

INW LevelSCOUT

Level/Temperature
Smart Sensor and Datalogger



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Introduction

What is the LevelSCOUT?

The INW 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 INW Smart Sensor family. Its compatibility with INW's Wireless Data Collection technology makes it ideal for remote monitoring.

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 Barometric Compensation Utility to adjust the LevelSCOUT readings for current atmospheric pressure.

A 1/2 AA 3.6v lithium battery powers the LevelSCOUT. The unit is programmed using INW's easy-to-use Aqua4Plus Lite or Aqua4Plus control software. Once programmed the unit will measure and collect data at the time interval programmed.

Replace your analog sensor/datalogger with the INW LevelSCOUT as a stand-alone unit or network with other INW Smart Sensors. While most will use the LevelSCOUT with INW's Aqua4Plus Lite or Aqua4Plus 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. | Don't support the device with the connector. Use a strain relief device to take the tension off the connectors. |
| Do store the device in a dry, inside area when not in use. | Don't allow the device to free-fall down a well as impact damage can occur. |
| Do install the device so that the cable connector is kept dry. | 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 20° 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):

$$P_g = P_a - P_{atm}.$$

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

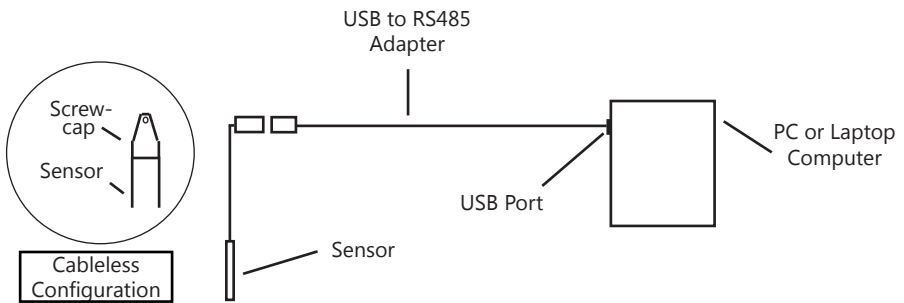
Installation and Operation

Power

The LevelSCOUT comes with a 1/2 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. (For alternate connection options, see Appendix C.)



Connect the sensor to your PC using INW's USB to RS485 adapter. (See Appendix C for alternate connections.)

Installing the Aqua4Plus Lite or Aqua4Plus Software

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

Using the LevelSCOUT Without Aqua4Plus Lite or Aqua4Plus

Most users will use the LevelSCOUT with INW's Aqua4Plus Lite or Aqua4Plus software. However, the LevelSCOUT is quite versatile, communicating via Modbus® RTU, allowing you to use your own software or logging equipment. (See Appendix D for further details.)

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. (See Technical Specifications in Appendix A for 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.

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.

Collecting Data

Following is a brief overview on using Aqua4Plus Lite or Aqua4Plus to collect data. Please refer to the software instruction manuals for further details.

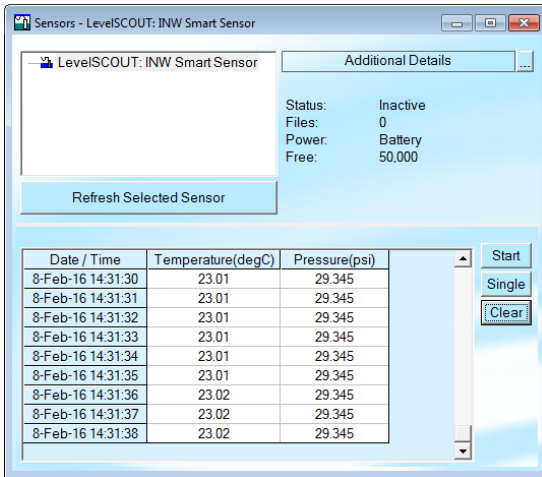
Real Time Monitor

Click Single to get a single reading.

Click Start to get a reading once a second for 60 seconds.


Click Stop to stop the reading.

