INSTRUCTION MANUAL

AquiStar® T32

1-Wire® Smart Sensor
(32 Channel Temperature)

AquiStar™
Data Collection Systems

INW™

True data, measure by measure

Table of Contents

Introduction

What is the T32 Smart 1-Wire® Temperature Sensor?

The AquiStar® T32 Smart 1-Wire® Temperature Sensor is a submersible pH/temperature sensor and datalogger combined in one small diameter unit. The T32 records 61,000 to 698,000 records (depending on the number of 1-Wire sensing units), operates on low power, and features easy-to-use software with powerful features.

The T32 measures temperature using low-cost, highly accurate 1-Wire technology. Up to 32 sensing units can be attached to any one T32 recording unit.

The T32 Smart Sensor is powered with two AA alkaline batteries or with an auxiliary power supply for data intensive applications. The unit is programmed using a laptop or desktop Windows® based computer via its RS485/RS232 adaptor and INW's Aqua4Plus software. Once programmed, the unit will measure and collect data on a variety of time intervals. Direct read registers are also available on the T32, so you can read the temperature values using other Modbus® RTU devices.

Several T32's, or a combination of T32's and any other AquiStar Smart Sensors, can be networked together and controlled from one location, either directly from a single computer or via INW's WaveData® Wireless Data Collection System.

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.

Do's and Don'ts

Do handle the device with care.

Don't bang or drop the device on hard objects.
Don't install without the screw cap secured to the top of the tube enclosure.

Installation and Operation

Installing the T32

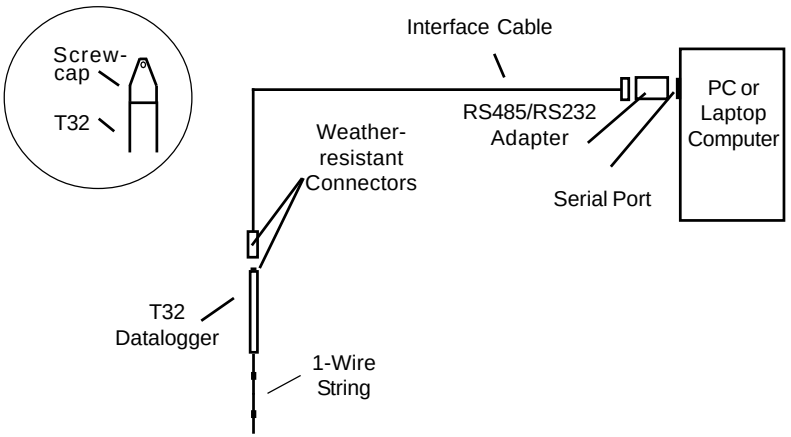
Prior to shipping your T32, INW engineers will work with you to determine the best configuration for your application. Depending on your particular application, the T32 may or may not come with the 1-Wire units connected. If they are not connected, INW will provide documentation specific to your configuration.

Connecting External Power

The T32 comes with two AA internal batteries. If auxiliary power is desired, you can use a 6 - 13 VDC supply that can provide 15 mA. See wiring information later in this manual.

Connecting the T32 to a Computer

The T32 is terminated with a weather-resistant connecter inside a screw-cap. Connect the weather-resistant connector to your PC or laptop serial port via the interface cable and an RS485/RS232 adapter, as shown below. For USB connections, see Appendix C.



Connect the sensor to your computer using the interface cable and an RS485/RS232 adapter. See Appendix C for details on connecting using a USB Port.

Installing the Aqua4Plus Software

What is Aqua4Plus?

Aqua4Plus is INW's easy-to-use Windows-based software for communicating with and controlling INW's state-of-the-art Smart Sensors.

The T32 comes with the Aqua4Plus 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 software manual for details on installing and using Aqua4Plus.

Using the T32 Without Aqua4Plus

If you want to access the T32 data via the Modbus® protocol and your own software or if you want to display readings on a panel meter, please contact INW for details.

