



**Instrumentation  
Northwest, Inc.**

Protecting our water resources since 1982

Reading

**AquiStar<sup>®</sup>**

**Smart Sensors**

**With a PD865 Meter**

**INSTRUCTION  
MANUAL**

---

# Table of Contents

Introduction .....	3
What is a PD865 Meter for Reading AquiStar® Smart Sensors? .....	3
Initial Inspection and Handling .....	3
Do's and Don'ts .....	3
Currently Supported Sensors .....	4
Setup .....	5
Installing the Aqua4Plus Software .....	5
Setting Display Units .....	5
Setting Baud Rate in the Smart Sensor .....	6
Connecting the Sensor to the Meter .....	7
Power Connection .....	8
Operation .....	8
Meter Settings .....	8
Slave ID .....	9
Register Number .....	10
Polling Interval .....	11
Decimal Point Placement .....	11
Appendix A - Specific Smart Sensor Settings .....	12
PT2X Pressure Sensor - firmware 1.5 .....	12
PT2X Pressure Sensor - firmware 2.1 or above .....	12
CT2X Conductivity Sensor .....	12
T32 Temperature Sensor .....	12
Appendix B - Display Units - Alternate Method .....	13
Changing Display Units on the Meter .....	13
PT2X Pressure Sensor .....	14
CT2X Conductivity Sensor .....	15
T32 Temperature Sensor .....	16
Appendix C - Meter Reset and Configure .....	17
Meter Reset .....	17
Complete Meter Configuration .....	18
Reordering Information .....	20
Limited Warranty/Disclaimer - PD865 Meter for Reading AquiStar® Smart Sensors .....	21

Information in this document is subject to change without notice and does not represent a commitment on the part of the manufacturer. No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose without the express written permission of the manufacturer.

---

## **Introduction**

---

### **What is a PD865 Meter for Reading AquiStar® Smart Sensors?**

This is a Precision Digital PD865 RS485 Modbus® meter that is specially configured to read AquiStar® Smart Sensors.

The meter is available in either an 85 - 265 VAC version for wired-in power or in a 12 VDC version for remote or portable usage.

The meter comes installed in a weatherproof Nema 4X enclosure with an external port for connecting to an AquiStar® Smart Sensor.

AquiStar® Smart Sensors are combination sensors and dataloggers in small diameter packages. These industry standard digital RS485 interface devices record hundreds of thousands of records, operate with low power, and feature easy-to-use software with powerful features. Refer to specific sensor instruction manuals for further details.

---

### **Initial Inspection and Handling**

Upon receipt of your meter, 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. If concealed damage is found, immediately file a claim with the carrier.

---

### **Do's and Don'ts**

*Do* handle the device with care.

*Don't* install the device so that the box or connector is submerged.

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

---

## Currently Supported Sensors

Currently, the PD865 supports reading from several Aquistar Smart Sensors. (New sensors are being added, so check with your INW representative if you need other measurements.) Currently supported sensors are listed below.

<b>Sensor</b>	<b>Minimum Sensor Firmware</b>	<b>Minimum Aqua4Plus Software</b>	<b>Measures</b>
PT2X	1.5	1.8.4	Pressure, Temperature
PT2X	2.1	1.8.410	Temperature, Pressure
CT2X	1.5	1.8.402	Temperature, Conductivity, Pressure
T32	0.9	1.8.407	Temperature

### Determining Firmware and Software Versions

If you are unsure of your firmware version, determine the version as follows:

- Connect your sensor directly to your computer. (Refer to the Aqua4Plus instruction manual for information on connecting your sensor to your computer.)
- Run Aqua4Plus and scan to locate your sensor. If more than one sensor is connected, be sure to highlight the correct one.
- Click on the button in the upper right corner of the sensor window. The firmware version will display in the drop-down information box.

If you are unsure of your software version, determine the version as follows:

- Run Aqua4Plus
- Click on the Help menu, and then select About. The software version will display on a popup window.