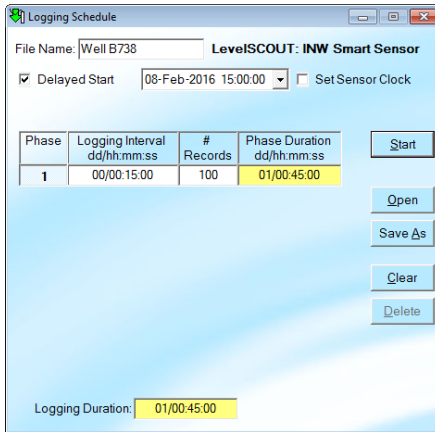
Note: These are snapshot readings and are not recorded on the sensor.



The Real Time Monitor gives a snapshot of the current readings on the sensor.


Setting up Data Recording

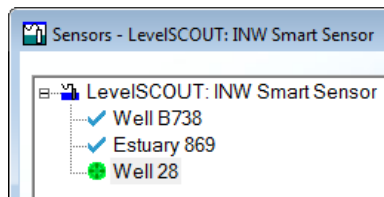
Click the  tool button. A Logging Schedule window will open. Refer to the software manual for details in describing your schedule. Click the Start button to send the schedule to the sensor and begin recording. Note: The LevelSCOUT is limited to only one phase.



Using the Logging Schedule Window, describe the test steps for your particular test.




Retrieving Data from the Sensor/Datalogger

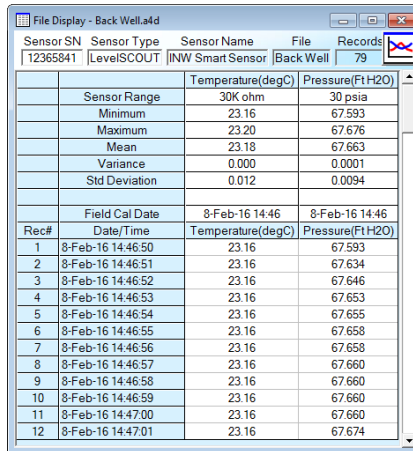
- Click on the file you want to retrieve.
- Click the  tool button.
- Select a file location.
- Click Save.
- Click Start.



Select the data file you are ready to retrieve.

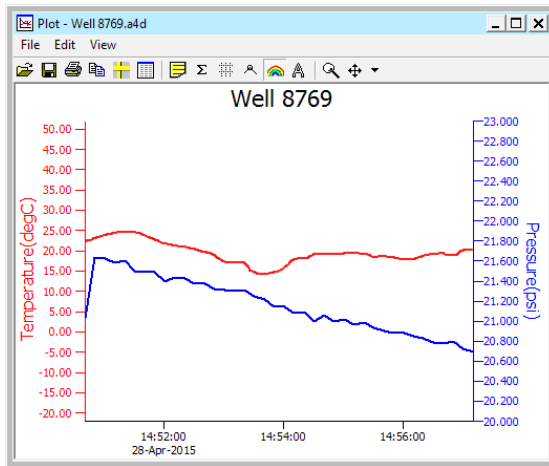
Viewing Data

- Click the  or  tool button to view data as a table.
- Click the  tool button to view data as a graph.
- Navigate to the desired file, then click the Open button.






Sensor SN	Sensor Type	Sensor Name	File	Records
1236584T	LevelSCOUT	INW Smart Sensor	Back Well	79
Sensor Range		30K ohm	30 psia	
Minimum		23.16	67.593	
Maximum		23.20	67.676	
Mean		23.18	67.663	
Variance		0.000	0.0001	
Std Deviation		0.012	0.0094	
Field Cal Date		8-Feb-16 14:46	8-Feb-16 14:46	
Rec#	Date/Time	Temperature(degC)	Pressure(FtH2O)	
1	8-Feb-16 14:46:50	23.16	67.593	
2	8-Feb-16 14:46:51	23.16	67.634	
3	8-Feb-16 14:46:52	23.16	67.646	
4	8-Feb-16 14:46:53	23.16	67.653	
5	8-Feb-16 14:46:54	23.16	67.655	
6	8-Feb-16 14:46:55	23.16	67.658	
7	8-Feb-16 14:46:56	23.16	67.658	
8	8-Feb-16 14:46:57	23.16	67.660	
9	8-Feb-16 14:46:58	23.16	67.660	
10	8-Feb-16 14:46:59	23.16	67.660	
11	8-Feb-16 14:47:00	23.16	67.660	
12	8-Feb-16 14:47:01	23.16	67.674	

The File Display window displays your data in a tabular format.



