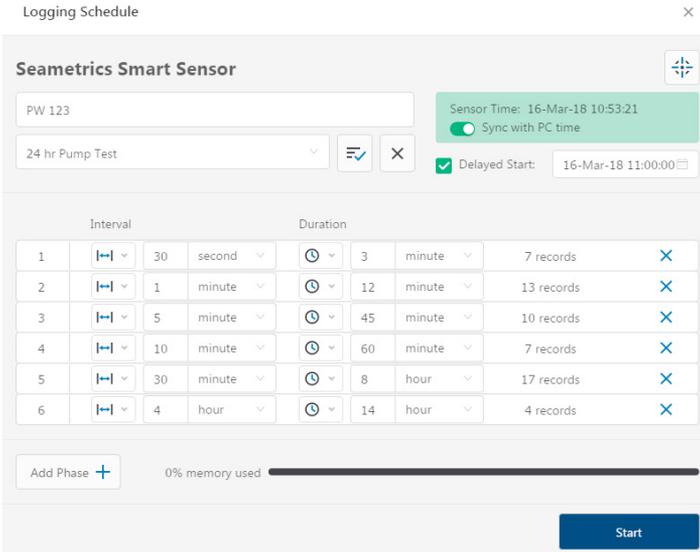
This will return you to the Sensor screen and your status will change to Active with the data file displayed under the Data Files tab. Mouse over an active file to pause, terminate, download, or view logging setup details.
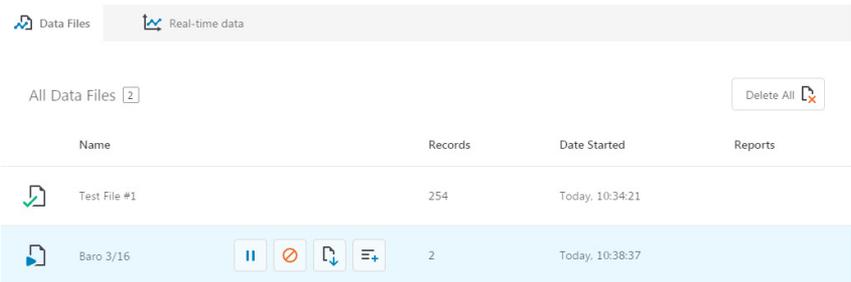
Data files already downloaded will show the Reports column, clicking here will bring you to the reports screen to view the data. See Reports section for details.

You may only have 1 active data file recording on each sensor, however you can store multiple files in memory if desired.

Do you want to schedule new logging?   ✕

This device already has an active logging schedule. Do you want to terminate it?

Cancel   OK
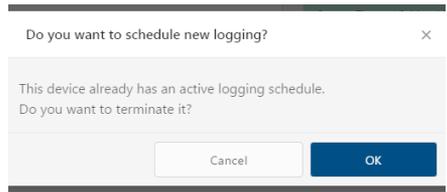
Starting a new file will automatically terminate the active logging and begin the new logging schedule. Real-time data is available during active logging.
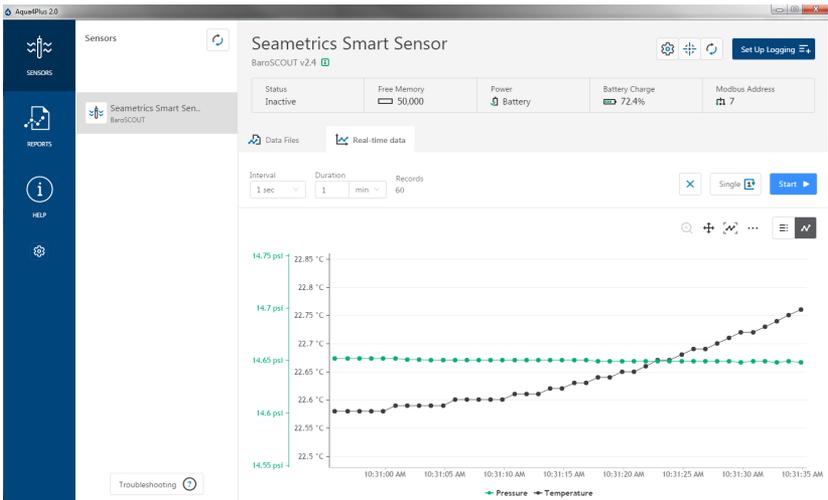
To delete files from memory make sure they have all been downloaded to Reports. Files are removed from memory all at once rather than individually.

Once confirmed files are permanently deleted from the sensor memory.

Erase all data files?   ✕

All data files on this sensor will be erased.

