



# Thermo Scientific AquaPro

**Multi-Input Process Transmitter**

**Thermo**  
SCIENTIFIC

The specifications, descriptions, drawings, ordering information and part numbers within this document are subject to change without notice.

This publication supersedes all previous publications on this subject.

## Preface

This instruction manual describes the use of the Thermo Scientific AquaPro Transmitter Platform and is written to cover as many applications as possible. Please do not hesitate to contact Thermo Fisher Scientific or an authorized representative with questions or concerns.

The information presented in this instruction manual is subject to change without notice as improvements are made, and does not represent any commitment whatsoever on the part of Thermo Fisher Scientific.

Thermo Fisher Scientific cannot accept any responsibility for damage or malfunction of the product due to improper use.

## Contact Information

To contact Thermo Scientific Technical Support:

Within the United States call 1.800.225.1480 or fax 978.232.6015.

Outside the United States call 978.232.6000 or fax 978.232.6031.

Email to [WLP.ProcessSupport@thermofisher.com](mailto:WLP.ProcessSupport@thermofisher.com)

In Europe, the Middle East and Africa, contact your local authorized dealer.

Visit us on the web at [www.thermofisher.com/processwater](http://www.thermofisher.com/processwater)

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# 1

## SECTION 1 Introduction

### General Information

Thank you for purchasing the Thermo Scientific™ AquaPro™ Transmitter.

The product is designed for continuous use in industrial process applications and complies with safety regulations currently in force. Improper use could lead to hazards for the user or a third-party, and/or adverse effects to the plant or other equipment.

Thermo Fisher Scientific does not accept any liability for damage that may arise if information in this manual is not followed. Therefore, the operating instructions and specifications must be read and understood by all persons involved in installation and operation of this equipment.

This user manual identifies safety instructions and additional information by means of the following symbols:



This symbol draws attention to **safety instructions and warnings of potential danger**, which if neglected, could result in injury to persons and/or damage to property.



This symbol identifies **additional information and instructions**, which if neglected, could lead to inefficient operation and possible loss of production.

It is recommended that this user manual be made accessible to everyone who may need it as a reference.

Please contact Thermo Fisher Scientific or an authorized representative with any questions.

## Intended Use

The Thermo Scientific AquaPro Transmitter is designed to monitor and control up to four in-line measurement points with all Thermo Scientific™ DataStick™, AnalogPlus™ and RDO® process sensors.

Other prerequisites for appropriate use include:

- Follow the instructions, notes and requirements set out in this or updated instruction manuals.
- Observing all local safety regulations.
- Observing all warnings and cautions in the documentation regarding all products used in this measurement system, including the sensor, mounting hardware, AquaPro electronics and cabling.
- Observing the prescribed environmental and operational conditions.
- Verifying chemical compatibility with all wetted materials.

## Non-Intended Use

Any other use, or use not mentioned here, that is incompatible with the technical specifications is deemed inappropriate. The operator is solely responsible for any damage arising from such use.

## Safety Instructions



The AquaPro Transmitter should be installed and operated only by personnel familiar with the sensors and qualified for such work.

A defective AquaPro Measurement System should be returned to Thermo Fisher Scientific for repair or replacement. Contact Thermo Fisher Scientific Technical Service Department to obtain a Return Material Authorization (RMA) number.

No unauthorized modifications to the AquaPro Transmitter are allowed. The manufacturer/supplier accepts no responsibility for damage caused by unauthorized modifications. The risk is borne entirely by the user.

**Do not power** the Transmitter without a sensor cable being connected as specified in the Sensor Parameter Wiring Section of the Manual. Failure to do so may result in permanent damage to the system or its components.



Protection against electric shock will be achieved only by following the corresponding installation instructions.

SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A,B,C AND D HAZARDOUS LOCATIONS, OR NONHAZARDOUS LOCATIONS ONLY.



**CAUTION:** Before using or maintaining this product, please be sure to read the manual carefully. Failure to follow these instructions may cause the product to malfunction.



**CAUTION:** Use this product only in the way described in the product literature and in this manual. Before using it, verify that this product is suitable for its intended use. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



**CAUTION:** Do not modify system components. Use OEM exact replacement equipment or parts. Before use, confirm that the product has not been altered in any way.



**WARNING:** Unauthorized repair of your unit will invalidate your warranty. Contact Technical Service at 1-866-984-3766 for additional information.



**WARNING :** EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITABLE CONCENTRATIONS.



**WARNING :** EXPLOSION HAZARD - SUBSTITUTION OF ANY COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.



**WARNING :** EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE SEALED RELAY DEVICE.

## Construction Details

Devices shall be constructed in accordance with Section General and the following description.

**Tolerances** - Unless specific otherwise, all dimensions are nominal.

**Connectors** - All use connectors are described in the Description area of the Report. Connectors not described are not to be used in the construction of Models evaluated.

**Make/Break Components** - All make and break components are either in non-incendive circuits or are considered as non-arching components as described.

**Corrosion Protection** - All parts are of corrosion resistant material or are suitably plated,

painted or otherwise protected against corrosion.

**Printed Wiring Boards** - R/C (ZMPV2) rated V-1 and suitable for direct support with a temperature rating of 105 C minimum.

**Fuses** - All fuses are soldered into place unless specifically mentioned in the description. They are not subject to overloading.

**Spacings** - The device complies with spacing requirements of UL/ CSA61010-1, 2nd edition table 4.

## Removal from Service / Correct Disposal of the AquaPro Transmitter

### Removal from Service

- Disconnect the cable wiring from the Transmitter terminal block.
- Remove the AquaPro from the mounting hardware.

### Correct Disposal of Unit

- When the AquaPro is taken out of service, observe the local environmental regulations for correct disposal.

# 2

## SECTION 2 Product Description

### System Overview



The AquaPro is an on-line liquid analytical measurement platform that supports up to four sensors in an outdoor rated enclosure. The enclosure can be mounted in a ½ DIN panel, U-bolted to a pipe or mounted on a wall. Six conduit mounting holes are available for wiring.

The large color graphics display makes it easy to view measurements over a wide range of environmental conditions. There is a USB data port that is accessible from the front panel to transfer data, auto-configure the system setup or to upgrade the operating software with new features..

AquaPro Configuration Options offer flexibility to meet your needs today and tomorrow, including:

- Sensors: Up to 4 analog or digital sensor measurements that currently include options for pH, ORP, DO, conductivity, turbidity, ozone, suspended solids, free chlorine and others. All sensors include provisions to measure temperature.

- **Calculated Measurements:** When two sensors, pH or Conductivity, that measure the same parameter are installed, math functions can be configured on a “fifth channel.”
- **Current Outputs:** There are two current outputs provided with each sensor input. Up to eight outputs are supported. Outputs can be configured for either 0 to 20 mA or 4 to 20 mA only in both linear and log formats. Outputs can also be setup for PID control for pH or conductivity channels.
- **\*Relays:** Up to six 1 Amp Form C relays are supported. Three relays are standard with every AquaPro configuration. If additional relays are required, an optional Relay Card, with 3 relays, can be added to the AquaPro. All relays are programmable and can be driven by any sensor or temperature input in the system for alarm or control functions. The relays can additionally be programmed as wash timers or set as error indicators.
- **\*Host Communications:** The Transmitter can be optionally configured to operate remotely through Modbus®, Ethernet IP, Ethernet TCP/IP, and others.
- **Data and Event Logging:** Internal data storage will support a minimum of 20,000 data points across four sensors. Data can easily be downloaded as a .CSV file via front USB port for analysis using a spreadsheet .
- **Interface:** Color graphics display with seven button navigation.
- **Enclosure:** For outdoor or indoor use with panel, pipe and wall mount capability. The AquaPro Transmitter uses a ½ DIN panel standard and has up to six conduit fittings for routing cable.

\* Note: A maximum of three sensors may be used when six relays or host communications features are installed.

## AquaPro Transmitter Platform Sensor Compatibility

The AquaPro Transmitter supports the following measurements intended for in-line and on-line analytical process applications.

Parameter	AnalogPlus Sensor	Digital DataStick
Chlorine (Free – Amperometric ppm)		✓
Conductivity (Two Electrode)	✓	✓
Conductivity (Toroidal)	✓	✓
Dissolved Oxygen (Amperometric ppm)	✓	✓
Dissolved Oxygen (Optical ppm)		✓
Dissolved Oxygen (Amperometric ppb)		✓
ORP/Redox	✓	✓
Ozone (ppm)	✓	✓

Parameter	AnalogPlus Sensor	Digital DataStick
pH	✓	✓
Suspended Solids		✓
Turbidity (Low Range 0 to 100 NTU)		✓
Turbidity (High Range 0 to 2000 NTU)		✓

As additional capabilities become available, software updates can be saved to a USB stick. It is an easy upload through the USB port on the AquaPro front door panel—without removing the mounted AquaPro from the wall. Simply unscrew the Data/USB cover with a coin to access the port.

Parameter measurement ranges for the sensors are listed below.

Measurement	Range	Resolution	Units
pH	0 to 14 pH	0.01 pH	pH
ORP	+/- 2000 mV	1 mV	mV
Toroidal	0 to 2 S/cm	1 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
1.0 2-cell Conductivity	0 to 2000 $\mu$ S/cm	0.1 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
0.1 2-cell Conductivity	0 to 500 $\mu$ S/cm	0.01 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
0.05 2-cell Conductivity	0 to 250 $\mu$ S/cm	0.01 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
0.01 2-cell Conductivity	0 to 50 $\mu$ S/cm	0.001 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
RDO Pro Optical DO	0 to 20 ppm; 0 to 500% saturation	0.1 ppm	ppm, % saturation
DO (ppm)	0 to 40 ppm	0.1 ppm	ppm, % saturation
DO (ppb)	0 to 20 ppm	1 ppb; 0.001 ppm	ppb, ppm, % saturation
Low Turbidity	0 to 100 NTU	0.001 NTU	NTU
High Turbidity	0 to 2000 NTU	0.1 NTU	NTU
Ozone	0 to 10 ppm	0.1 ppm	ppm
Free Chlorine	0 to 10 ppm	0.01 ppm	ppm
Suspended Solids	0 to 15,000 ppm, mg/L	1ppm, mg/L	ppm, mg/L, %
Temperature**	-5 to 200°C	0.1°C	°C/°F

\*\*Note: Temperature type is selectable from PT1000, PT100, NTC300, NTC30K, or Manual. The default element is PT1000.