The Graph Window displays your data on an X Y coordinate graph.

Exporting Data to .csv or .xls Files

- Click the  or  tool button to view data as a table.
- Click on the  tool button.
- Select a file location and enter a name for the file.
- Select a file type.
- Click Save.

A Word About Units

Readings from the LevelSCOUT Smart Sensor can be displayed in various units, such as PSI, Ft. H₂O, or mm H₂O for level, 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.

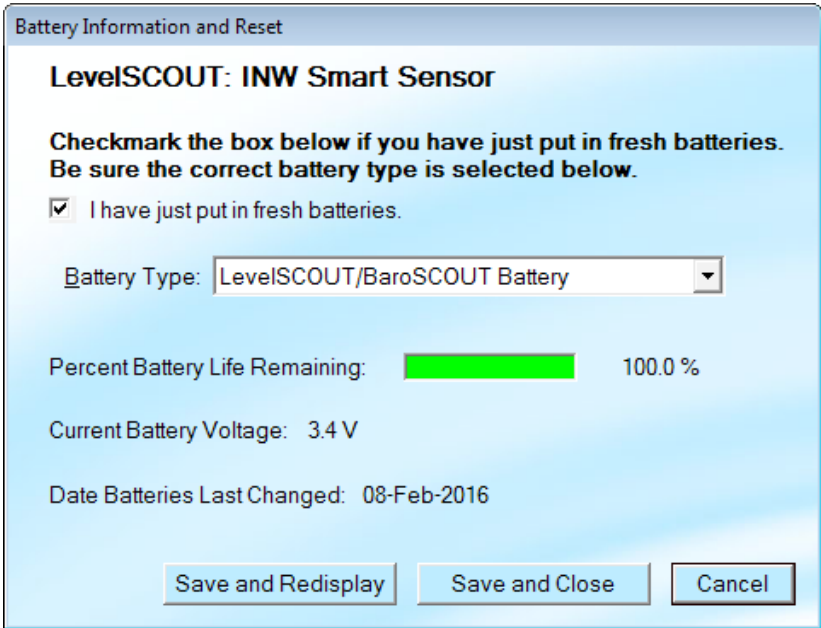
Maintenance

Changing Batteries

The LevelSCOUT is powered by a single 1/2 AA 3.6 lithium battery. In most situations the battery will last for years. If you need to replace the battery, contact INW for information on getting it replaced. You cannot simply replace the battery itself but must replace the entire compartment.

IMPORTANT NOTE!

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.



Reset the Battery Life Calculator if you change the battery.

Miscellaneous

Sensor: There are no user-serviceable parts, other than the batteries. If problems develop with sensor stability or accuracy, contact INW. 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. 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 connectors used by INW are not submersible, but are designed to be splash-resistant.

Troubleshooting

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 INW 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 INW 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**. INW recommends connecting the shield to ground at the connector end.

Appendix A: Technical Specifications

General Specification

The INW 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 Lite
File Formats	.xls / .csv / .a4d

Power

Internal Battery	One 1/2 AA 3.6 lithium battery
Expected Battery Life	4.5 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

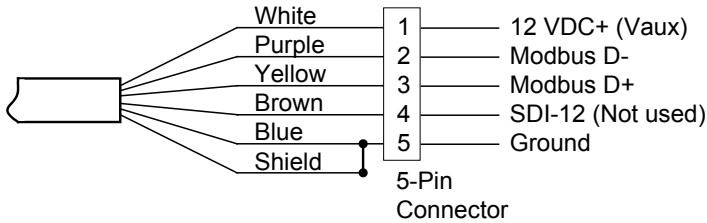
Level

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)

¹Depth range has 15 PSI subtracted to give actual depth allowed.