Selecting Channels and Assigning Channel Labels

Selecting Channels

Each T32 sensor can read up to 32 1-Wire temperature sensors. By default, the software uses all 32 channels, whether or not there are sensors connected to all 32. If INW configures your system, all unused channels will be turned off. If you are configuring your own system, or if you want to change the configuration of your current system, use the Advanced Calibration option to select which channels you want to be active.

There are two advantages to turning off unused channels. First, all displays and output files will show only those you have turned on, thus eliminating extraneous data. Second, the fewer channels that are active, the more records can be stored on the sensor.

The Advanced Calibration option is only available if there are no sessions stored on the sensor. If there are any sessions stored on the sensor, upload any data you want and then erase the sessions before continuing. (Sessions Menu | Erase All Sessions)

On the sensor map, select the desired sensor. Next, select Advanced from the Configuration Menu, and then select Advanced Calibration. You will be asked for a password. The default password is admin. (This can be changed from Options Menu | Change Password.) The Advanced Calibration window will appear.

On the left there is a list of all possible channels. Click to checkmark those channels that you are using, and then click OK. (If you need to change any of the advanced calibration data, contact INW for further instructions.)

Assigning Channel Labels

Each channel on a T32 has a unique label. By default, these labels are Temperature 1, Temperature 2, etc., corresponding to the channels on the board itself. These labels display on the Real Time Monitor as well as the data and graph displays. To assign more meaningful names to each active channel, use the Field Calibration option from the Configure menu.

The Field Calibration option is only available if there are no sessions stored on the sensor. If there are any sessions stored on the sensor, upload any data you want and then erase the sessions before continuing. (Sessions Menu | Erase All Sessions)

On the sensor map, select the desired sensor, and then open the Field Calibration window. Click on each channel you want to label. Type in a name in the Channel Label field. When you finish changing the labels, click on OK.

Field Calibration

If desired, each individual channel can be calibrated using the Field Calibration option (Configure Menu | Field Calibration.) You can perform either a one- or a two-point calibration.

Calibration can only be done when there are no sessions stored on the sensor. If there are any sessions stored on the sensor, upload any data you want and then erase the session before continuing.

To do this calibration you will need an accurate temperature reference, such as a digital thermometer, and an environment where the temperature can be changed and stabilized or two different environments with two different temperatures.

Preparation:

- Run Aqua4Plus and scan for sensors.
- On the Sensor Map, click the sensor you want to calibrate.
- From the Options Menu, select the units you want to use to measure temperature, i.e., degrees Celsius, degrees Fahrenheit, or degrees Kelvin.
- From the Configure Menu, select Field Calibration.
- Click on Pressure in the left panel.

One-Point Calibration:

— Computing Calibration Value —

- Place sensor in calibration environment. Allow time for thermal stabilization.
- Using an accurate alternate measurement device, measure the temperature of the environment.
- In the ***Ref*** box for the first point, enter this temperature.
- Click first ***Measure*** button.
- When readings have stabilized to your satisfaction, click the ***OK*** button in the pop-up box.

— Applying Calibration Value —

- Click the ***Apply*** button to apply calibration value.
- The computed b value will be transferred to the calibration field.
- Click ***OK*** to save the value to the sensor.

— Verifying Calibration Value —

- Using the Real Time Monitor, take a few readings while the sensor is still at the precise known temperature. Readings should be very close to that temperature.

Two-Point Calibration:

— Compute First Calibration Point —

- Place sensor in first calibration environment. Allow time for thermal stabilization.
- Using an accurate alternate measurement device, measure the temperature of the environment.
- In the ***Ref*** box for the first point, enter this temperature.
- Click first ***Measure*** button.
- When readings have stabilized to your satisfaction, click the ***OK*** button in the pop-up box.

— Compute Second Calibration Point —

- Place sensor in second calibration environment. Allow time for thermal stabilization.
- Using an accurate alternate measurement device, measure the temperature of the environment.
- In the ***Ref*** box for the second point, enter this temperature.
- Click second ***Measure*** button.
- When readings have stabilized to your satisfaction, click the ***OK*** button in the pop-up box.

— Applying Calibration Values —

- Click the ***Apply*** button to apply calibration values.
- The computed m and b values will be transferred to the calibration fields.
- Click ***OK*** to save the values to the sensor.