## NOTES:

1. Derived Measurement functions are available when two conductivity or two pH measurements are configured.
2. Host communication and relay option cards in Channel 4 slot only.

## AquaPro Transmitter Installation

### Mounting

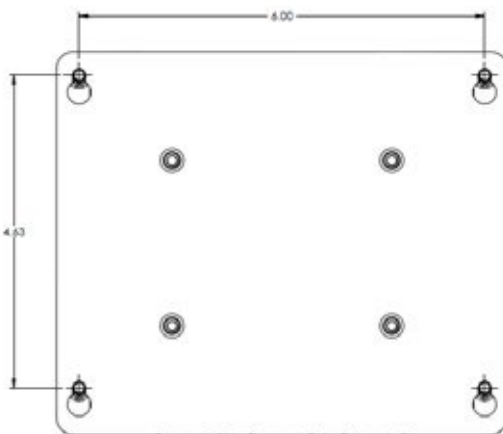
The AquaPro Transmitter can be mounted on a wall with a standard mounting plate and four screws. The surface wall mounting kit is supplied with the standard Transmitter. A ½ DIN panel mount kit (AP0PANKT) or a pipe mount kit (AP0PIPKT) can be ordered separately. Mounting instructions must be followed to maintain environmental seal integrity.

### Wall Mount

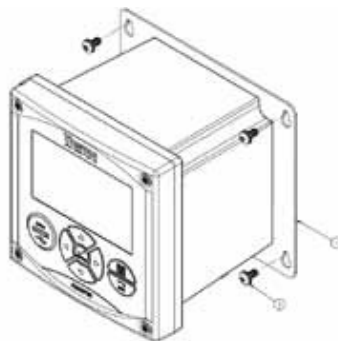
The AquaPro Transmitter comes with a wall mounting plate.

To mount the enclosure on a wall:

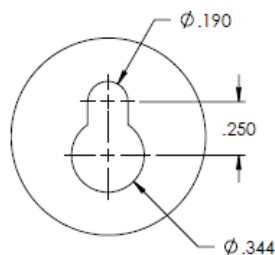
1. Fasten the plate to the back of the Transmitter. The screws are spaced 6 inches apart horizontally and 4.63 inches apart vertically.



2. Place the Transmitter where it is to be mounted on the wall and mark the corner holes for drilling. Install anchors in the wall and screw the plate down with four # 10 screws.



- The mounting holes are designed so that when loosening the screws, the mounting plate can slide up for easy removal.



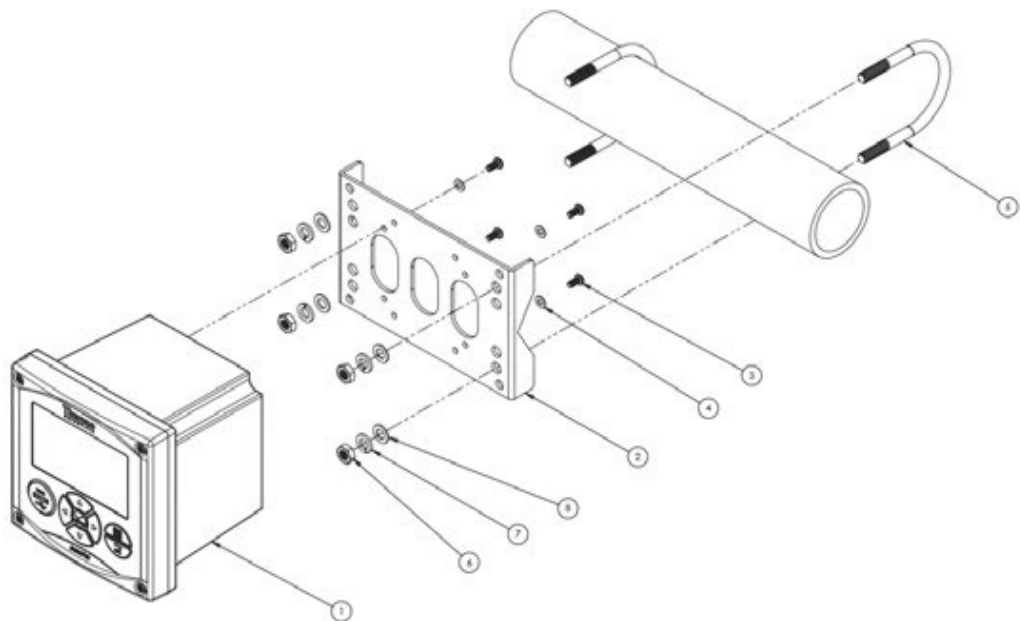
- The enclosure extends 5.0 inches from the wall.

### Pipe Mount Kit (Cat. No. AP0PIPKT)

The pipe mount accessory kit is ordered separately and provides the hardware needed to mount the AquaPro on a vertical or horizontal pipe. The hardware will accommodate pipe diameters between 1 inch and 2 inches.

The AP0PIPKT consists of:

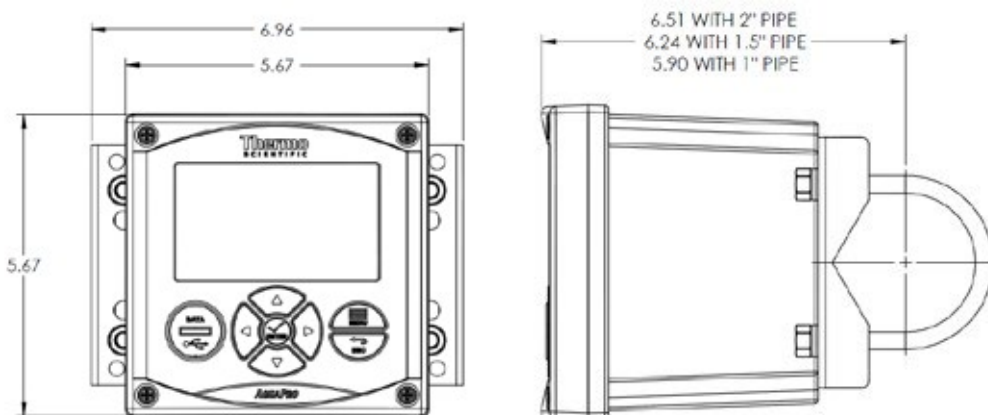
- One Pipe/Panel Mounting Plate
- Four #8 Screws and four small washers to fasten the mounting plate to the AquaPro.
- Four 5/16 inch nuts, four washers and four lock washers to fasten two U-Bolts to the mounting plate.
- Two U-Bolts for pipe mounting 1.5 inch 2 inch diameter pipe.
- Two U-Bolts for pipe mounting 1 diameter pipe.



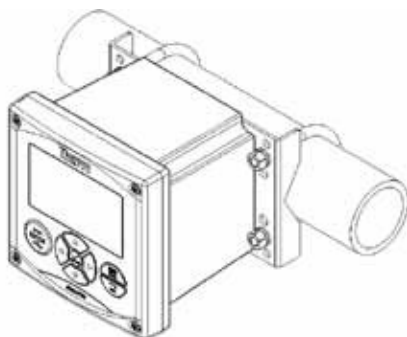


1. Assemble the mounting plate (**item 2**) with the AquaPro (**item 1**) using four #8 screws (**item 3**) and four washers (**item 4**). Position the bracket as shown in the exploded view figure when mounting to a horizontal pipe run. When mounting to a vertical pipe run, rotate the mounting bracket 90 degrees before mounting it to the monitor.
2. Place the mounting plate and AquaPro assembly on the pipe. The pipe should rest in the V-notches on the mounting plate.
3. The mounting kit includes four U-bolts. Use the larger U-bolts when mounting to a 2" or 1-1/2" pipe. Use the smaller U-bolts when mounting to a 1" pipe.
4. Secure the mounting plate/AquaPro assembly to the pipe with the appropriate sized U-bolts (**item 5**). Use two 5/16" nuts (**item 6**), two small washers (**item 7**) and two large washers (**item 8**) for each U-bolt to secure the AquaPro to the pipe. Only finger-tighten the nuts at this point, do not wrench-tighten them.
5. Rotate the monitor to the desired position and wrench-tighten the nuts that secure the U-bolts.

Clearances for the pipe mount assembly are shown:



## Horizontal Pipe Mounting



Install the mounting plate on the AquaPro in the horizontal position for horizontal pipe mounting.

## Vertical Pipe Mounting

Install the mounting plate on the AquaPro in the vertical position



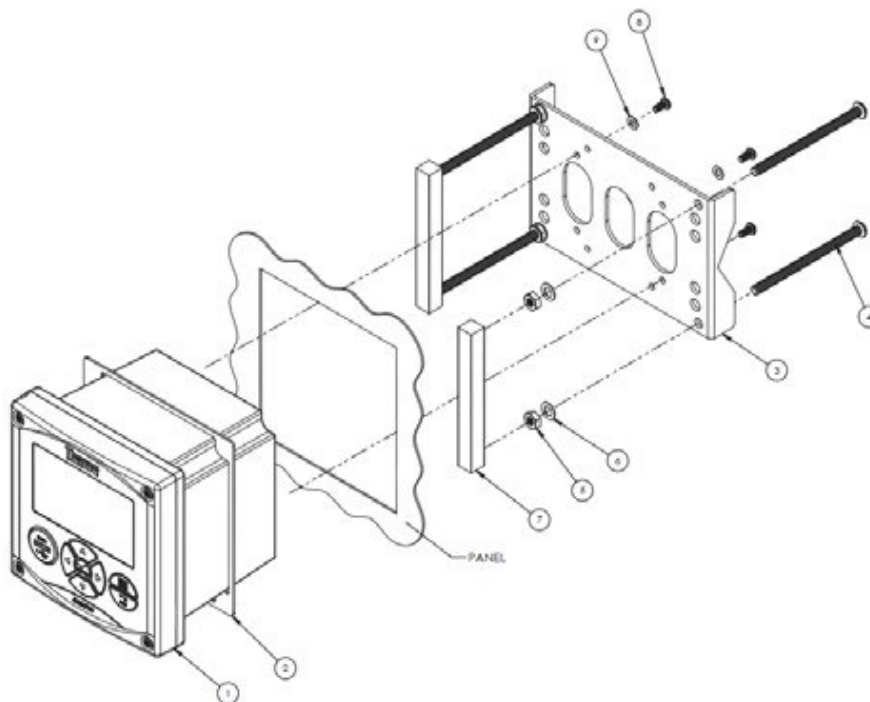
for vertical pipe mounting.