²Approx. 658 feet or 200 meters

Wiring and Component Information



Appendix B: Settings and Calibration


Settings and calibration values can only be changed when there is no data on the sensor. Be sure to retrieve any data and then erase the data on the sensor before proceeding.

The temperature channel rarely needs adjustment. If you think your temperature channel needs calibrating, contact your service representative.

Before leaving the factory, your LevelSCOUT has been inspected using precision instruments. However, you may want to change some of the settings for the level channel for the following reasons:

- To set a specific zero-reference point for submergence
- To return values as depth-to-water
- To return values as elevation in relation to sea-level
- To return values relative to a staff gauge

Preparation

- Run Aqua4Plus Lite or Aqua4Plus and scan for sensors.
- On the Sensor Map, click the sensor you want to adjust.
- From Aqua4Plus Lite:
 - Select the units you want to use for measurements, i.e., psi, feet of water, inches of mercury, etc. Set this from the Configure Menu | Program Configuration | Set Computer Display Units.
 - Open the Settings and Calibration window by clicking on the  Settings button.
- From Aqua4Plus:
 - Select the units you want to use for measurements, i.e., psi, feet of water, inches of mercury, etc. Set this from the Options Menu | Display Units.
 - Open the Settings and Calibration window from the Configure Menu | Settings and Calibration.

Select the setting type from the Select Setting Type dropdown box. A picture will display illustrating the type of selection. Step-by-step instructions will be displayed on the right.

Settings and Calibration

LevelSCOUT: INW Smart Sensor

Channels

1: Temperature

2: Pressure

Select Setting Type

Depth/Submergence
▼

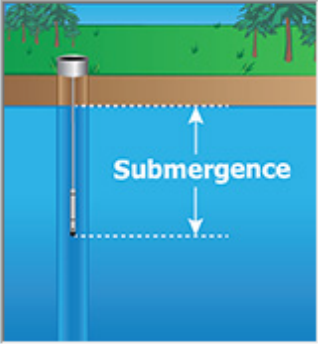
Channel Label:

Cal Date:

slope:

offset:

Comment:



Ref. Ft H2O:

Measured:

First Point

Second Point

slope:

offset:

Measure

Measure

Apply

Sample Settings and Calibration Window

Submergence

One-Point Calibration:

-- Computing Offset --

- Place sensor in the fluid you are measuring at a precise known level.
- In the **Ref** box for the first point, enter this level or pressure.
- Click first **Measure** button.
- When readings have stabilized, click the **Accept** button in the pop-up box.

-- Applying Offset --

- Click the **Apply** button to apply calculated offset.
- The calculated offset will be transferred to the offset field near the top of the window.
- **Click OK to save the value to the sensor!!!**

Two-Point Calibration:

-- Compute First Calibration Point --

- Place sensor in the fluid you are measuring at a precise known level.
- In the **Ref** box for the first point, enter this level or pressure.
- Click first **Measure** button.
- When readings have stabilized, click the **Accept** button in the pop-up box.

-- Compute Second Calibration Point --

- Place sensor in the fluid you are measuring at a second precise known level.
- In the **Ref** box for the second point, enter this level or pressure.
- Click second **Measure** button.
- When readings have stabilized, click the **Accept** button in the pop-up box.

-- Applying Slope and Offset --

- Click the **Apply** button to apply calculated values.
- The calculated slope and offset will be transferred to the fields near the top of the window.
- **Click OK to save the value to the sensor!!!**

-- Verifying Settings --

- Using the Real Time Monitor, take a few readings to verify it is reading as expected.

IMPORTANT NOTE!

When taking readings on an **absolute** sensor, such as the LevelSCOUT, you will need to **SUBTRACT** the current barometric pressure to get submergence. See the Barometric Compensation Utility Application Note (9C0275) for information on how the Barometric Utility can help automate this process.