— Verifying Calibration Values —

- Using the Real Time Monitor, take a few readings while the sensor is still at the second precise known temperature. Readings should be very close to that temperature.

Collecting Data

Following is a brief overview on using Aqua4Plus to collect data. Please refer to the *Aqua4Plus Instruction Manual* for further details on configuring and using Aqua4Plus.

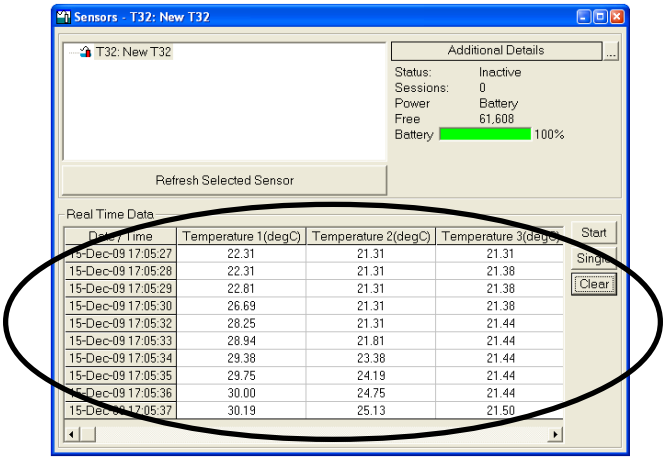
Real Time Monitor

Click Single to get a single reading.

Click Start to get a reading once a second.

Click Stop to stop the reading.

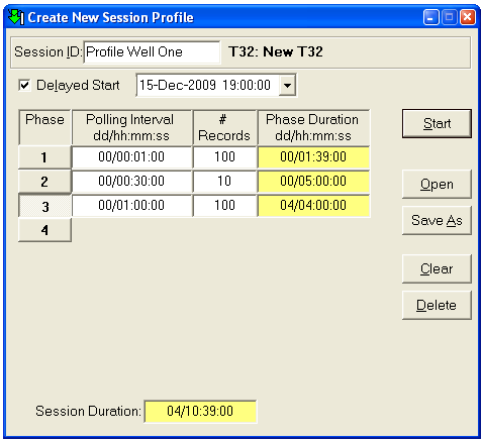
Note: These are snapshot readings and are not recorded on the sensor.



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

Setting up a Data Recording Session

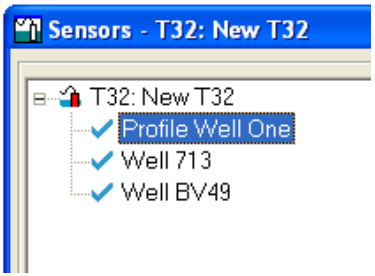
Click the tool button. A Session Profile Window will open. Refer to the *Aqua4Plus Instruction Manual* for details in describing your session profile. Click the Start button to save the session to the sensor and begin recording.



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

Retrieving Data from the Sensor/Datalogger

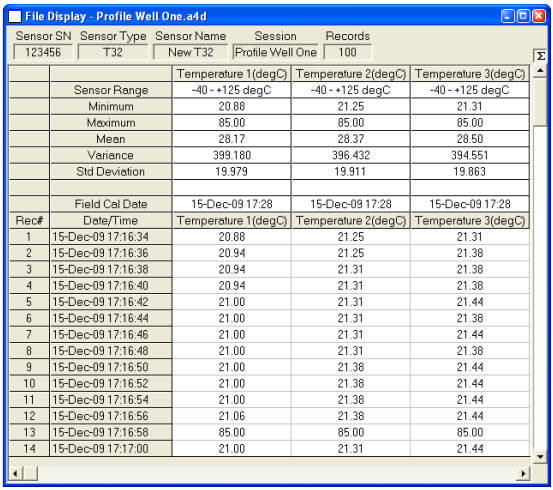
- Click on the session you want to upload.
- Click the tool button.
- Select a file location.
- Click Save.
- Click Start.



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.)