### Panel Mount Kit (Cat. No. AP0PANKT)

The panel mount accessory kit is ordered separately and provides the hardware needed to mount the AquaPro in a ½ DIN panel cutout.

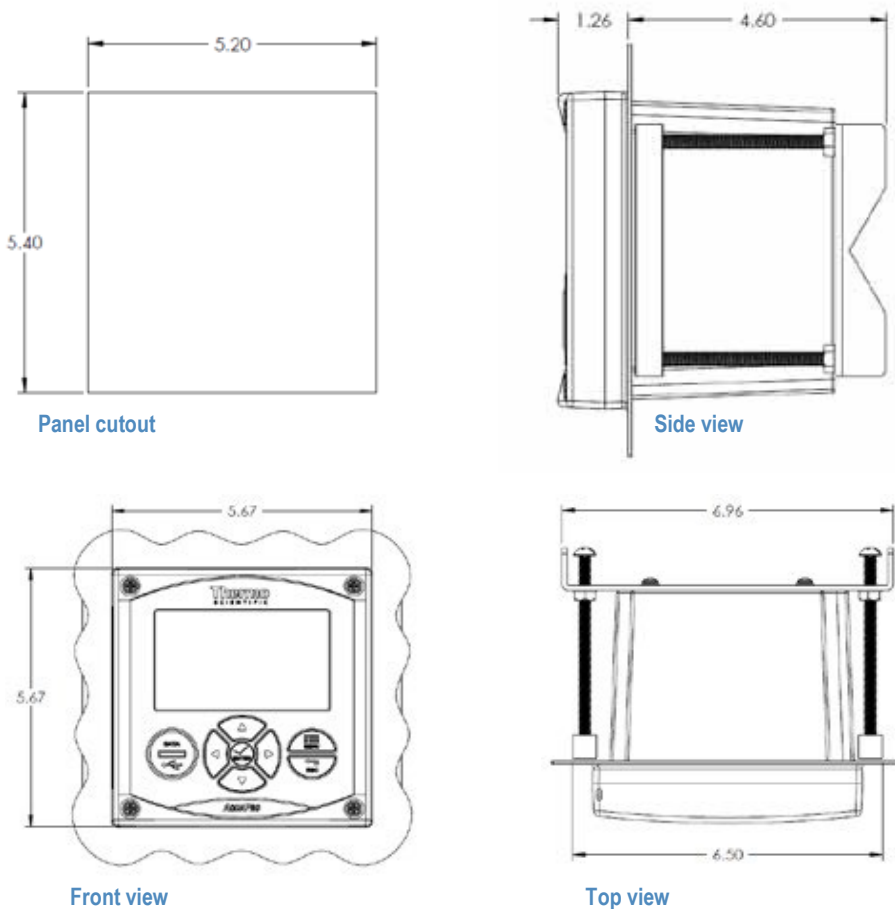
The Panel Mount Kist (AP0PANKT) consists of:

- One Pipe/Panel Mounting Plate
- One face gasket
- Four ¼ inch jack screws
- Four ¼ inch nuts and washers (one set per jack screw)
- Two jack screw clamp bars
- Four #8 Screws and four small washers to fasten the mounting plate to the AquaPro.



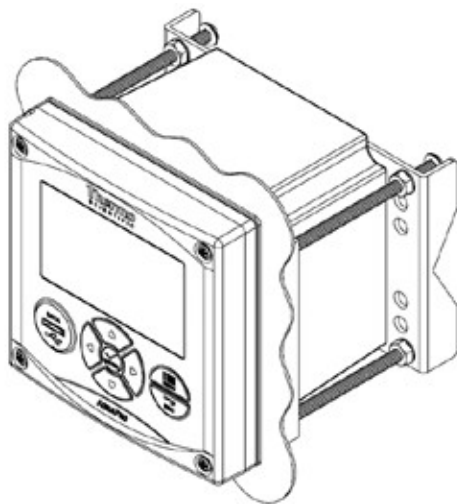
1. Cut an opening in the panel – 5.2 inches on the horizontal and 5.4 inches on the vertical.
2. Insert the 1/4" jackscrews (**item 4**) into the mounting bracket (**item 3**).
3. Slide the 1/4" washers (**item 6**) and loosely thread the 1/4" nuts (**item 5**) approximately halfway onto the jackscrews.
4. Assemble the clamp bars (**item 7**) to the ends of the jackscrews. Align the threaded holes on the clamp bars with the jackscrews and thread the jackscrews into the clamp pads until they are hand tight.
5. Slide the gasket (**item 2**) onto the monitor housing (**item 1**).
6. Assemble the AquaPro into the panel opening from the front side of the panel.
7. Attach the mounting plate (**item 3**) to the back of the monitor housing and secure the two parts with four #8 screws (**item 8**) and four washers (**item 9**).
8. Push jackscrews (**item 4**) until the clamp pads (**item 7**) are tight against the back surface of the panel.
9. Tighten the 1/4" nuts (**item 5**) against the mounting bracket (**item 3**) to secure the clamp pads to the back of the panel.

Clearances for the panel mount assembly are shown below:



## Final Panel Mount Assembly

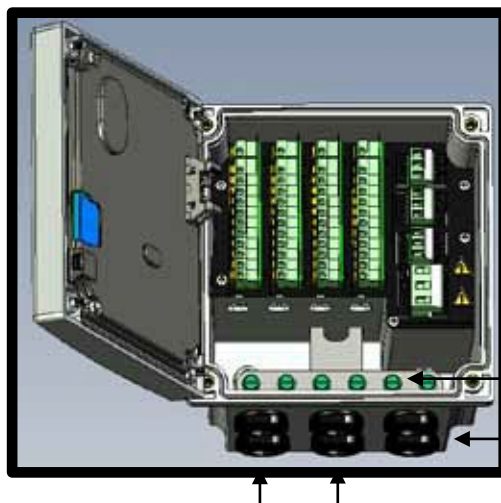
Jack Screws are tightened against the nuts and mounting plate as shown.



## Power, Relay and Current Loop Wiring

### Conduit Hole Preparation

1. Six conduit plugs are installed in the AquaPro enclosure when it is shipped from the factory. These plugs are o-ring sealed and can be removed with a 5/16 inch Allen wrench or a 15/16 inch spanner wrench. Interior nuts are not needed to install plugs or cord grips. To route cables into the box, the appropriate plugs should be replaced with cord grips (included) or conduit that are sized to fit 13.5pg conduit holes. There is a metal plate on the inside wall which will make a direct Earth Ground connection to metal conduit when metal conduit nuts are used.



Earth Ground Plate for conduit ground connection

Two conduit holes for Power and Relays

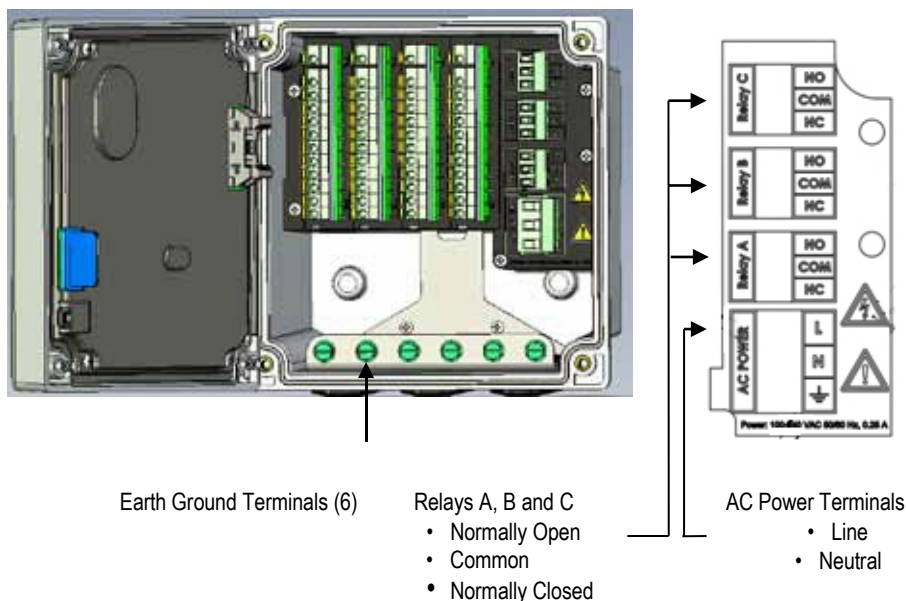
Four conduit holes for sensors and outputs

2. Power cables and relay cables should be routed through the two conduits on the right side of the box. Sensor communications and current output cables should be routed through the four conduit openings on the left side of the box as shown.
3. Dress the sensor wires so they lay between the wiring labels.
4. Stow excess cable in the space below the cards. Bunching cables above the cards is not recommended.

## Wire Termination

### Power Supply Wiring:

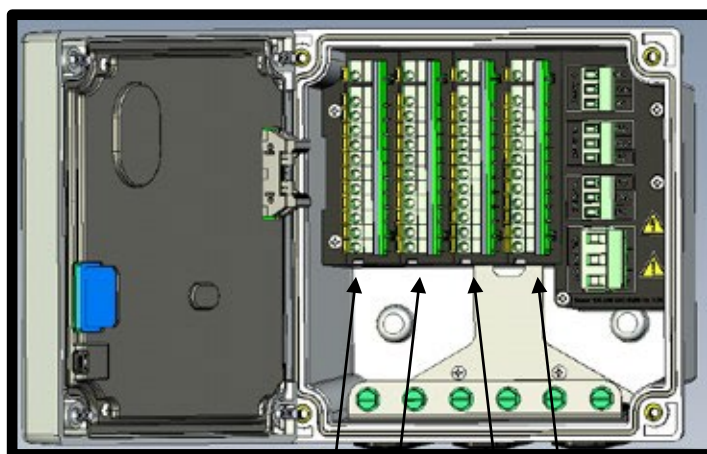
1. **WARNING:** Before wiring any high voltage/current cables, make sure that the power is off at the source and that the cables are not live.  
**WARNING :** EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITABLE CONCENTRATIONS.  
**WARNING :** EXPLOSION HAZARD - SUBSTITUTION OF ANY COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.
2. Pass the power and relay cable through the conduit. Use conduit holes on the right side of the unit (when facing the unit as shown).
3. The power and relay terminal blocks are pluggable and should be removed to insert wires.



