

Seametrics

INW Multi-Parameter

Smart Sensor and Datalogger



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About this Manual

This manual covers basic use of the Multi-Parameter Smart Sensor. Further details about each connected probe, including calibration information, can be found in their respective manuals. Be sure to refer to these manuals for important information on care and maintenance of your probe. Detailed software information can be found in the *Aqua4Plus Software Manual*. Information on using these with other Modbus equipment, such as panel meters or RTU/PLC applications, refer to the application note *Modbus Direct Read on INW Smart Sensors*. All of these are available on our web site at www.inwusa.com.

Introduction

What is the Multi-Parameter Smart Sensor?

The INW Multi-Parameter Smart Sensor combines up to three INW Smart Sensor probes in a single, easy-to-deploy, unit. Depending on configuration the Multi-Parameter Sensor can measure pH, ORP, temperature, conductivity, salinity, TDS, pressure, level, and dissolved oxygen or turbidity, depending on configuration.

The Multi-Parameter Smart Sensor is powered from a 12 VDC power supply and can be networked with other INW Smart Sensors, either directly from a single computer or via a WaveData Wireless Data Collection System.

Features

- Measures pH, ORP, temperature, conductivity, salinity, TDS, pressure level, and dissolved oxygen or turbidity (depending on configuration)
 - Modbus® and SDI-12 interface for greater flexibility
 - Non-volatile memory
 - RS485 network — connect with other INW Smart Sensors
 - Wireless connectivity — radios and/or cellular
 - Modular design — accommodate changes to parameter and data needs
 - Flexible, Windows®-based programming
 - Real time viewing
 - Easy export to spreadsheets and databases
 - Direct read option — use with panel meters or RTU/PLC applications
 - Fits in 2" (5.1 cm) well
-

Initial Inspection and Handling

Upon receipt of your smart sensor, inspect the shipping package for damage. After opening the carton, look for concealed damage, such as a cut cable. If damage is found, immediately file a claim with the carrier. 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 install the device so that the connector end is submerged.

Don't support the device with the connector or with the connectors of an extension cable. 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.

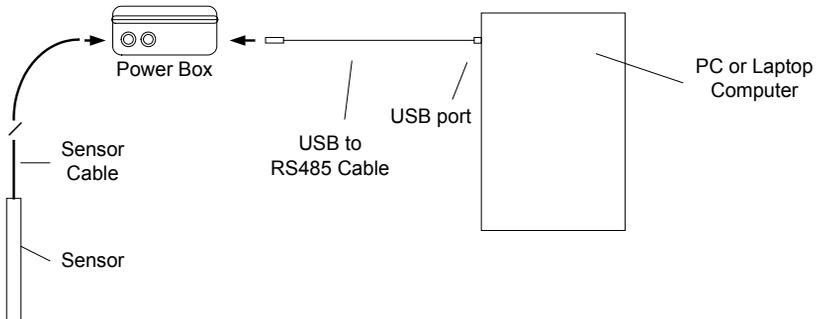
Don't bang or drop the device on hard objects.

Installation and Operation

Connecting to External Power and a Computer

The Multi-Parameter sensor normally comes with INW's 12VDC power supply. Simply connect the sensor cable to the female connector on the power box. (Note: the individual probe units do not have internal batteries.)

Connect the INW USB communication cable to the male connector on the power box. (For alternate connection options, see Appendix B.)



*Connect the sensor to your PC using a USB to RS485 adapter.
(See Appendix B for alternate connection options.)*

Installing the Aqua4Plus Software

The Multi-Parameter Sensor comes with the Aqua4Plus host software to be installed on your PC or laptop. Use this software to calibrate the sensor, 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 software manual for details on installing and using Aqua4Plus.

NOTE: When using Aqua4Plus (or any other Modbus software), each probe will appear on a separate Modbus address—two to three addresses, depending on configuration.

Calibration

All active channels can be calibrated in the field. Temperature and Pressure channels rarely need calibrating, however the pH, ORP, and Conductivity channels should be calibrated before first use and periodically thereafter. Refer to the specific probe manuals for details.