If you do not have the correct software or if your sensor does not have the correct firmware, contact INW for information on obtaining the correct versions. Note that some older sensors may require a hardware upgrade before the current firmware can be installed.

---

## Setup

---

### Installing the Aqua4Plus Software

All Aquistar® Smart Sensors come with the Aqua4Plus host software that is installed on your PC or laptop. This software is used 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.

---

### Setting Display Units

#### PT2X

The PT2X by default uses the following units:

- Temperature    Degrees Celsius
- Pressure        PSI

If you want to change to different units, for example, degrees Fahrenheit for temperature or meters of water for pressure, set these units now, using Aqua4Plus, as shown on next page.

Note: for PT2X units with firmware lower than 2.2, see Appendix B for setting display units in the meter, instead.

#### CT2X

The CT2X by default uses the following units:

- Temperature    Degrees Celsius
- Pressure        PSI
- Conductivity    uS/cm

If you want to change to different units for temperature or pressure, for example, degrees Fahrenheit for temperature or meters of water for pressure, set these units now, using Aqua4Plus, as shown on next page.

If you want to change to different units for conductivity, see Appendix B for setting these display units in the meter, instead.

Note: for CT2X units with firmware lower than 2.2, see Appendix B for setting display units in the meter, instead.

#### T32

The T32 always displays temperature in degrees Celsius

- Connect your sensor to your computer.
- Run Aqua4Plus (Be sure that you have Aqua4Plus version 1.8.5 or later. Also, be sure you have the correct sensor firmware versions, as described above.)
- Scan for and click on your sensor.
- Click on the Configure menu, and then select Advanced.
- From the flyout menu, select Direct Read Units. If you do not see this option, be sure your sensor is running the correct firmware.
- On the popup box, click the down-arrows next to Temperature and Pressure, and then select the units you want to use on the meter. (Note, this does not affect the units used on the Aqua4Plus display. Refer to the Aqua4Plus software manual for details on using Aqua4Plus.)
- Click OK.

---

### **Setting Baud Rate in the Smart Sensor**

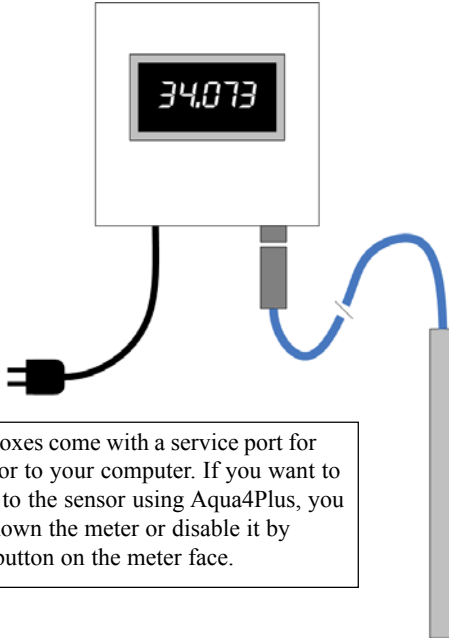
The PD865 meter is set to communicate at 19,200 baud. The normal baud rate for a Smart Sensor is 38,400. The sensor supplied with your meter has been set to 19,200. If you will be using another sensor, you will have to set the baud rate in that sensor before connecting to the meter, as follows:

- Connect your sensor to your computer.
- Run Aqua4Plus (Be sure that you have the correct Aqua4Plus and sensor firmware versions. See the Introduction section of the manual for more details.)
- Scan for and click on your sensor.
- Click on the Configure menu, and then select Advanced.
- From the flyout menu, select Sensor Baud Rate. If you do not see the baud rate option, be sure your sensor is running the correct firmware.
- On the popup box, click the down-arrow and select 19,200, and then click OK.

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

- Click the Options menu, and then select Baud Rate.
- On the popup box, click the down-arrow and select 19,200, and then click OK.