4. Connect the power line and neutral onto the AC power block.
5. Connect the power ground to the Earth Ground Terminal.

## Sensor Wiring:

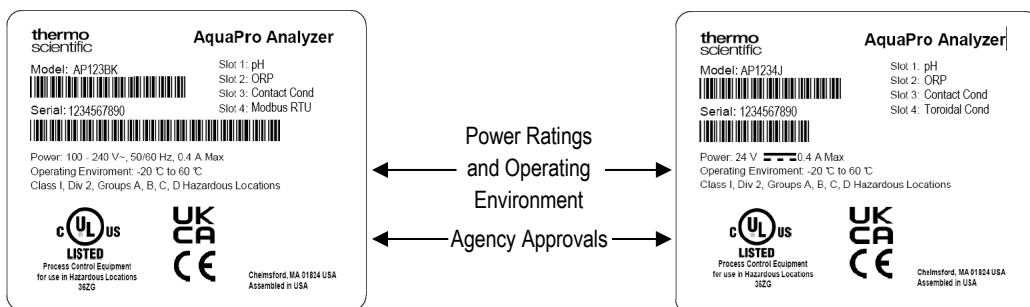
1. Verify that the sensor type and the measurement at the top of the card label are correct.
2. Press down the wire chart, attached to the right of the terminal block, to read the wiring instructions.
3. Locate the wiring label at the end of the sensor cable or use wiring diagram supplied with sensor wire to match its function.
4. Install the sensor cable wires by depressing the tabs on the side of the appropriate terminal block with a small flat blade screwdriver. Insert the bare wire and remove the screw driver.
5. Gently pull on the wire to be sure that it is secure in the terminal block.



Slot 1 Slot 2 Slot 3 Slot 4 ← Sensor and Special Function Card Slots 1- 4

## Card Types

Cards can be inserted into slots 1 through 4 as needed by the customer. The product label identifies the way that the product was configured at time of manufacture.



It is possible to replace cards in the field when service is required and it also possible to add card functions after installation.

**WARNING :** Do not remove the cards during the process of normal installation and wiring. **The terminal blocks are designed to be wired in place.**

## Sensor Parameter Wiring

### Analog Sensor - pH, ORP, Ozone, Dissolved Oxygen (Amperometric)

For correct wiring, bend the wire cable tag over to identify function or wire color.

- Sensor: Match function or wire color list to wire cable tags or label on the cable itself.
- Current Outputs: Both outputs use a single “common” terminal.

### Combination pH Sensor Wiring

Standard Thermo Scientific Combination pH Sensors with Standard PT1000 Temperature Elements. Orion ATC probe, 2001TM, can be used for electrodes without integrated ATC.

Pin No.	Label Description	Thermo Scientific Process ROSS	Thermo Scientific Process ROSS with pre-amp	Thermo Scientific 2001SC pH
12	Active	Clear Wire	Red Wire	Clear Wire
11	Shield		Clear Wire	
10	Process Ground	Green Wire	Black Wire	Red Wire
9	Reference	Black Wire	Green Wire	Black Wire
8				
7	Temp Comp	Red Wire	Yellow Wire	Green Wire
6	Temp Low	White Wire		White Wire
5	Power (+)		Blue Wire	
4	Power (-)		White Wire	
3	mA Out 1			
2	Output Common			
1	mA Out 2			

### Differential pH Sensor Wiring

Standard Thermo Scientific Differential pH Sensors use an NTC300 or PT1000 temperature element that must be set up in software.

Sensors: AnalogPlus SP and FP Sensors

Pin No.	Label Description	Sensors with NTC300 (temp type-8)	Sensors with PT1000 (temp type-9)
12	Active	Red	Red
11	Shield	Shield	Shield
10	Process Ground	Black	Black
9	Reference	Green	Green
8			
7	Temp Comp	Yellow	Yellow
6	Temp Low		
5	Power (+)		Blue
4	Power (-)	White	White
3	mA Out 1		
2	Output Common		
1	mA Out 2		

### Differential ORP Sensor Wiring

Standard Thermo Scientific Differential ORP Sensors use an NTC300 or PT1000 temperature element that must be set up in software.

Sensors: AnalogPlus SR and FR Sensors

Pin No.	Label Description	Sensors with NTC300 (temp type-8)	Sensors with PT1000 (temp type-9)
12	Active	Red	Red
11	Shield	Shield	Shield
10	Process Ground	Black	Black
9	Reference	Green	Green
8			
7	Temp Comp	Yellow	Yellow
6	Temp Low		
5	Power (+)		Blue
4	Power (-)	White	White
3	mA Out 1		
2	Output Common		
1	mA Out 2		



## AnalogPlus Ozone Sensor Wiring

Standard Thermo Scientific Ozone Sensors are set up with PT1000 temperature elements.

Sensors: AnalogPlus SZ31 Ozone sensor family

Pin No.	Label Description	SZ31 Ozone Sensors
12	Sense	Red
11	Shield	Shield
10		
9		
8	Drive	Green
7	Temp Comp	Yellow
6	Temp Black	Black
5	Power (+)	Blue
4	Power (-)	White
3	mA Out 1	
2	Output Common	
1	mA Out 2	

## AnalogPlus Dissolved Oxygen Sensor Wiring

Standard Thermo Scientific Dissolved Oxygen Sensors are set up with PT1000 temperature elements.

Sensors: AnalogPlus SD31 Dissolved Oxygen sensor family

Pin No.	Label Description	SD31 Dissolved Oxygen Sensors
12	Sense	Red
11	Shield	Shield
10		
9		
8	Drive	Green
7	Temp Comp	Yellow
6	Temp Black	Black
5	Power (+)	Blue
4	Power (-)	White
3	mA Out 1	
2	Output Common	
1	mA Out 2	

## Analog Sensor - Two-electrode Conductivity/Resistivity and Toroidal Conductivity

For correct wiring, bend over wire cable tag to identify function or wire color.

- Sensor: Match function or wire color to wire cable tags.
- Current Outputs: Both outputs use a single “common” terminal.

### AnalogPlus Toroidal Conductivity Sensor Wiring

Standard Thermo Scientific Toroidal Conductivity sensors are set up with PT1000 temperature elements.

Sensors: AnalogPlus ST Toroidal Conductivity sensor family.

Pin No.	Label Description	Toroidal Conductivity
11	Drive 1	White
10	Drive 2	Blue
9		
8	Sense	Green
7		
6	Shield	Shield
5	Temp Comp	Red
4	Temp Low	Yellow
3	mA Out 1	
2	Output Common	
1	mA Out 2	

### AnalogPlus Two Electrode Contacting Conductivity Sensor Wiring

Standard Thermo Scientific Two Electrode Conductivity sensors are set up with PT1000 temperature elements.

Sensors: AnalogPlus SC, KC, BC, Two Electrode sensor families.

Pin No.	Label Description	Two Electrode Contacting Conductivity	Thermo Scientific 2002SS
11	Drive	Red	Green/Blue
10			
9	Sense	Black	Red/Orange
8			
7			
6	Shield	Shield	
5	Temp Comp	Blue	Black
4	Temp Low	White	White
3	mA Out 1		
2	Output Common		
1	mA Out 2		

### DataStick Sensor Wiring

**DataStick Digital Sensor Systems:** pH, ORP, contacting conductivity, toroidal conductivity, dissolved oxygen (ppm), trace dissolved oxygen (ppb), free chlorine, ozone, low range turbidity, high range turbidity, suspended solids. All of these digital sensors are connected to the DataStick card.

Pin No.	Label Description	DataStick
8	+24 VDC	Red
7	Ground	Black
6	Comms (+)	White
5	Comms (-)	Blue
4	Shield	Shield
3	mA Out 1	
2	Output Common	
1	mA Out 2	

## RDO Pro Sensor Wiring

Thermo Scientific's Optical dissolved oxygen sensor with digital communications.

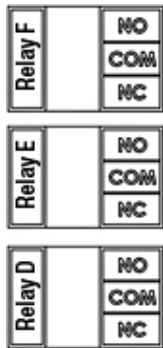
Pin No.	Label Description	RDO Pro
8	+24 VDC	Red
7	Ground	Black
6	Comms (+)	Blue
5	Comms (-)	Green
4	Shield	Shield
3	mA Out 1	
2	Output Common	
1	mA Out 2	

Note: The Comms (+) and Comms (-) are different colors than the DataStick connection

## Relay Wiring

### Relay Card

- Remove the terminal block from the desired relay and wire to the common contact (COM) and to either the normally open contact or the normally closed contact.
- Plug the terminal block into the card.



Relays D, E and F

- NO = Normally Open Contact
- COM = Common Contact
- NC = Normally Closed Contact

## Host Communications Wiring

### Host Digital Communications Cards

When installed, the Host Comms card provides a means for a remote computer to take control of the measurement system – to report data directly or to remotely diagnose setup or calibrate the system.

Please refer to the appropriate Host Comms manual for programming, routing and operation.

The AquaPro currently supports one of the following communications protocols as described in the sales order configuration guide on page 13.

- A Host Communications with Modbus 232 (no longer available)
- B Host Communications Modbus RTU (RS-485)
- C Host communications Ethernet IP, TCP/IP, Modbus TCP.
- D Host Communications DeviceNet (no longer available)
- E Host Communications CANopen (no longer available)

After connections are made, communication is established through the Host Computer. There is nothing to set up in the AquaPro menu system.