Environmental conditions of turbulence and temperature swings, as well as local likelihood for bio-fouling or mineral deposition, can vary considerably from site to site. Therefore, where the sensor is to be used for long-term monitoring, it is recommended that the calibration be initially checked frequently until a performance history is established.

Field Deployment

The black reference reservoir at the lower end of the TempHion™ Smart Sensor is shipped filled with INW reference solution. (If your reference reservoir is not filled, see the Maintenance section of the TempHion manual.) The black reference assembly has two grooves. The upper groove contains a small hole that forms the liquid junction port. During shipping and storage, an o-ring is located in the upper groove, preventing reference solution leakage and contamination. Be sure to move the o-ring to the lower groove before deploying, thus exposing the liquid junction port. If the o-ring continues to cover the opening, readings will not be representative or accurate.



Be sure to move the o-ring to the lower groove before deploying, thus exposing the liquid junction port.

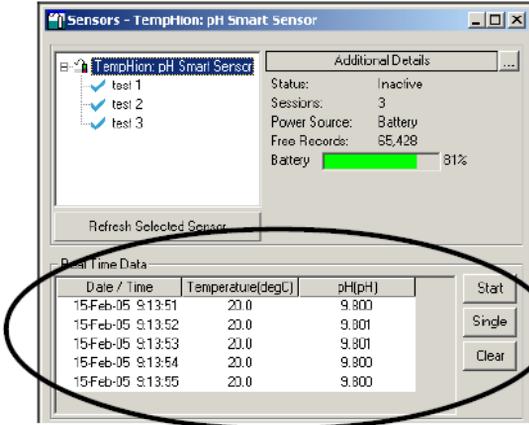
Lower the sensor to the desired depth. Fasten the cable to the well head using the strain-relief system. (Note that for shallow installations the liquid in which the sensor is submerged must, at all times, reach high enough to cover all sensing elements.)

Do not install such that the connector at the top of the connector might become submerged with changing weather conditions. The box and connectors can withstand incidental splashing but is are not designed to be submerged.

Collecting Data

Following is a brief overview on using Aqua4Plus to collect data. Please refer to the *Aqua4Plus Software Manual* for further details on configuring and using Aqua4Plus. Remember that Aqua4Plus will display two sensors (a TempHion and a CT2X) in Aqua4Plus. Each is read separately. Each must be programmed separately and data is uploaded from each.

Real Time Monitor



Click Single to get a single reading.

Click Start to get a reading once a second.

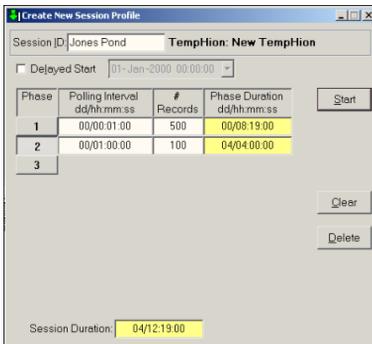
Click Stop to stop the reading.

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 a Data Recording Session

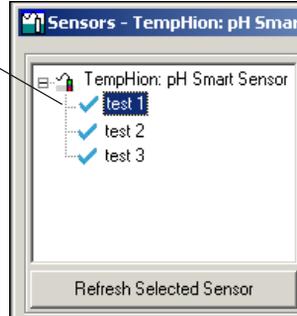
Click the  tool button. A Session Profile Window will open. Refer to the *Aqua4Plus Software Manual* for details in describing your session profile. Click the Start button to save the session to the sensor and begin recording.



Using the Session Profile Window, describe the test steps for your particular test.

Retrieving Data from the Sensor/Datalogger

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



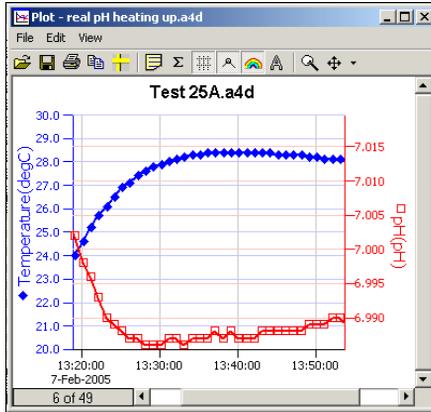
Select the data session you are ready to upload.

Viewing Data

- Click the  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. (If the File Open box does not appear, click the File Menu, then select Open.)