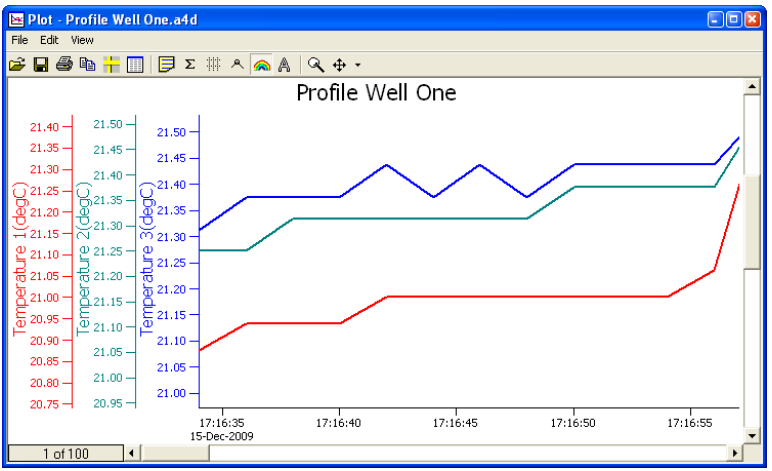


File Display - Profile Well One.a4d

Sensor SN	Sensor Type	Sensor Name	Session	Records
123456	T32	New T32	Profile Well One	100

		Temperature 1(degC)	Temperature 2(degC)	Temperature 3(degC)
	Sensor Range	-40 - +125 degC	-40 - +125 degC	-40 - +125 degC
	Minimum	20.88	21.25	21.31
	Maximum	85.00	85.00	85.00
	Mean	28.17	28.37	28.50
	Variance	399.180	396.432	394.551
	Std Deviation	19.979	19.911	19.863
	Field Cal Date	15-Dec-09 17:28	15-Dec-09 17:28	15-Dec-09 17:28
Rec#	Date/Time	Temperature 1(degC)	Temperature 2(degC)	Temperature 3(degC)
1	15-Dec-09 17:16:34	20.88	21.25	21.31
2	15-Dec-09 17:16:36	20.94	21.25	21.38
3	15-Dec-09 17:16:38	20.94	21.31	21.38
4	15-Dec-09 17:16:40	20.94	21.31	21.38
5	15-Dec-09 17:16:42	21.00	21.31	21.44
6	15-Dec-09 17:16:44	21.00	21.31	21.38
7	15-Dec-09 17:16:46	21.00	21.31	21.44
8	15-Dec-09 17:16:48	21.00	21.31	21.38
9	15-Dec-09 17:16:50	21.00	21.38	21.44
10	15-Dec-09 17:16:52	21.00	21.38	21.44
11	15-Dec-09 17:16:54	21.00	21.38	21.44
12	15-Dec-09 17:16:56	21.06	21.38	21.44
13	15-Dec-09 17:16:58	85.00	85.00	85.00
14	15-Dec-09 17:17:00	21.00	21.31	21.44

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 T32 can be displayed in various units, such as degrees Celsius, degrees Fahrenheit, or degrees Kelvin. Select the units you want from the Options | Units menu.

Appendix A: Technical Specifications

General Specification

The AquiStar® T32 is a microprocessor based digital intelligent datalogger designed to measure and record temperature, utilizing state-of-the-art low power, battery operated circuitry and 1-Wire sensor element technology.

The microprocessor on the circuit board obtains readings from the sensors, stores the data in on-board non-volatile memory, and communicates the information via a serial communication link (RS485) to the host computer or to a WaveData® Wireless network.

Wiring and Component Information

T32 Communication Connector Wiring Information:

Connector Pin		Function
1	=	Vaux (6 - 13 VDC)
4	=	Digital out (not used)
5	=	Ground
3	=	Comm D+
2	=	Comm D-

Mechanical:

Datalogger Enclosure

Dimensions	11.035" x 0.75" - cableless version 11.260" x 0.75" - cabled version
Enclosure Material	316 stainless steel or titanium
Wire Seal Materials	Viton® and PTFE/FEP
Weight	.80 lbs.