The specific communication protocol being used is described on the AquaPro product label on the outside of the case.

### Wiring for Modbus RTU (RS-485)

The AquaPro does not provide external power to the communications cable. The ground connection between the AquaPro and the host computer should be made first.

Pin No.	Label Description (RS-485)
7	
6	
5	Shield
4	
3	Comms A (-)
2	Comms B (+)
1	Ground

### Wiring for Modbus 232 (RS-232) (no longer available)

The AquaPro does not provide external power to the communications cable. The ground connection between the AquaPro and the host computer should be made first.

Pin No.	Label Description (RS-232)
7	
6	
5	Shield
4	
3	RX
2	TX
1	Ground

### Wiring for DeviceNET or CANopen (no longer available)

The AquaPro does not provide external power to the communications cable. The ground connection between the AquaPro and the host computer should be made first. The wiring is the same for DeviceNET and CANopen protocols.

Pin No.	Label Description (DeviceNET)	Pin No.	Label Description (CANopen)
7	Ground	7	Ground
6	CAN_L	6	CAN_L
5	Shield	5	Shield
4	CAN_H	4	CAN_H
3		3	
2		2	
1		1	

### Wiring for Ethernet

An RJ45 jack is provided on the Host Comms card when the Ethernet protocol is configured. The AquaPro supports several Ethernet protocols including Ethernet/IP, TCP/IP, Modbus TCP, HTTP, PC3.

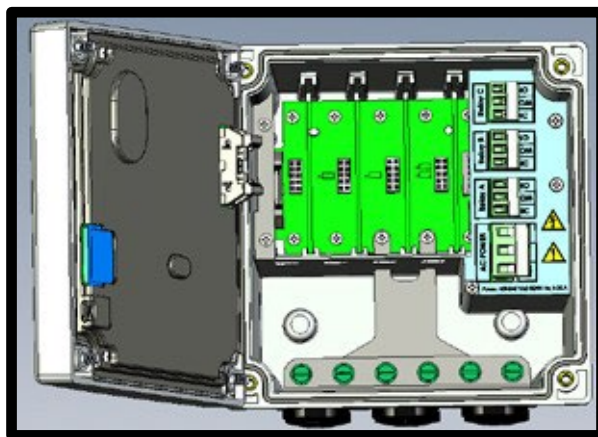
## Field Replacement /Addition of Sensor Scaling and Special Function Cards

When servicing the AquaPro in the field, cards can be removed or inserted. When doing so, it is recommended that the AquaPro power is off.

Cards should never be removed just to connect wires to the terminal blocks. Terminal block wiring should be done with the cards installed.

To remove an existing card or blank from a slot, gently pull on the wiring tab on the front of the card.

When all four cards and card blanks are removed from the AquaPro, the backplane and card guides are visible.



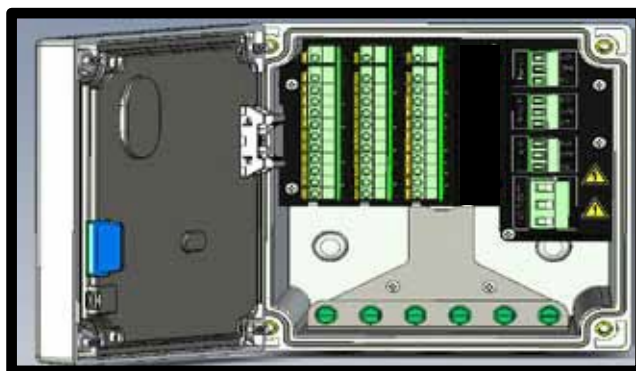
To install any Card:

1. Install sensor scaling cards from left to right without leaving any gaps. The first card goes in Slot 1 (far left); second scaling card goes in Slot 2, and so on.
2. Relay and communications cards are always inserted into Slot 4.
3. Orient the card so that the locking tab for the card is lined up with the interior wall of the AquaPro.
4. Line up the edges of the card so that they slide into the Slot card guide.



If there is an empty card slot in the AquaPro unit, the cards in a higher number slot would not be read, nor be viewable, on the main display.

The following image shows the AquaPro system with three scaling cards installed (from left to right). The fourth card slot has a card blank installed and is available for field upgrade to a fourth sensor, a Host comms card or a relay expansion card.



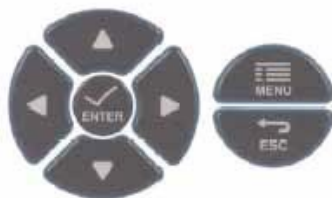
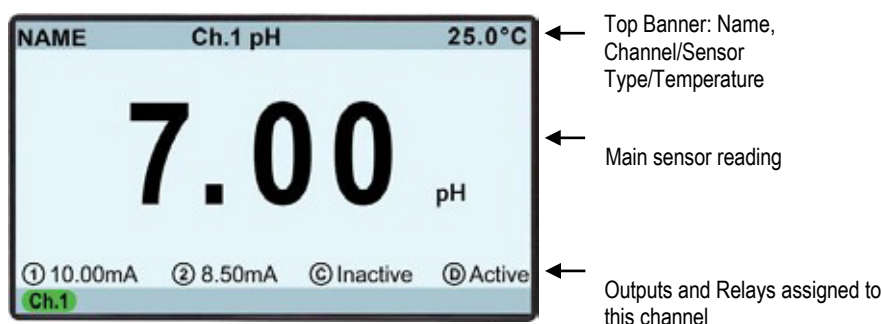
## Measure Screen Overview

The AquaPro has a large color graphics display and 7 keys for menu navigation.

When powering up the unit, the graphics screen will display the multi-channel measurement parameters.

If other channels are configured, press the RIGHT and LEFT arrows to select other single parameter measurement screens and combined measurement screens.

The information contained on the measure screen is organized as follows:



The top line banner displays a User Entered Channel "NAME" to the left, the channel and measurement type in the center and the temperature on the right. By default the "NAME" is blank.

The bottom line banner displays the status of all channels system along with time and date. A channel with a green background is operating normally. A channel with a yellow background has a diagnostic issue. The most common would be that the sensor should be calibrated. A channel with a red background is disconnected or not working.

When a sensor card or Digital DataStick sensor of the same type is replaced in the AquaPro, current output, PID and relay settings are maintained. If a sensor module of a new type is installed, these settings are automatically set to default conditions appropriate to the new parameter.





Single channel view



Two channel view



Three channel view



Four channel view

# 3

## SECTION 3 **Software Menus and Navigation**

Menus are accessed by pressing the MENU key (highlighted in Gray).



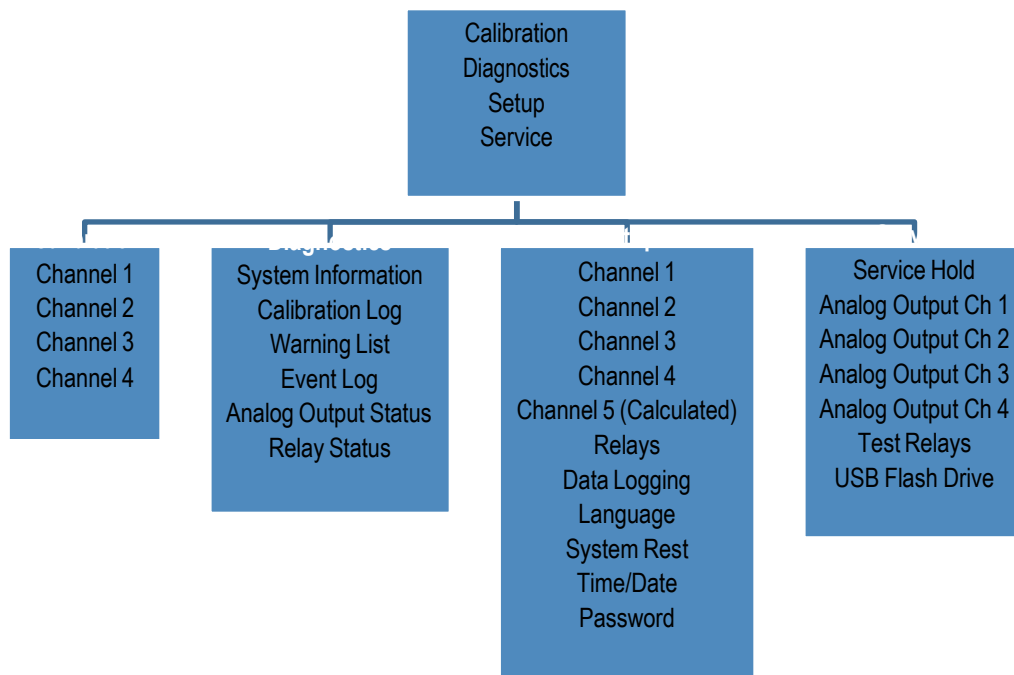
Select the appropriate Up, Down, Left, and Right Arrows to highlight to your selection.

Press ENTER to select the highlighted selection and access the available menus and tasks.

Use the UP/DOWN arrow keys to scroll through the list of Menu options.

Use the ENTER key to select an option.

Use the ESC key to move up in the structure and back into the MEASURE screens.



The **Main Menu** has four selections: Calibration, Diagnostics, Setup, and Service.

- **Select Calibration:** For all sensor and temperature calibration functions in the system. Displayed a list of the installed Channels with their measurement parameter and an optional name, such as process or location, if added by the user.
- **Select Diagnostics:** To display System Information, Calibration Log, Warning List, Event Log, Analog Output Status, and Relay Status.
- **Select Setup:** To set up the sensor cards installed in the Transmitter, listed by Channel 1 through 4 and Channel 5 (Calculated); only used where either 2 pH or 2 contacting conductivity probes require calculated functions. Relays, Data Logging, Language, System Reset, Time/Date, and Passwords settings are configured here. Default value for Enable passwords is No.
- **Select Service:** To program a Service Hold to stop all operations, or select by channel to stop current output and relays states, view Analog Output for analog sensor channels to test and calibrate current outputs, and test relays operation. Select USB to perform functions such as downloading logged data, copying configuration setups from one monitor to other monitors electronically, and loading new features into the AquaPro software. (see section 6 for more information) USB operations require the user to have a USB stick for data transfers.