Depth-to-Water

When using the Depth-to-Water setting, you may want to change the channel label at the top of the Settings window to read "Depth" or "Depth-to-Water".

NOTE: Be sure to use the same units for all measurements in this calculation. For example, if you have the program set to display in Ft H2O then be sure to enter the barometric pressure and depth-to-water readings in Ft H2O.

-- Computing Offset --

- Enter the current barometric pressure in the **Barometric** box.
- Place the sensor in the well.
- Using a water level indicator or other measuring device, determine the depth-to-water from the top of the well (or other reference point).
- Enter this value in the **DTW** box.
- Click the **Measure** button.
- When readings have stabilized, click the **Accept** button in the pop-up box.

-- Applying the Slope and Offset --

- Click the **Apply** button to apply the calculated values.
- The calculated slope and offset will be transferred to the fields near the top of the window.
- **Click OK to save the values to the sensor!!!**

-- Verifying Settings --

- Using the Real Time Monitor, take a few readings to verify it is reading as expected.

IMPORTANT NOTE!

When taking readings on an **absolute** sensor, such as the LevelSCOUT, you will need to **ADD** the current barometric pressure to the sensor reading to get depth-to-water. See the Barometric Compensation Utility Application Note (9C0275) for information on how the Barometric Utility can help automate this process.

Elevation Above Sea Level

When using the Elevation setting, you may want to change the channel label at the top of the Settings window to read "Elevation".

NOTE: Be sure to use the same units for all measurements on this page. For example, if you have the program set to display in Ft H₂O then be sure to enter the elevation, barometric pressure, and depth-to-water in Ft H₂O.

-- Computing Offset --

- Enter the elevation of the top of the well (or other reference point).
- Enter the current barometric pressure in the **Barometric** box.
- Place the sensor in the well.
- Using a water level indicator or other measuring device, determine the depth-to-water from the top of the well (or other reference point).
- Enter this value in the **DTW** box.
- Click the **Measure** button.
- When readings have stabilized, click the **Accept** button in the pop-up box.

-- Applying Offset --

- Click the **Apply** button to apply the calculated offset.
- The calculated offset will be transferred to the offset field near the top of the window.
- **Click OK to save the values to the sensor!!!**

-- Verifying Settings --

- Using the Real Time Monitor, take a few readings to verify it is reading as expected.

IMPORTANT NOTE!

When taking readings on an **absolute** sensor, such as the LevelSCOUT, you will need to **ADD** the current barometric pressure to get elevation. See the Barometric Compensation Utility Application Note (9C0275) for information on how the Barometric Utility can help automate this process.

Staff Gauge

When using the Staff Gauge setting, you may want to change the channel label at the top of the Settings window to read "Staff Gauge".

NOTE: Be sure to use the same units for all measurements on this page. For example, if you have the program set to display in Ft H2O then be sure to enter the barometric pressure and staff gauge readings in Ft H2O.

-- Computing Offset --

- Enter the current barometric pressure in the **Barometric** box.
- Place the sensor in the well.
- Note the current level on your staff gauge.
- Enter this value in the **Staff** box.
- Click the **Measure** button.
- When readings have stabilized, click the **Accept** button in the pop-up box.

-- Applying Offset --

- Click the **Apply** button to apply the calculated offset.
- The calculated offset will be transferred to the offset field near the top of the window.
- **Click OK to save the values to the sensor!!!**

-- Verifying Settings --

- Using the Real Time Monitor, take a few readings to verify it is reading as expected.

IMPORTANT NOTE!