Sensor SN	Sensor Type	Sensor Name	Session Name
2452034	TempHion	pH Smart Sensor	Test 25A
Sensor Range		Temperature(degC)	pH(pH)
Minimum		22.0	6.986
Maximum		28.4	7.019
Mean		27.0	6.992
Variance		4.02	0.0001
Std Deviation		2.00	0.0091
Element		30K type 5 thermistor	
Cal Date		7-Feb-05	7-Feb-05
Rec#	Date/Time	Temperature(degC)	pH(pH)
1	07-Feb-05 13:13:03	22.0	7.018
2	07-Feb-05 13:14:03	22.0	7.018
3	07-Feb-05 13:15:03	22.0	7.019
4	07-Feb-05 13:16:03	22.2	7.016
5	07-Feb-05 13:17:03	22.7	7.013
6	07-Feb-05 13:18:03	23.3	7.005
7	07-Feb-05 13:19:03	24.0	7.002
8	07-Feb-05 13:20:03	24.6	6.998
9	07-Feb-05 13:21:03	25.2	6.996
10	07-Feb-05 13:22:03	25.7	6.993

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

- Using the File Display window, open the file you want to export.
- 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 Multi-Parameter Sensor can be displayed in various units. Select the units you want from the Options | Units menu.

- Temperature: Degrees Celsius, Fahrenheit, or Kelvin
- pH: pH or mV
- Redox (ORP): mVH or mV
- Conductivity: uS/cm, mS/cm
- TDS: mgL
- Salinity: PSU
- Pressure: PSI, Ft H₂O, mH₂O, and many others
- DO: ppm
- Turbidity: NTU

When using pH, ppm, or mVH units, all readings are automatically compensated for temperature and all field calibration factors are applied. When using millivolts or ohms, only the actual millivolt or resistance values are displayed - no adjustments are made.

Storing Sensor

For long-term storage, the TempHion probe should be stored dry.

- Unscrew and empty the reservoir cap. **Do not touch or scratch the sensing elements or the reference electrode!**
- Clean the cap and electrode assembly as detailed in the TempHion manual.
- Let cap and electrode assembly dry thoroughly.
- Replace cap to protect electrode from scratching.

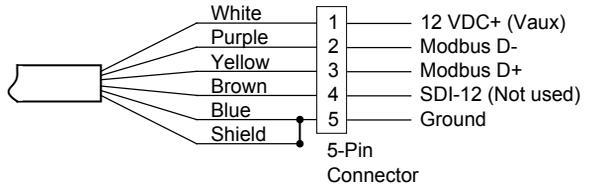
Appendix A: Technical Specifications

Wiring Information

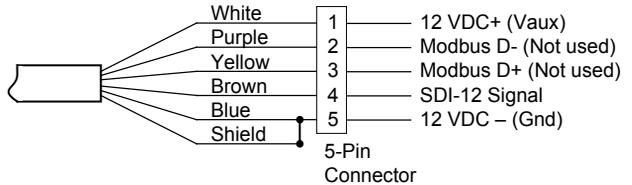
Cable Type: 9-conductor, shielded

Shield	=	Ground
White	=	Vaux (6 to 13 VDC)
Brown	=	SDI-12
Orange	=	Vbat+ (1.8 to 3.3 VDC)
Blue	=	Ground
Yellow	=	Comm D+
Purple	=	Comm D-