Sensor String Cable

OD	0.25" maximum
Break Strength	100 lbs.
Maximum Length	325 feet
Weight	4 lbs. per 100 feet

Operating Specifications:

Accuracy	±0.2° C (at 25° C)
Resolution	0.1 ° C
Temperature Range	-40° C to +125° C

Power Supply

Internal	2 AA Alkaline batteries
Auxiliary	6 - 13 VDC, 15 mA

Appendix B: Changing Batteries

Because changing the batteries involves opening the water-tight seal, **this must be done in a clean, dry environment to avoid contamination or moisture damage to the circuitry.**

The T32 uses two standard AA Alkaline batteries.

Opening the Housing

Open the housing by removing the top-cap, as outlined below. The top-cap is the connector between the tube housing the datalogger and the screw cap covering the communication port.

1. Push down and then twist gently to unscrew the top-cap.
2. Gently separate the top-cap from the body of the tube. Top-cap remains attached to body via several colored wires.

Caution! Pulling forcefully on the top-cap can pull out the insides or snap the connections inside. Removing the circuit board **may void your warranty.**

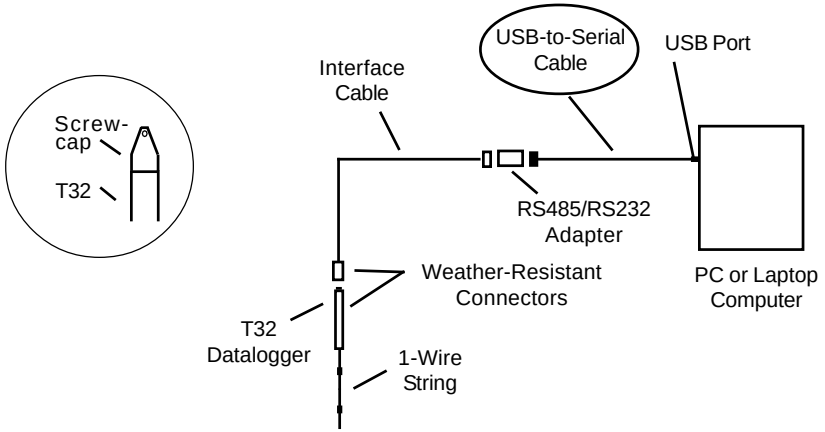
Note: O-rings provide a water-tight seal for the sensor housing. Take care not to nick or otherwise damage these O-rings.

Replacing the Batteries

3. Tip housing over and gently slide batteries out.
4. Insert new batteries - **positive terminals towards top cap**.
5. Replace and retighten top cap.

Appendix C: Using USB-to-Serial Cables

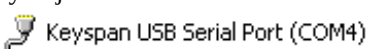
The standard communication cable/RS485-232 adapter that comes with the Smart Sensor plugs into a 9-pin serial port on the PC or laptop. Many new computers, especially laptops, do not come with 9-pin serial ports. If you have one of these computers, or if all of your serial ports are in use, you can connect to a Smart Sensor using a USB-to-serial cable, as shown below.



Connect the sensor to your computer using the interface cable, an RS485/RS232 adapter, and a USB-to-Serial cable. (See Installation section earlier in this manual if you want to connect via a serial port.)

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 or on the Internet. Install as follows:

- Plug into USB port.
- Install the drivers provided with the particular unit. (If using Windows® Vista or Windows® 7, you will need to download the Vista drivers from Keyspan's web site at www.tripplite.com/en/support/downloads.)
- 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: 

  - Close Manager.

- Connect to the T32.
- On the Aqua4Plus software, select the COM port noted above. (If you do not see your new COM port in the drop-down box, open the Communications dialog box from the Options menu. Increase the Highest COM port number.)

Reordering Information

For sales & service offices, please contact:

Instrumentation Northwest, Inc.
www.inwusa.com
800-776-9355

LIMITED WARRANTY/DISCLAIMER - AquiStar® T32 SMART TEMPERATURE 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 ONE (1) year 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 twelve (12) 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.

INW
8902 122nd Avenue NE
Kirkland, WA 98033 USA
425-822-4434
FAX 425-822-8384 / info@inwusa.com

1-800-PRO-WELL
WWW.INWUSA.COM