Scroll to the desired Menu Tree using the UP and DOWN arrows and press ENTER.



The **Diagnostics Menu** is helpful for checking that systems are operating properly.

- **System Information:** The system information gives a list of the Front Panel Slots and what is in each slot number. The type of card is listed here – either DC scaling, AC scaling, DataStick, NONE. For each card with a probe, the probe description is listed as well.
- **Calibration Log:** The calibration log can be viewed per channel for the measurement for the active channel. The log lists the most recent calibration. The user may scroll back to see the history. All calibrations have a time and date stamp for auditing.
- **Warning List:** The warning list is a list by channel of the colored status for the channel. The list shows the detailed cause of the warning color.
- **Event Log:** The event log is a listing of the events that have occurred on each channel, sorted by date and time. Examples are On Hold, DataStick Found or Not Found, Temperature Broken, Default Calibration, Power Up, etc.
- **Analog Output Status:** The analog outputs are assigned to an Analog Output by the user. Output 1 and Output 2 are displayed for each active channel. The user can assign the output of the Sensor, Temperature, or PID. The default milliamp (mA) range is 4-20 mA, 0-20 mA is selectable in Setup. Analog output values must be directly proportional to the channel reading, i.e. the value assigned to 20mA must be greater than the value assigned to 4mA.
- **Relay Status:** Each relay in the system is listed and status is noted as Active or Inactive. Relays are identified by a capital letter starting with Relay A, Relay B, etc. Relays A, B, and C are the system relays and if a Relay Card is added relays D, E, and F will appear in the menu.

The **Setup Menu** allows the user to customize the AquaPro for their needs.

- **Channel 1 (or 2, 3, or 4):** User selects the channel of interest, presses Enter to move into the Channel 1 Setup. Each channel's options include sensor, temperature, and PID options (pH or conductivity). PID Controller setup is detailed in Section 6.

- **Calibration Setup:** Set the Calibration Interval and Buffer Set (pH) or other standardization methods corresponding to the test being performed
- **Measurement Settings:** Select the Measurement Units and the Sensor type, Show mV (yes or no), Display Resolution (X.XX), Sensor Filter (10 sec), Temperature parameters of Elements (PT1000, etc), Units (°C), and Filter (seconds).
- Channel Name
- Hold/Transfer
- Solution Compensation (Off/On)
- Channel Active (Yes, No)

The 3 other channels may be set up the same way with a few differences due to the parameter being measured.

An additional Channel, called the **Calculated Function**, can be used when two channels are measuring samples using the same sensor type. For example, if two channels are using Contacting Conductivity then math calculation can be performed on the readings. Both channels need to be on to use the Calculated Function. Currently this function only applies to pH and Conductivity measurements.

The Calculated Function Channel is not visible unless two channels with the same measurement being performed are active and running.

**Setup Menu:** for the **Calculated Function** options is listed below:

- **Sensor Units:** Automatically populated if only one pair of measurements is viable
- **Display Resolution:** Displays the resolution, based on the measurement channel data
- **Set Channel X:** Assign a channel as **Channel X**
- **Set Channel Y:** Assign a channel as **Channel Y**
- **Set Formula:** Select formula from table below

X-Y	$(X-Y)/X*100\%$
X+Y	$X/(X+Y)*100\%$
$X/Y*100\%$	
$(X+Y)/2$	
$X*Y$	

- **Channel Name:** Assign name if applicable, such as Ch5-Math
- **Channel Enabled:** Select “Yes” to enable, “No” to disable

The main menu choices are shown for an AquaPro configured with four sensors. When only one sensor card is installed, the listings in the menu will only indicate choices for one channel. Every effort is made to organize the lists with most frequently used functions first.

# 4

## SECTION 4 Calibration Menus

Calibration methods supported in the AquaPro are automatically determined depending on the sensor card installed. The software makes the calibration process very easy for the user to calibrate and get back online quickly.

The calibration process goes through a sequence of steps to configure the calibration. The step sequence is the same. Option lists are used where user must give information, such as selection to calibrate the sensor or temperature, or the number of cal points (2 or 1).

Sequence:

- Step 1: Output/Relay State during calibration (Hold, Transfer, Active)
- Step 2: Select the sensor or temperature as main parameter (Sensor or Temperature)
- Step 3: Select the type of calibration (based on sensor type)
- Step 4: Select the number of points to calibrate (based on sensor type)
- Step 5: Put the sensor in desired calibration solution and allow it to stabilize
- Step 6: Set the desired value for manual/sample calibration; this step is skipped for buffer, air, and zero calibration
- Step 7: Initiate calibration and wait for completion
- Step 8: Display will show calibration result along with slope and offset information where appropriate

When selected, all outputs and relays will remain in a hold state. This will continue throughout the calibration process and for a period of time after completion of the calibration process. This time can be varied and is found in the SETUP menu.

Calibration methods currently employed:

Calibration Type	Function	Sensors Supported
1-Point Sample	Set measured reading to desired reading. Changes offset.	All
2-Point Sample	Sets measured reading to desired reading for two points separated by more than 2 pH units. Changes slope and offset.	pH, Conductivity (100µS only)
1-Point Buffer/Standard	Automatically sets measured reading to closest buffer/standard point. Buffer/standard set is selected in the configuration menu. Changes offset.	pH
2-Point Buffer	Automatically sets measured readings to closest buffer standard. Two points need to be separated by more than 2 pH units. Buffer standard set is selected in the configuration menu. Changes slope and offset.	pH
Zero	Set measured reading to zero. Measured reading must be close to zero.	Conductivity, Turbidity, Dissolved Oxygen, RDO, Ozone, Suspended Solids
Air	Adjust measured reading to calculated reading of oxygen in air with pressure and salinity configuration settings as well as temperature reading. Assumes sensor is placed in air.	Dissolved Oxygen, RDO
Temperature 1-Point	Set measured reading to desired reading. Changes offset.	All

Calibration steps are listed below by measurement.

## pH Calibration

1. From the main measurement screen, press Menu key and select Calibration.
2. Select the pH channel you wish to calibrate.

**Note:** DataStick pH calibrations are performed using the DataStick card.

### 1-Point pH Calibration

1. Select a point for calibration that is near or at the point you are measuring. The point can be a known sample value or a buffer point.
2. Under the calibration screen, select the channel to be calibrated and press enter to start calibration. The measurement will be adjusted to the new calibration point.

### 2-Point pH Calibration

1. Select 2 points that represent the measurement range using either US buffers (4.01, 7.00, 10.01) or DIN-19267 buffers (1.09, 4.65, 6.79, 9.23, 12.75). Be sure to use fresh buffers for the greatest accuracy.

2. Perform the calibration following the screen prompts for the buffer order of measurement.
3. Slope and offset value will be displayed and saved in the calibration log.
4. A calibration timer may be set to automatically remind the user to recalibrate at the specified time interval. Default is 30 days. (Reminder interval is adjusted in the Setup menu)

## ORP (Redox) Calibration

1. From the main measurement screen, press Menu key and select Calibration.
2. Select the ORP channel you wish to calibrate..  
**Note:** DataStick ORP calibrations are performed using the DataStick card.
3. Select a standard for the ORP calibration. Do not use Orion ORP standard for the calibration as it will damage the probe. Select either 200 mV (order number ORPSOL200) or 600 mV (order number ORPSOL600), whichever is closer to your expected measurement point, or perform a sample calibration using a known sample.
4. Press enter to start calibration. The measurement will be adjusted to the new calibration point.

## Contacting Conductivity

Contacting Conductivity probes are all calibrated using Manual/Sample, Zero Calibration, or Nominal Cell Constant entry, for all cell constant values.

**Manual/Sample Calibration** uses a standard solution of known concentration or a sample solution for the calibration solution.

**Zero Calibration** is an air calibration to create a zero conductivity point.

**Cell Constant** shows the current nominal cell constant and allows the user to edit the cell constant to another value.

## 1-Point Contacting Conductivity Calibration

1. Select a point for calibration that is near or at the point you are measuring. The point can be a known standard (when using 100 $\mu$ S the AquaPro will automatically apply temperature compensation) or a known sample value.
2. Under the calibration screen, select the channel to be calibrated and press enter to start calibration. The measurement will be adjusted to the new calibration point.



After each successful calibration, the calibrated cell constant value is displayed and stored. The temperature sensor may also be calibrated.

## Toroidal Conductivity

1. Select a point for calibration that is near or at the point you are measuring. The point can be a known standard or a known sample value.
2. Under the calibration screen, select the channel to be calibrated and press enter to start calibration. The measurement will be adjusted to the new calibration point.

After each successful calibration, the calibrated cell constant value is displayed and stored. The temperature sensor may also be calibrated.

## AnalogPlus DO or DataStick DO Calibration

Dissolved Oxygen probe sensors can be calibrated as Manual/Sample, Air Calibration, or Zero Calibration (where the oxygen has been depleted or almost depleted).

Manual calibration is a calibration in a sample solution and a known value in ppm is entered manually. The default is 0.00 ppm, but the user can set the calibration value from 0.00 to 20.00 ppm for a standard or a known sample value.

### 1-Point DO Calibration

1. Select a point for calibration. The point can be a ppm standard or a sample value, a zero point, or an air calibration. Air calibration is quick and easy to use. The oxygen level depends on salinity (in mS/cm) and pressure (in mmHg). Those variables should be determined and entered into the AquaPro in the Setup menu for the channel. Scroll boxes allow the input of the salinity and pressure. The temperature in the DO probe will be read live so temperature compensation occurs automatically within the measurement calculation.
2. After the settings are entered, press escape to return to Calibration in the main menu. Select the channel to be calibrated and press enter to start calibration.
3. The first calibration screen is Hold so; the sensor should be put into the appropriate calibration location (solution or air), then press continue.
4. Define the calibration; either Sensor or Temperature calibration may be performed. The measurement will be adjusted to the new calibration point.
5. Select the Type of Calibration; either Manual/Sample, Air Calibration, or Zero Calibration.