## Connecting the Sensor to the Meter

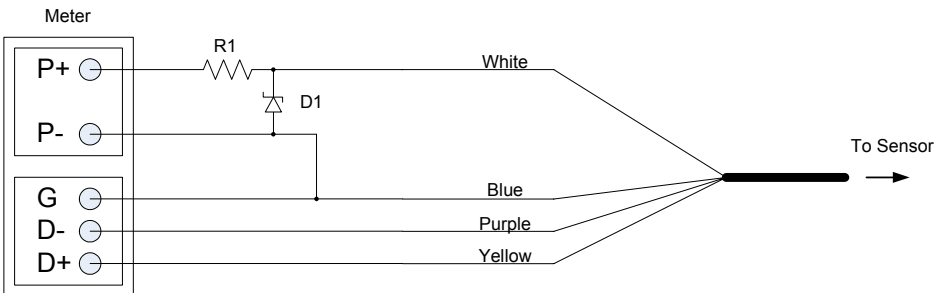


Note: Some meter boxes come with a service port for connecting the sensor to your computer. If you want to use this port to talk to the sensor using Aqua4Plus, you must either power down the meter or disable it by pressing the Menu button on the meter face.

*Connect the sensor to the meter using the round 5-pin connector.*

The sensor comes with a male weather resistant connector. Connect this to the mating connector on the bottom of the meter enclosure. The sensor has internal AA batteries, but will draw power from the meter whenever it is plugged in.

If you purchased your meter without the mating connector you can directly wire it to the meter. (See drawing below.) Note, however, that the weather resistant connector on the sensor is needed for communication with Aqua4Plus for starting recording sessions and uploading data, if you are planning on using your sensor to record data.



R1 = Res, Carbon Film, 1200 ohm, 5%, 1/2W  
D1 = Diode, Zener, 12V, 5%, 1W, DO-41, 1N4742A

---

## Power Connection

INW does not supply a power connection. It is up to the client and their engineers to wire the power connection.

Meter manufacturer power specifications:

AC: 85 - 265 VAC, 50/60 Hz, 15 Watts

Recommended fuse: 1 A, 250V, slow-blow

Wire: Copper with 60° C or 60/75° C insulation



**Caution!**

Observe all safety precautions. To ensure safety and prevent damage to the meter, wiring should be done by a qualified technician in accordance with all local, state, and federal guidelines.

---

## Operation

Your PD865 meter comes preconfigured to read your specific Aquistar® Smart Sensor. Once the meter is powered and the sensor is connected, the meter should immediately begin displaying readings. See Appendix A for specific sensor details.

---

## Meter Settings

Although your meter comes preconfigured, there may be times when you want to change some of the settings. The meter is controlled via four buttons on the front of the meter face:



**MENU**



**RESET**



**MAX**



**ACK**









*Use the meter control buttons to make setting changes on your meter.*



The most common settings are detailed in the following sections. For complete settings, see Appendix C.

## Slave ID

The Slave ID is the sensor address assigned to your sensor. You can find this address on the calibration sheet that came with your sensor. Alternately, you can view your sensor with Aqua4Plus. Roll the mouse over the sensor in the sensor tree. A popup box will display the sensor address.

If you need to reset the address in the meter, do so as follows:









<u>Press</u>	<u>Display or Action</u>
	mode
	maSt r
	FunCod
 2 times	SLAU.id
	Id.PU I
	Change sensor address here
	rEG.nbr
	Sensor begins reading

To change a value on the meter, use the  to select the digit you want to change. Use the  to cycle through acceptable values.

## Register Number








---

The meter reads a particular register (memory) address on the sensor in order to display a reading. The sample below shows registers for a PT2X rev 1.5. See Appendix A for a complete list of sensors and their registers. In this example, the PT2X has two registers – one for pressure and another for temperature. The meter can read only one register, so you must enter the register for the reading you want to obtain. The meter comes preconfigured to read pressure. If you want to read temperature, you must set the meter to read the correct register, as shown below.