Cancel   Erase All
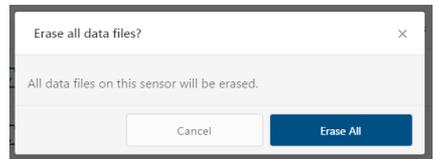
Reports

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.

Graph saving and export options are available here
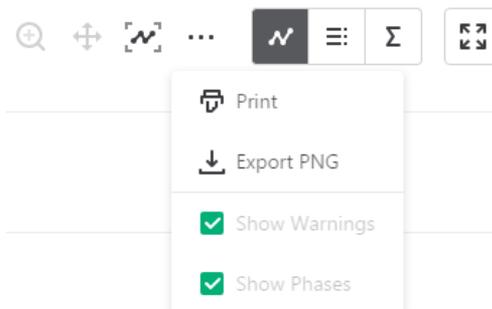
Report Details

Desk 3-12			Status Incomplete	Records 1,509	Date Started ⏱ 12-Mar-18 14:02:55

ⓘ Information   🦑 Data   ☰₊ Schedule

Name	Temperature °C	Conductivity μS/cm	Pressure psi	Salinity PSU	TDS mg/L
Sensor Range	150K ohm	0-300 mS/cm	500 psia	unknown	unknown
Min	21.02	337.8	14.535	0.1626	165.5
Max	23.45	360.0	14.700	0.1725	176.4
Mean	22.51	346.4	14.632	0.1664	169.7
Variance	0.54	38.4	0.002	0.0000	9.2
Deviation	0.74	6.2	0.045	0.0028	3.0
Calibration Date	unknown	19-Feb-18 12:48:12	21-Feb-18 14:22:57	unknown	unknown

Delete 🗋ₓ   Export ⬇   Close

Click ⤢ to switch to full screen graphing view

Click ☰ to view data as a table

Click Σ to view data statistics

You may change the display units within the graph view by selecting the appropriate channel here:
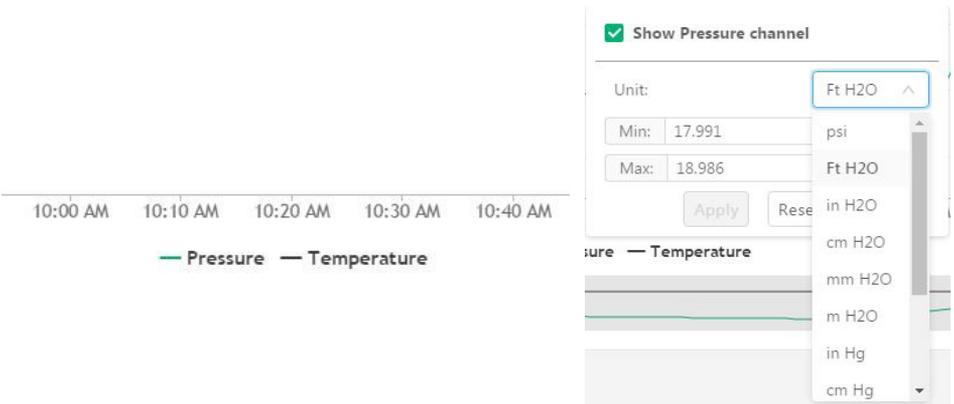
The Information tab is a new feature allowing users to add metadata to their reports such as site location, field notes, or comments.The Schedule tab will display the logging setup details for the report

Report Details

Desk 3-12	Status	Records	Date Started
	Incomplete	1,509	🕐 12-Mar-18 14:02:55

ⓘ Information   🗠 Data   ☰₊ Schedule

Report Name

Desk 3-12

Location(GPS or Job Site)

Comment

Sensor name
Seametrics Smart Sensor

Sensor type
CT2X

Serial number
0021746043

Last modified
🕐 13-Mar-18 15:11:39

Downloaded
🕐 13-Mar-18 15:11:39

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.