- a. The **Manual/Sample** calibration is performed in a known sample, standard, or sample stream.
  - b. **Air Calibration** is a quick, accurate way to calibrate as the DO in air at a temperature and pressure is typically stable.
  - c. **Zero Calibration** point is the most time consuming method, as it requires very low level of oxygen in a solution and time for the sensor to achieve that zero state.
6. Start the calibration and follow the instructions on the screen. At the end, Calibration Successful will be displayed. If not successful, Calibration Unsuccessful with a description of the error, if identified, will be displayed. The calibration will not be logged, as it was not accepted.

## RDO Pro/RDO Pro-X

The RDO (Rugged Dissolved Oxygen) Pro probe is an Optical RDO measurement probe. It uses a specific RDO card in the AquaPro. Although similar to the DataStick card, the RDO wiring is different for the Comms (+) and Comms (-) connections.

### 1-Point RDO Calibration

1. Select a point for calibration. The point can be a ppm standard or a sample value, a zero point, or an air calibration. Air calibration is quick and easy to use. The oxygen level depends on salinity (in mS/cm) and pressure (in mmHg). Those variables should be determined and entered into the AquaPro in the Setup menu for the channel. Scroll boxes allow the input of the salinity and pressure. The temperature in the DO probe will be read live so temperature compensation occurs automatically within the measurement calculation.
2. After the settings are entered, press escape to return to Calibration in the main menu. Select the channel to be calibrated and press enter to start calibration.
3. The first calibration screen is Hold so the sensor can be put into the appropriate calibration location and the type of calibration can be defined, then press continue.
4. Define the calibration; either Sensor or Temperature calibration may be performed. The measurement will be adjusted to the new calibration point.
5. Select the Type of Calibration; either Manual/Sample, Air Calibration, or Zero Calibration.
  - a. The **Manual/Sample** calibration is performed in a known sample or standard or sample stream.
  - b. **Air Calibration** is a quick, accurate way to calibrate as the DO in air at a temperature and pressure is typically stable.
  - c. **Zero Calibration** point is the most time consuming method, as it requires very low level of oxygen in a solution and time for the sensor to achieve that zero state.

6. Start the calibration and follow the instructions on the screen. At the end, Calibration Successful will be displayed. If not successful, Calibration Unsuccessful with a description of the error, if identified, will be displayed. The calibration will not be logged, as it was not accepted.

## DataSticks

There are many sensor options in the DataStick product line, but the AquaPro DataStick card is used for all DataStick measurements. The sensor is identified on the channel description over the measurement data. The instructions for the sensor calibration can be followed for the measurement being used. Additional DataStick measurements include Turbidity, Suspended Solids, and Free Chlorine.

## Temperature Calibration

While in the calibration screen of any parameter, a 1-point temperature calibration can also be performed.

# 5

## SECTION 5 **Diagnostics Menu**

The diagnostics menu allows the user to quickly and easily determine the status of the Transmitter functions.

<b>System Information</b>	Displays Channel information such as card type and measurement such as in use, in addition to power and relay information
<b>Calibration Log</b>	Select channel to review stored calibrations
<b>Warning List</b>	Description of Condition(s) causing Yellow or Red-colored channel label
<b>Events Log</b>	Rolling log of time and date-stamped events such as power up, default calibration in use, Temperature broken (no sensor), holds on or off
<b>Analog Output Status</b>	Displays mA outputs for the installed Channels
<b>Relay Status</b>	Displays status of Active or Inactive

### System Information

The AquaPro can be configured with many hardware options. Diagnostics is the best place to look when reviewing the hardware that is installed in the system. Basic information for each board function is listed:

**Front Panel:** Main processor serial number, software version, hardware version, and time/date.

**Slot 1:** Sensor type, electronic serial number, protocol version, software version.

**Slot 2:** Sensor type, electronic serial number, protocol version, software version.

**Slot 3:** Sensor type, electronic serial number, protocol version, software version.

**Slot 4:** Sensor or special function type, electronics serial number, protocol version, software version.

## Calibration Log

The calibration log will list calibration events for all sensors configured, with date/time, calibration type, temperature reading, calibration results (pass/fail) as well as slope and offset data where appropriate.

Calibrations must be performed in the selected measurement unit for the parameter. If another unit is selected, a warning message will display on the screen.

## Warning List

If a fault or warning is present in the AquaPro, it will display in the list with a description. Once the fault or warning has been cleared it will automatically clear from the list.

The color around the channel number for the sensor displays the status of the channel with green, yellow or red signifying Good, Warning and Failure. The error messages associated with the colored circle are listed in the Warning list codes and messages table below.

Color	Error Message	Instructions /Error Cleared
RED	TEMPERATURE BROKEN	CLEAR TEMPERATURE BROKEN
RED	SENSOR NOT FOUND	SENSOR FOUND
RED	INVALID CONFIGURATION	CLEAR INVALID CONFIGURATION
RED	DATASTICK NOT FOUND	DATASTICK FOUND
YELLOW	ON HOLD	CLEAR HOLD
YELLOW	DEFAULT CALIBRATION	CLEAR DEFAULT CALIBRATION
YELLOW	CALIBRATION DUE	CLEAR CALIBRATION DUE
GREEN	POWER UP	NO ACTION REQUIRED
YELLOW	RDO CAP EXPIRATION WARNING	CLEAR RDO CAP EXPIRATION WARNING
RED	CONTROL OVERFEED TIMER	CLEAR CONTROL OVERFEED TIMER
RED	RDO CAP EXPIRED NOW	CLEAR RDO CAP EXPIRED

## Event Log

The event log will list all events over a period of time, from the most current to the oldest, including relay switching, data log downloads, channel setting changes, system setting changes, and channel status changes such as temperature failure.

## Analog Output Status

This function provides a single screen to display current output readings from all channels in one place.

## Relay Status

This function provides a single screen to display current state of all configured relays.

# 6

## SECTION 6 Setup Menu

The setup menu is where the AquaPro functions are set up for specific applications.

Setup Choices:

Channel 1  
Channel 2  
Channel 3  
Channel 4  
Calculated Function (Math Channel)  
Relay Setup  
Data Logging  
Language  
System Reset  
Time/Date

**Channel 1:** When configured the menu list will show the sensor type – pH, Conductivity, DO, etc. Settings for each of the following are available for any sensor input card.

- **Analog Outputs:** Set outputs 1 and 2 to be driven by the sensor or temperature, then select the scale for the output. Chose linear, log, or PID functions. If the calculated function is present, the the mA output can be mapped to one of its channels.
- **Calibration Setup:** Set up a calibration reminder interval for this particular sensor in days. If the sensor is not calibrated after the time period is up, an indicator on the main measure display screen will turn yellow to indicate the sensor should be checked.
- **Measurement Settings:** Set up sensor units, filters, temperature elements, manual temperature settings, temperature units. Analog sensor cards will allow for the setup of sensor type. This is not necessary when using a DataStick sensor.

- **Channel Name:** A customizable name can be entered for the channel to record the measurement information (for example, Basin 31).
- **Hold/Transfer:** Calibration hold time after a calibration is complete, settings for transfer current output values, and Error current output values (output can be set to 22mA on Error condition).
- **Solution Compensation:** Sensor-specific options for compensation are chosen here.
- **User Value:** Temperature compensation values are chosen here (for example, 2  $\mu\text{S}/\text{cm}/^\circ\text{C}$ ).
- **Channel Active:** When a sensor is not being used and the user wants to remove the channel from the measure screen options and diagnostic fault alarms, the channel can be turned off. When the channel is off, the setup menu and diagnostic information is still present and can easily be turned back on.

**Calculated Function:** When the AquaPro is configured with two sensors, using the same units of measure, the “Math Channel” can be set up to derive a calculated measurement. Currently the pH and conductivity measurements are the only ones that can use this feature.

Map the channels to be used into the variables X and Y. Then select the math function. Once this is set up, a calculated measurement will appear in the main measure display screens, and current outputs and relays can be driven by this function. (Refer to page 36)

**Relays:** There are three standard relays in the AquaPro. Three additional relays can also be installed for a total of six relays. The standard relays are designated A through C. The add-on relays are D through F. All relays are Form C with normally open and normally closed contacts. Choosing the correct contact is necessary to achieve the desired action.

Each relay in the system can be driven by any measurement parameter in the system.

Additionally, each relay can be configured to operate as follows:

**Disabled:** Relay will not activate. This means that the normally open contact remains open and the normally closed contact remains closed.

**Alarm:** Set low and high alarm values, low and high deadband values, on- and off-delay values.

**Control:** Set Phase, Setpoint, Deadband, on-delay, off-delay, and Overfeed timer.

**Wash:** Set Interval and duration with off-delay timer.

**Error:** Activate the relays when the assigned measurement is in an error state (e.g: open temperature or out of calibration).

**Data Logging:** Set up the data logging to ON or OFF and set up the interval of data recording.

**Language:** The AquaPro can be set up with the following languages:

- English
- Spanish
- German
- French



- Italian
- Portuguese
- Chinese

**Factory Defaults:** The AquaPro can be returned to its original factory configuration. Please be careful when using this command and be sure that functions currently configured are not being used on control.

**Time/Date:** Set up the time and date.

**Passwords:** Passwords can be set up to protect system settings and calibration settings. The factory default setup is to disable passwords.

## PID Functions

Use the UP/DOWN arrows to scroll the list of PID Controller options for viewing and editing.

PID Controller Setup→PID Controller		PID Controller Setup→PID Controller	
Algorithm	ISA ▲	Full Scale	2000000 uS/cm
Full Scale	2000000 uS/cm	Zero Scale	0 uS/cm
Zero Scale	0 uS/cm	Set Point	1000000 uS/cm
Set Point	1000000 uS/cm	Proportional Gain	+0.00
Proportional Gain	+0.00	Integral Gain	0.0 reps/min
Integral Gain	0.0 reps/min	Derivative Gain	0.0 seconds
Derivative Gain	0.0 seconds	Manual Reset	0.0 %
Manual Reset	0.0 %	Manual Mode	▼

Each of the PID options used to configure and tune the loop is shown below for a sensor type of pH.