<u>Press</u>	<u>Display or Action</u>
	mode
	mASt r
	Funcod
 3 times	rEG.nbr
	rEG.PU 1
	Enter register to read
	462593 for pressure
	462595 for temperature
	DATA. 1
	Sensor begins reading











## **Polling Interval**

The polling interval controls how often the meter queries the sensor for a new value. The meter comes preconfigured with a two second polling interval. You can change this interval as follows:

<u>Press</u>	<u>Display or Action</u>
	modE
	mAStr
	FunCod
 5 times	t-Poll
	Change polling interval here
	t-rESP
	Sensor begins reading

## **Decimal Point Placement**

The meter can display a maximum of six digits and comes preconfigured to best match your specific sensor. For example, a PT2X comes preconfigured to display pressure as three digits followed by three decimal places, e.g., 154.925. You can change the number of decimal places as follows:

<u>Press</u>	<u>Display or Action</u>
	modE
 2 times	ProG
	DISP.dP
	Adjust decimal place by pressing  as needed
	Flot.dP
	Adjust decimal place by pressing  as needed
	ScALE
	Sensor begins reading

## Appendix A - Specific Smart Sensor Settings

Each Smart Sensor measures different parameters in various different registers. This section will give details pertinent to the PT2X, the CT2X, and the T32. See also the Introduction section on required firmware and software for these sensor models.

A table below for each sensor gives details on the following:

- Parameter to read
- Register number to read
- Default units for that parameter
- Suggested number of decimal places for that parameter

If you want to change the default units for a particular parameter, see Appendix B. If you want to change the number of decimal places for a particular parameter, see the previous section on Decimal Point Placement.

---

### PT2X Pressure Sensor - firmware 1.5

Parameter to read	Register Number	Default Units	Suggested number of decimal places
Pressure	462593	PSI	3
Temperature	462595	Degrees Celsius	1

---

### PT2X Pressure Sensor - firmware 2.1 or above

Parameter to read	Register Number	Default Units	Suggested number of decimal places
Temperature	462593	Degrees Celsius	1
Pressure	462595	PSI	3

---

### CT2X Conductivity Sensor

Parameter to read	Register Number	Default Units	Suggested number of decimal places
Temperature	462593	Degrees Celsius	1
Conductivity (linear)	462595	microSiemens/cm	1
Conductivity (non-linear)	462597	microSiemens/cm	1
Pressure	462599	PSI	3

---

### T32 Temperature Sensor

Though the T32 has 32 channels of temperature data, the current version will only read the first 16 channels with the PD865. Watch for updates from INW.

















Parameter to read	Register Number	Default Units	Suggested number of decimal places
Temperature (Ch 1)	462593	Degrees Celsius	1
Temperature (Ch 2)	462595	Degrees Celsius	1
↓	↓	↓	↓
Temperature (Ch 16)	462623	Degrees Celsius	1

## Appendix B - Display Units - Alternate Method

Each Smart Sensor comes configured to display readings in certain units. On PT2X and CT2X sensors with firmware 2.2 or higher, you can select the units for temperature and pressure using Aqua4Plus before connecting to the meter. (See page 5 in this manual.) For older PT2X and CT2X units and for conductivity on all CT2X units, see the rest of this section on how to change units.

The chart below gives information on how to change display units on the meter. The following sections give specific details for the PT2X and the CT2X. Note that the T32 always displays in degrees Celsius.

### Changing Display Units on the Meter

<u>Press</u>	<u>Display or Action</u>
	modE
 2 times	PrOG
	DISP.dP
 2 times	ScALE
	INP 1
	Enter value for Input 1
	DIS 1
	Enter value for Display 1
	INP 2
	Enter value for Input 2
	DIS 2
	Enter value for Display 2
	INP 1
	SAVE ? Flashes
	RELAy
	Sensor begins reading

## PT2X Pressure Sensor

---

### Pressure on all firmware versions less than 2.2

The PT2X comes configured to display pressure in PSI and temperature in degrees Celsius. If you continue to use these units, you do not need to make any changes in the display units. You can change between pressure and temperature simply by changing the register number, as described in a previous section of this manual. You cannot change display units for temperature, however if you want to use other units for pressure, read the following sections.