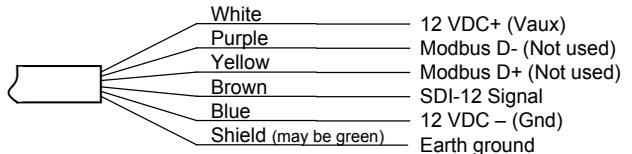
For Modbus® —
with 5-pin connector



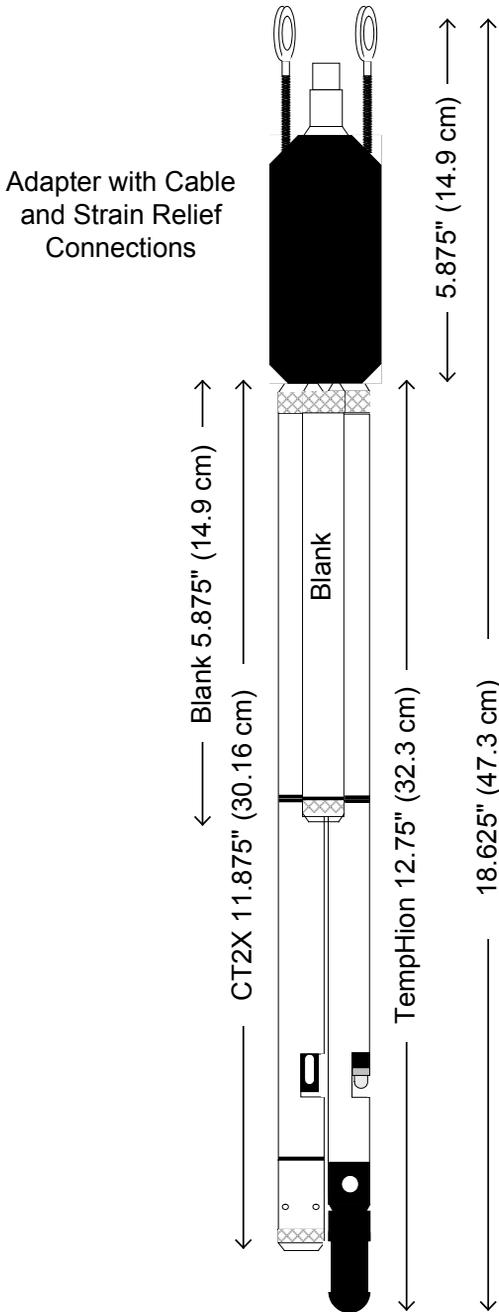
For SDI-12 with —
with 5-pin connector



For SDI-12 with —
without connector



Dimensions and Specifications



MECHANICAL

Length (with TempHion & CT2X)	18.63" (47.3 cm)
Maximum Diameter	1.75" (4.45 cm)
Weight	2 lb (0.9 kg)
Adapter Material	Acetal
Tube Material	316 stainless steel or titanium
Wire Seal Materials	Flouropolymer and PTFE
Submersible Cable	Polyurethane, polyethylene, FEP or ETFE
Cabel OD	0.28" (0.7 cm)
Cable Weight	4 lbs/100 ft (1.8 kg/30 m)
Maxium Cable Length	2000 feet (610 meter)
Break Strength	138 lbs (62.7 kg)
Maximum Operating Pressure	100 PSI (70 H ₂ O)
Burst Pressure	200 PSI (140 H ₂ O)

GENERAL

Communication	RS485 Modbus® RTU & SDI-12 (ver. 1.3)
Direct Modbus Output	32-bit IEEE floating point
SDI-12 Output	Serial
Internal Math	32-bit floating point
Operating Temperature Range	-5° C to 40° C
Storage Temperature Range	-20° C to 80° C

POWER

External Supply	12 VDC – Nominal 6V-13VDC @ 15mA
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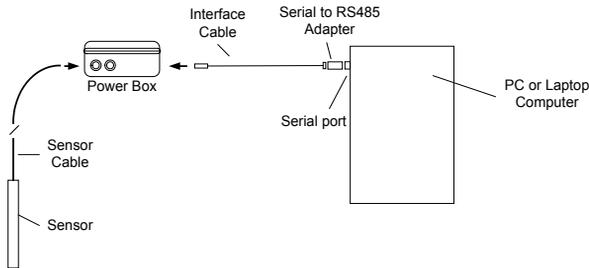
RANGE, RESOLUTION, ACCURACY

	Range	Resolution	Accuracy
Level/Pressure		16 bit	± 0.05% FSO typical
Absolute PSIA	100 PSI		± 0.1% FSO maximum
Absolute mH ₂ O	70 mH ₂ O		(B.F.S.L. 20° C)
Absolute FtH ₂ O	231 FtH ₂ O		
Conductivity	0-100 mS/cm	0.001 mS/cm	± 0.5% of measured value
Salinity	2–42 PSU	0.001 PSU	± 1% of reading or 0.1 PSU whichever is greater
TDS	4.9–49,000 mg/L	0.1 mg/L	± 0.5% of measured value
pH	1-14 pH units	0.01 pH units	± 0.2 pH units
ORP	± 1200 mV	0.01 mVH	0.1 mVH
Temperature	-5° C to 40° C	0.1° C	± 0.5° C
DO	0–5 ppm	0.01 ppm below 4.0 0.1 above 4.0	1% of reading or 0.02 ppm whichever is greater
Turbidity	0–400 NTU 0–3000 NTU		± 2% or ± 2 NTU @ 25° C whichever is greater

Appendix B: Alternate Connection Options

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.