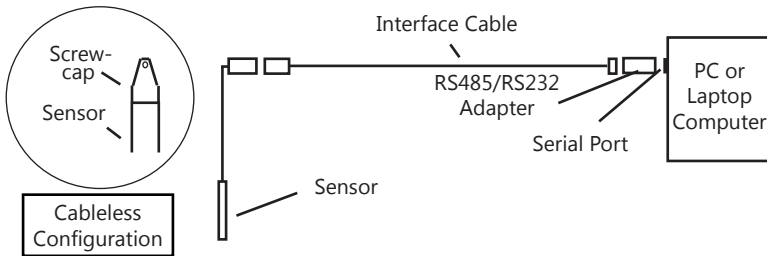
When taking readings on an **absolute** sensor, such as a LevelSCOUT, you will need to **SUBTRACT** the current barometric pressure to get a staff gauge reading. See the Barometric Compensation Utility Application Note (9C0275) for information on how the Barometric Utility can help automate this process.

Appendix C: Alternate Connection Options

INW recommends connecting the sensor to your computer using the INW USB cable. However, when using Aqua4Plus, the sensor can also be connected using an RS232 serial port or a USB-to-Serial cable, as described below. (Note: Aqua4Plus Lite can only communicate using the INW USB cable.)

Connecting via RS232 Serial Port


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 serial port as shown below.



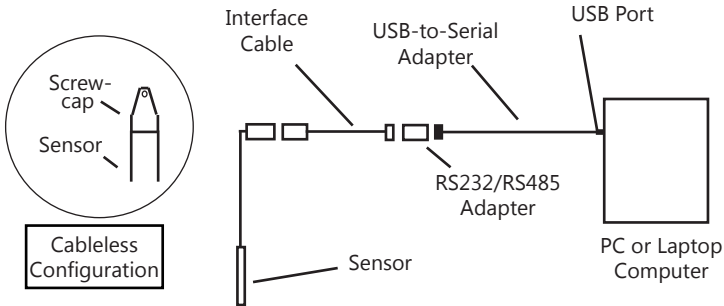
Connect the sensor to your computer using an RS485/RS232 adapter and an interface cable.

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. INW has tested and recommends the Keyspan USA-19HS. It is available from INW as well as from many sites on the Internet. Install as follows:

- Plug into USB port.
- Install the drivers provided with the particular unit.
- Determine the port number to which the adapter is assigned.
 - Right-click on My Computer.
 - From the popup menu, select Manage to open the Computer Management window.
 - On left panel, click on Device Manager.
 - On right panel, double-click on Ports.
 - A list of active COM ports will be displayed. Note the COM number assigned to the adapter you just installed.
For example:  Keyspan USB Serial Port (COM4)
 - Close Manager.
- Connect to the sensor.

- On the Aqua4Plus software, select the COM port noted above. (If you do not see your new COM port in the dropdown box, open the Communications dialog box from the Options menu. Increase the Highest COM port number, up to a maximum of 15.)



Connect the sensor to your computer using a USB to Serial adapter and an interface cable.

Appendix D: Reading the LevelSCOUT via Direct Read

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

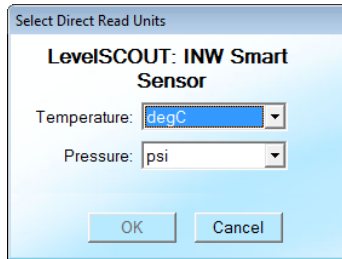
Setting Units for Direct Read

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/Aqua4Plus Lite.

- From Aqua4Plus select Direct Read Units from the Configure | Advanced menu.
- From Aqua4Plus Lite select Set Direct Read Units from the Sensor configure menu.
- On the popup box, click the down-arrows next to the channel types you want to change, and then select the units you want. (For level, select units from the Pressure dropdown box.)
- Click OK.



Select the units for your direct read Modbus measurements

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 Lite or Aqua4 Plus display. Refer to the software manual for details.)

Reading Via Modbus® RTU

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.)

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 INW application note, “Modbus Direct Read on INW Smart Sensors” available from our web site at <http://www.inwusa.com/appnotes.htm>.

**LIMITED WARRANTY/DISCLAIMER - INW LevelSCOUT
SUBMERSIBLE LEVEL /TEMPERATURE SENSOR**

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Seametrics • 19026 72nd Avenue South • Kent, Washington 98032 • USA
(P) 253.872.0284 • (F) 253.872.0285 • 1.800.975.8153 • inwusa.com

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