#### *Pressure*

If you want to display pressure in feet of water or meters of water, set the input and display parameters according to the following chart. (When using alternate units, you cannot measure higher than 500 PSI without also changing the decimal place.)

<b>Units</b>	<b>Input 1</b>	<b>Display 1</b>	<b>Input 2</b>	<b>Display 2</b>
PSI (Default)	-199.999	-199.999	999.999	999.999
Feet H2O	-10.000	-23.070	299.999	692.098
Meters H2O	-10,000	-7.031	299.999	210.926

#### *Changing Between Pressure and Temperature*

Temperature will always display in degrees Celsius. If you are using PSI for pressure, you can simply switch between pressure and temperature by changing the register number.

However, if you have been using other than PSI for pressure and you now want to read temperature, you must set the display units per the chart below. Failure to do this will result in erroneous temperature readings. If you switch back to pressure (other than PSI), you must reset for pressure units again.

<b>Units</b>	<b>Input 1</b>	<b>Display 1</b>	<b>Input 2</b>	<b>Display 2</b>
Default	-199.999	-199.999	999.999	999.999

---

## CT2X Conductivity Sensor

### Pressure on all firmware versions less than 2.2, and conductivity on all firmware versions

The CT2X comes configured to display temperature in degrees Celsius, conductivity in micro-Siemens per centimeter, and pressure in PSI. If you continue to use these units, you do not need to make any changes in the display units. You can change between parameters simply by changing the register number, as described in a previous section of this manual. You may also want to change the decimal place if making pressure readings.

You cannot change display units for temperature, however if you want to use other units for conductivity or pressure, read the following sections.

#### *Pressure*

If you want to display pressure in feet of water or meters of water, change the decimal place to three, and set the input and display parameters according to the following chart. (When using alternate units, you cannot measure higher than 500 PSI without also changing the decimal place to two or one.)

<b>Units</b>	<b>Input 1</b>	<b>Display 1</b>	<b>Input 2</b>	<b>Display 2</b>
PSI (Default)	-199.999	-199.999	999.999	999.999
Feet H2O	-10.000	-23.070	299.999	692.098
Meters H2O	-10,000	-7.031	299.999	210.926

#### *Conductivity*

If you want to display conductivity in milli-Siemens per centimeter set the input and display parameters according to the following chart. Be sure the decimal place is set to one.

<b>Units</b>	<b>Input 1</b>	<b>Display 1</b>	<b>Input 2</b>	<b>Display 2</b>
uS/cm (Default)	-199.999	-199.999	999.999	999.999
mS/cm	-19999.9	-00019.9	99999.9	00099.9

---

### *Changing Between Pressure and Temperature*

Temperature will always display in degrees Celsius. If you are using PSI for pressure, you can simply switch between pressure and temperature by changing the register number.

However, if you have been using other than PSI for pressure and you now want to read temperature, you must set the display units per the chart below. Failure to do this will result in erroneous temperature readings. If you switch back to pressure (other than PSI), you must reset for pressure units again.

<b>Units</b>	<b>Input 1</b>	<b>Display 1</b>	<b>Input 2</b>	<b>Display 2</b>
Default	-199.999	-199.999	999.999	999.999

### *Changing Between Conductivity and Temperature*

Temperature will always display in degrees Celsius. If you are using micro-Siemens per centimeter for conductivity, you can simply switch between conductivity and temperature by changing the register number.

However, if you have been using other than micro-Siemens per centimeter for conductivity and you now want to read temperature, you must set the display units per the chart below. Failure to do this will result in erroneous temperature readings. If you switch back to conductivity (other than micro-Siemens per centimeter), you must reset for conductivity units again.