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.
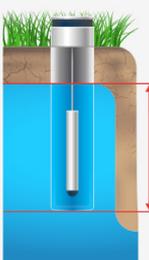
If compensating for Depth to Water enter your depth to water reference measurement and the date/time the measurement was taken (typically taken with a water level indicator before data is uploaded from the sensor) before clicking Continue.
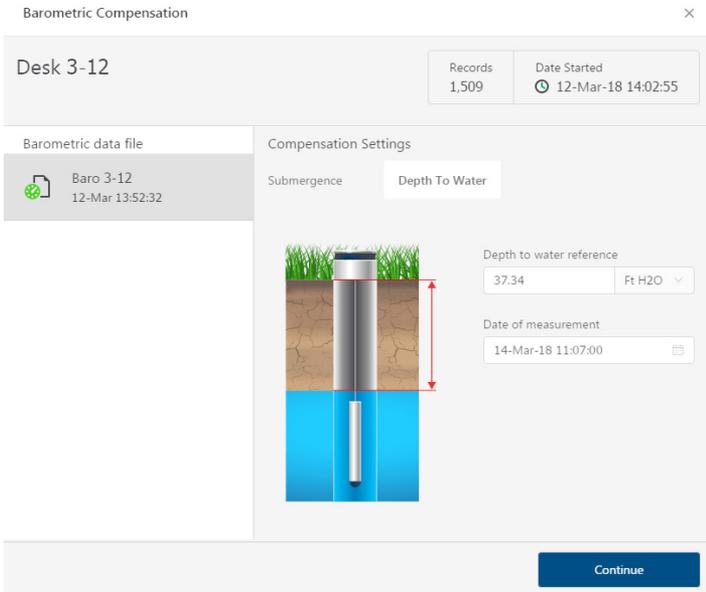
Aqua4Plus 2.0 will perform the barometric compensation and create a new compensated report. Original reports are retained as uploaded.
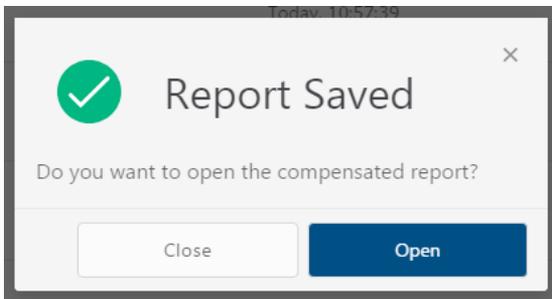
Report Details
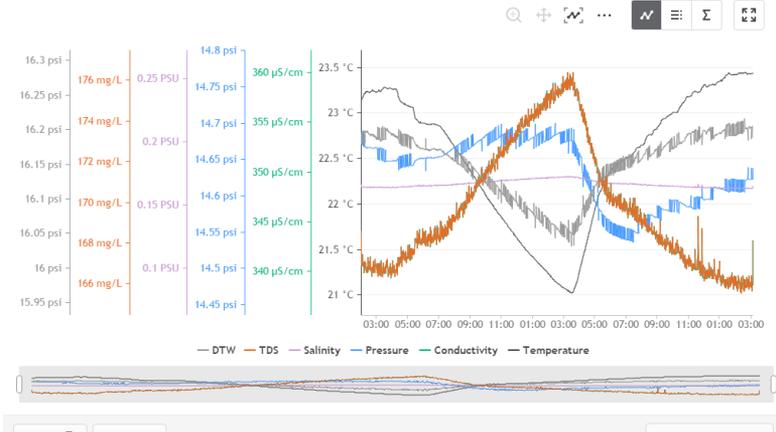
Compensated report can then be viewed and exported as needed.

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

Setting Units for Direct Read

By default, the LevelSCOUT uses the following units:

Temperature	Degrees Celsius
Level	PSI

However, you can select from a variety of units for direct read measurements. If you want to change to different units, for example, degrees Fahrenheit for temperature or feet of water for level, set these units using Aqua4Plus 2.0 (see sensor settings).

Once set, these units are saved on the sensor and direct readings will return values using these units. (Note: These settings do not affect the units used on the Aqua4Plus 2.0 display. Refer to the software manual for details.)

Reading Via Modbus® RTU

Taking Measurements

Read measurements using Modbus function 03 – Read Holding Registers.

Readings are located in two registers each, starting at address 62592. (LevelSCOUT 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.)

Register addresses for LevelSCOUT

	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 four 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 four 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 four 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 application note, availabile on our website at www.seametric.com

Changing Batteries

The LevelSCOUT and BaroSCOUT Smart Sensors feature a replaceable battery pack, the following describes how to perform battery replacement.

NOTE: Changing the battery requires opening the sensor housing, exposing internal components. Although it is possible to replace the battery in the field it MUST be done in a clean, dry environment. Seametrics recommends replacing the battery indoors.

Required Items: Battery replacement kit 7A62115 (Includes battery, O-ring, & retaining clip).

After removing the cableless cap (or cable accessory) you will find a retaining clip around the inside edge of the housing. This holds the connector insert in place, to remove it slip small screwdriver (or preferred tool) under the retaining clip at the slightly angled portion. The clip will want to rotate around the channel in the housing, to prevent this hold the sensor in a way that allows you to hold the clip in place with your finger. Once you get the tool under the clip you can work it around the radius and the clip will pop out.

Next, remove the connector insert by carefully pulling straight up while working it side-to-side to help break the O-ring seal. You don't want to pull too hard causing the O-ring seal to release suddenly as that could damage the internal wiring. There is roughly ½" of slack in the internal wiring. Once the insert has been removed from the main housing you can disconnect the battery pack.