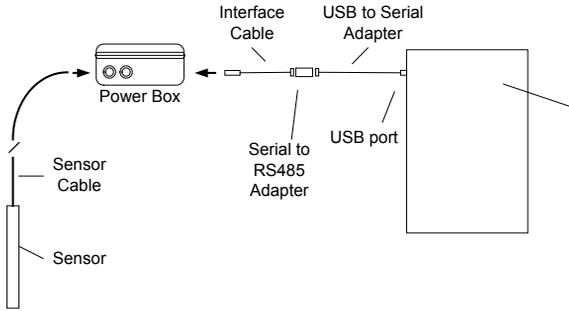


Connect the sensor to your computer using an RS485/RS232 adapter and an interface cable.

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 C: Reading the Multi-Parameter via Direct Read

While the Multi-Parameter sensor comes with INW's easy to use Aqua4Plus software, 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. Refer to the specific probe manuals for details.

**LIMITED WARRANTY/DISCLAIMER -
INW Multi-Parameter Smart Sensor**

A. Seller warrants that products manufactured by Seller when properly installed, used and maintained, shall be free from defects in material and workmanship. Seller's obligation under this warranty shall be limited to replacing or repairing the part or parts or, at Seller's option, the products which prove defective in material or workmanship within TWO (s) years from the date of delivery, provided that Buyer gives Seller prompt notice of any defect or failure and satisfactory proof thereof. Any defective part or parts must be returned to Seller's factory or to an authorized service center for inspection. Buyer will prepay all freight charges to return any products to Seller's factory, or any other repair facility designated by Seller. Seller will deliver replacements for defective products to Buyer (ground freight prepaid) to the destination provided in the original order. Products returned to Seller for which Seller provides replacement under this warranty shall become the property of Seller.

This limited warranty does not apply to lack of performance caused by abrasive materials, corrosion due to aggressive fluids, mishandling or misapplication. Seller's obligations under this warranty shall not apply to any product which (a) is normally consumed in operation, or (b) has a normal life inherently shorter than the warranty period stated herein.

In the event that equipment is altered or repaired by the Buyer without prior written approval by the Seller, all warranties are void. Equipment and accessories not manufactured by the Seller are warranted only to the extent of and by the original manufacturer's warranty.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. SELLER'S WARRANTY OBLIGATIONS AND BUYER'S REMEDIES THEREUNDER (EXCEPT AS TO TITLE) ARE SOLELY AND EXCLUSIVELY AS STATED HEREIN. IN NO CASE WILL SELLER BE LIABLE FOR CONSEQUENTIAL DAMAGES, LABOR PERFORMED IN CONNECTION WITH REMOVAL AND REPLACEMENT OF THE SENSOR SYSTEM, LOSS OF PRODUCTION OR ANY OTHER LOSS INCURRED BECAUSE OF INTERRUPTION OF SERVICE. A NEW WARRANTY PERIOD SHALL NOT BE ESTABLISHED FOR REPAIRED OR REPLACED MATERIAL, PRODUCTS OR SUPPLIES. SUCH ITEMS SHALL REMAIN UNDER WARRANTY ONLY FOR THE REMAINDER OF THE WARRANTY PERIOD ON THE ORIGINAL MATERIALS, PRODUCTS OR SUPPLIES.

B. With respect to products purchased by consumers in the United States for personal use, the implied warranties including but not limited to the warranties of merchantability and fitness for a particular purpose, are limited to twenty four (24) months from the date of delivery.

Some states do not allow limitations on the duration of an implied warranty, so the above limitation may not apply to you. Similarly, some states do not allow the exclusion or limitation of consequential damages, 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.



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