<b>Units</b>	<b>Input 1</b>	<b>Display 1</b>	<b>Input 2</b>	<b>Display 2</b>
Default	-199.999	-199.999	999.999	999.999

### *Changing Between Conductivity and Pressure*

If you are using micro-Siemens per centimeter for conductivity and PSI for pressure, you can simply switch between conductivity and pressure by changing the register number. You will want to change the decimal place to one for conductivity and three for pressure.

However, if you have been using other than micro-Siemens per centimeter for conductivity or PSI for pressure and you now want to switch between them, you must set the display units per the respective conductivity or pressure charts above. Failure to do this will result in erroneous readings.

---

## **T32 Temperature Sensor**

The T32 always displays temperature in degrees Celsius.

---

## Appendix C - Meter Reset and Configure



---

### Meter Reset

On occasion the meter can get into a state where you are unsure what it is doing. This can happen if a mistake is made while changing settings or if someone else has used the meter for some other purpose. It is often easier to set the meter back to factory defaults than to determine exactly what has changed.

Follow the steps below to set the meter back to factory defaults:


Press and hold 

Press  while still holding 

Hold until displays `FUNC`





















Press  6 times until says `Info`



Press and hold 

When display flashes `RESET`, press 

## Complete Meter Configuration

The meter is controlled via four buttons on the front of the meter face. Though your meter comes preconfigured, if it should ever need to be completely reset, follow the instructions below:









<u>Press</u>	<u>Display or Action</u>
	modE
	mAStr
	FunCod
	Fun 03
	PU.nbr
	1
	SLAU.Id
	Id-PU 1
	Change to match sensor address.
	rEG.nbr
	 until reads 6 dig
	rEG.PU 1
	Enter register to read
	See Appendix A for register numbers for your specific sensor.
	dAtA. 1
	 until reads FL0At
	1234
	t-Poll
	Enter 02.0 (2 second polling interval)

To change a value on the meter, use the  to select the digit you want to change. Use the  to cycle through acceptable values.

If other than 1, set to 1.

(Continued on next page.)









(Continued from previous page.)

<u>Press</u>	<u>Display or Action</u>
	t-rESP
	0.50 (Meter waits 5 seconds for response)
	SERIAL
	bAud
	 until reads 19200
	PARITY
	 until reads 00
	 until reads 1 Stop
	t-BYTE
	0.01
	PrOG
	DISP.dP
	Adjust decimal place by pressing  until reads ddd.ddd
	Flot.dP
	Adjust decimal place by pressing  until reads ddd.ddd
	SCALE
	InP 1
	- 199.999
	dis 1
	- 199.999

Alternately, adjust decimal places to best match your data type. See Appendix A for more details.

(Continued on next page.)

(Continued from previous page.)

<u>Press</u>	<u>Display or Action</u>
	INP 2
	999.999
	DIS 2
	999.999
	INP 1
	SAVE ? Flashes
	RELAY
	Sensor begins reading

*Further Information:*

If you need further information on the meter capabilities or settings, you can download the meter manual from [www.predig.com/download.asp?File=360](http://www.predig.com/download.asp?File=360)

---

## **Reordering Information**

For sales & service offices, please contact:

**Instrumentation Northwest, Inc.**

[www.inwusa.com](http://www.inwusa.com)

**800-776-9355**

---

## **LIMITED WARRANTY/DISCLAIMER - PD865 Meter for Reading Aquistar® Smart Sensors**

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.



[www.inwusa.com](http://www.inwusa.com)

Please visit INW's Web site to learn more about our products and services.

Copyright© 1997 - 2010 by Instrumentation Northwest, Inc. All rights reserved.  
Instrumentation Northwest and INW are trademarks registered with the  
U.S. Patent & Trademark Office.

Printed on recycled paper.

Doc# 9B0951r5 06/2010



## **Instrumentation Northwest, Inc.**

**8902 122nd Avenue NE**

**Kirkland, WA 98033**

**(425) 822-4434 • (425) 822-8384 (fax)**

**(800) 776-9355 • [www.inwusa.com](http://www.inwusa.com)**