To disconnect the old battery simply press the locking lever located to the inside of the connector and pull straight out. Remove the old battery pack from the housing, insert the fresh battery pack, and re-connect to the connector insert.

Before sealing the housing back up, replace the O-ring on the connector insert with the one provided. To reinstall the connector insert push it straight back into the housing noting the two flats on the insert as well as inside the housing. These flats prevent the connector insert from rotating during normal use and must be properly keyed when re-installing the insert for the retaining clip to seat properly.

Once the connector is seated, install the new retaining clip and connect to Aqua4Plus to reset the battery life calculator.

Note: The battery life calculator MUST be reset via Aqua4Plus to ensure a correct battery percentage display.

Battery replacement is complete, proceed with normal operations.

Flat
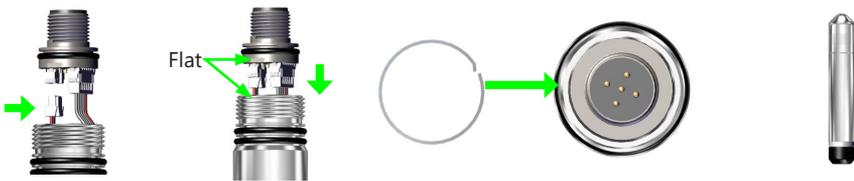
Miscellaneous

Sensor: There are no user-serviceable parts, other than the batteries. If problems develop with sensor stability or accuracy, contact Seametrics. If the sensor has been exposed to hazardous materials, do not return it 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.

End Connections: The connectors used by Seametrics are not submersible but are designed to be splash-resistant.

Erratic Readings

Erratic readings can be caused by a poor connection, damaged cable, moisture in the unit, or a damaged transmitter. In most cases, erratic readings are due to moisture getting into the system. The first thing to check is the connection. Look for moisture between contacts or a loose or broken wire. Next, check the cable for cracking or fraying. If the connections and cable appear OK, but the readings are still erratic, the transmitter may be damaged. Contact Seametrics for evaluation and repair. Erratic and erroneous readings can also occur due to improper grounding. See Grounding Issues, below.

Zero Readings When Pressurized

Continuous zero readings are usually caused by an open circuit which may indicate a broken cable, a bad connection, or possibly a damaged transmitter. Check the connector to see if a wire has become loose or if the cable has been cut. If damage is not readily apparent, contact Seametrics for evaluation and repair.

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.

The limited warranty set forth below is given by Seametrics, with respect to Seametrics brand products purchased 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.

j. SOFTWARE: The Seller grants the user a non-exclusive license to use Seametrics' software, according to the following limitations and conditions:

   i. The user may install the software on one or more desktop or laptop computers.

   ii. All title and intellectual rights to the software are owned by Seametrics.

   iii. No copies may be made or distributed except as described above.

   iv. The user may not modify or reverse-engineer the software.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY. NO IMPLIED WARRANTY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, APPLIED TO THE PRODUCTS AFTER THE APPLICABLE PERIOD OF THE EXPRESS LIMITED WARRANTY STATED ABOVE, AND NO OTHER EXPRESS WARRANTY OR GUARANTY, EXCEPT AS MENTIONED ABOVE, GIVEN BY ANY PERSON OR ENTITY WITH RESPECT TO THE PRODUCTS, SHALL BIND SEAMETRICS. SEAMETRICS SHALL NOT BE LIABLE FOR LOSS OF REVENUES, OR PROFITS, OR INCONVENIENCES, EXPENSE FOR SUBSTITUTE EQUIPMENT OR SERVICE, STORAGE CHARGES, LOSS OF DATA, OR ANY OTHER SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGE CAUSED BY THE USE OR MISUSE OF, OR INABILITY TO USE THE PRODUCTS, REGARDLESS OF THE LEGAL THEORY ON WHICH THE CLAIM IS BASED, AND EVEN IF SEAMETRICS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL RECOVERY OF ANY KIND AGAINST SEAMETRICS BE GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE PRODUCT SOLD BY SEAMETRICS AND CAUSING THE ALLEGED DAMAGE. WITHOUT LIMITING THE FOREGOING, YOU ASSUME ALL RISK OF LIABILITY FOR LOSS, DAMAGE, OR INJURY TO YOU AND YOUR PROPERTY AND TO OTHERS AND THEIR PROPERTY ARISING OUT OF USE OR MISUSE OF, OR INABILITY TO USE THE PRODUCTS NOT CAUSED DIRECTLY BY THE NEGLIGENCE OF SEAMETRICS.

SOME STATES DO NOT ALLOW LIMITATIONS ON THE DURATION OF AN IMPLIED WARRANTY, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. SIMILARLY, SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF CONSEQUENTIAL DAMAGE, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU. THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS; HOWEVER, YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.