PID Function	Edit Range	Default Setting
Set Algorithm	ISA or Velocity	ISA
Set Full-Scale	0 to 14 pH	14 pH (Do not change)
Set Zero-Scale	0 to 14 pH	0 pH (Do not change)
Set Setpoint	0 to 14 pH	7 pH
Set Proportional Gain	-99.99 to +99.99	0.00 (+ is direct action, - is reverse action)
Set Integral Gain	0.00 to 50.00 reps/min	0.00 reps/min
Set Derivative Gain	0.00 to 10.00 seconds	0.00 seconds
Set Transit Time	0 to 9999 seconds	0 seconds
Set Man Reset	0.0% to 100%	0.0%
Manual Mode	Control: 0.0% to 100%	0.0% (Process value is displayed)

Scroll through these configuration and tuning options with UP/DOWN arrows. Press ENTER to select an option and view or edit the setting. Press ENTER to change setting or ESC to leave a setting unchanged.

Note: There is a Manual Mode screen that will display preset values and user settings.

Each of the PID controller options used to configure and tune the loop is shown below for a sensor type of contacting or electrode-less conductivity.

PID Function	Edit Range	Default Setting
Set Algorithm	ISA or Velocity	ISA
Set Full-Scale	0 to 5000 $\mu\text{S/cm}$	2000 $\mu\text{S/cm}$ (Do not change)
Set Zero-Scale	0 to 5000 $\mu\text{S/cm}$	0 $\mu\text{S/cm}$ (Do not change)
Set Setpoint	0 to 5000 $\mu\text{S/cm}$	1000 $\mu\text{S/cm}$
Set Proportional Gain	-99.99 to +99.99	0.00 (+ is direct action, - is reverse action)
Set Integral Gain	0.00 to 50.00 reps/min	0.00 reps/min
Set Derivative Gain	0.00 to 10.00 seconds	0.00 seconds
Set Transit Time	0 to 9999 seconds	0 seconds
Set Manual Reset	0.0% to 100%	0.0%
Manual Mode	Control: 0.0% to 100%	0.0% (Process value is displayed)

When the configuration and tuning settings are made, select PID as the Parameter for current loop 1 or current loop 2.

Integral gain can be disabled by entering "0.00" to provide only PID controller action.

## Relays

Up to six Form C relays with normally open and normally closed contacts are available with the AquaPro.

The selectable features in the relay menus are the same regardless of the measurement. While the AquaPro is being used to calibrate the sensor, the relay is held in its present state. Use the UP/DOWN arrows to scroll the relay option list. Press ENTER to select. Press ESC to move up a level in the menu system.

Relays → Relay A	
Assignment	Alarm
Source	Ch.1 Sensor
Configuration	

The Relay menu is used to configure a relay for ALARM, CONTROL, or WASH functions. When ALARM is selected, the relay activation is determined by low and high limits of the chosen measured parameter. When CONTROL is selected, the relay activation is determined by a single set point. WASH is a timer function and does not depend on the sensor or temperature measurements.

- First select the desired relay function: ALARM, CONTROL, or WASH.
- Next, select the PARAMETER (Sensor or Temperature) that drives the relay if either Alarm or Control is selected. If Wash is selected, the relay operates as a timer.
- Select source

If ALARM is selected, the following activation options can be programmed in the Configuration menu.

ALARM Function	Edit Range	Default Setting
Low Alarm Value	Min to Max scale	Zero or most negative reading
High Alarm Value	Min to Max scale	Highest reading
Low Deadband	0 to 14 pH	0 pH
High Deadband	0 to 14 pH	0 pH
Off-Delay	0 to 999 seconds	0 seconds
On-Delay	0 to 999 seconds	0 seconds

If CONTROL is selected, the following activation options can be programmed in the Configuration menu.

ALARM Function	Edit Range	Default Setting
Phase	High or Low	High
Setpoint	Min to Max scale	Highest reading
Deadband	0 to 14 pH	0 pH
Off-Delay	0 to 999 seconds	0 seconds
On-Delay	0 to 999 seconds	0 seconds

If WASH is selected, the following activation options can be programmed in the Configuration menu.

ALARM Function	Edit Range	Default Setting
Interval	0.0 to 999.9 minutes	0.0 minutes
Duration	0 to 999 seconds	10 seconds
Off-Delay	0 to 999 seconds	0 seconds

## Error Function

You can also define how the relay will perform during an error. This can be done in the Relay Menu under Assignment.

# 7

## SECTION 7 **Cleaning Instructions**

### General Cleaning

- Wipe the exterior surfaces (except the display panel) using a lint free cloth dampened in clear water.
- Wipe the display panel with a clean microfiber cloth dampened with clear water taking caution to wipe lightly to avoid scratching the meter display.

# 8

## SECTION 8 **Service**

The AquaPro Transmitter Service menu is an easy way to access and test outputs, relays, and USB functions. All outputs and relays can be placed on hold whilst service is being conducted to a particular sensor or to all the sensors.



Functions:

- Service Hold: Choose to hold outputs and relays for Ch1, Ch2, Ch3, Ch4, or the full system. Also used to clear hold before the time out expires.
- Output 1, 2, 3, and 4: Set a value to test; calibrate 4 and 20 mA settings so the output agrees with the PLC or recording device.
- Test Relays: Toggle Active and Inactive states for each relay in the system (A through C or A through F).
- USB Configuration (use a thumb drive formatted to FAT32 with a size less than 8GB): Retrieve datalog on a memory stick (the file will download as \*.CSV), copy a system configuration to the AquaPro, or upload new software.

# 9

## SECTION 9 **Host Communications**

The AquaPro Transmitter can be set up to communicate with a host computer system in a variety of protocols. When using Host Communications, please refer to the selected communications manual for specific protocol setup and use.

Host Protocol	Reference Manual to Set up Address, Baud Rate and Parity
Modbus RTU	Modbus Communications Adapter Users Manual
DeviceNet	DeviceNet Communications Adapter Users Manual
RS-232	DataStick Instruction Manual: 9600 bps, no parity, 8 data bits, 1 stop bit
CANopen	CanOpen Communications Adapter Users Manual
Ethernet	Ethernet Communications Adapter Users Manual

# 10

## SECTION 10 **Certificate of Conformity**

### **Declaration of Conformity**

**Manufacturer:** Thermo Fisher Scientific Inc.  
22 Alpha Road  
Chelmsford, MA 01824  
USA

**Hereby declares that the following product:** AquaPro Transmitter

Conforms to the following directives and standards:  
2006/95/EC - Low Voltage Directive (LVD)  
EN 61010-1:2001 - Safety requirements for electrical equipment for  
measurement, control and laboratory use - Part 1: General requirements

**2004/108/EC - Electromagnetic Compatibility (EMC Directive)**  
EN 61326-1:2006 – Electrical equipments for measurement,  
control and laboratory use – EMC requirements - Part 1: General  
requirements



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Patrick Chiu  
Manager, EHS and Regulatory Programs

Place and Date of Issue:  
Chelmsford, MA USA  
December 20<sup>th</sup>, 2012



# 11

## SECTION 11 **Terms and Conditions**

### **AquaPro Warranty/Replacement Plan**

This transmitter is supplied with a warranty against significant deviations in material and workmanship defect for a period of one (1) years from date of shipment.

In the event that a defect is discovered during the warranty period, and the Thermo Fisher Scientific agrees, at its option, to repair or replace the defective product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products associated with this product including, but not limited to, chemical reagents and salt bridges. Electrode/sensor warranties are separate from the transmitter and differ based on the selected electrode/sensor.

Products may not be returned without authorization from Thermo Fisher Scientific. To obtain authorization, please call Thermo Fisher Scientific for a return material authorization number.

Limitations:

This warranty does not cover:

1. Damage caused by misuse, neglect (lack of appropriate maintenance), alteration, accident or improper application or installation.
2. Damage caused by any repair or attempted repair not authorized by Thermo Fisher Scientific.
3. Any product not used in accordance with the instructions furnished by Thermo Fisher Scientific.

4. Damage caused by acts of God, natural disaster, acts of war (declared or undeclared), acts of terrorism, work actions, or acts of any governmental jurisdiction.
5. Freight charges to return merchandise to Thermo Fisher Scientific.
6. Travel fees associated with on-site warranty repair.

This warranty is the sole expressed warranty made by Thermo Fisher Scientific in connection with its products. All other warranties, whether expressed or implied, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

The liability of Thermo Fisher Scientific shall be limited to the cost of the item giving rise to the claim. In no event shall Thermo Fisher Scientific be liable for incidental or consequential damages.

This warranty is the sole and complete warranty for Thermo Fisher Scientific. No person is authorized to make any warranties or representations on behalf of Thermo Fisher Scientific.

Thermo Fisher Scientific reserves the right to change or modify this warranty at any time.

**Return Material Authorization:** Authorization must be obtained from our Technical Support Team or authorized distributor before returning items for any reason. Please include data regarding the reason the items are to be returned. Contact Thermo Fisher Scientific Customer Service for a Return Material Authorization (RMA) number. Items returned without an RMA number will be rejected.

For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. The manufacturer will not be responsible for damage resulting from careless or insufficient packing.

Note: The manufacturer reserves the right to make improvements in design, construction, and appearance of products without notice

# 12

## SECTION 12 Ordering Information

Order Number	Description
AP01PH	pH Scaling Card
AP02ORP	ORP Scaling Card
AP03CC	Contacting Cond. Scaling Card
AP04TR	Toroidal Cond. Scaling Card
AP05DO	Dissolved Oxygen Scaling Card
AP06OZ	Ozone Scaling Card
AP07RDO	RDO Pro Digital Input Card
AP08DS	DataStick Digital Input Ca
AP0ESC	Expansion Slot cove
AP0BMBRTU	Modbus RTU Host Comms. Card
AP0CETH	Ethernet IP, TCP/IP Host Comms. Ca
AP0GREXC	Relay Expansion Card
AP0DA	Door Assembly
AP0KVAC	AC Power Supply PCB Assembly
AP0JVDC	DC Power Supply PCB Assembly
AP0BASAC	AquaPro Assy with AC Power Supply and Door
AP0BASDC	AquaPro Assy with DC Power Supply and Door
AP0PANKT	Panel Mount Kit
AP0PIPKT	Pipe Mount Kit
AP09UPPH	AquaPro UPpH Scaling Card

# 13

## SECTION 13 Specifications

### Parameter Measurement Ranges for the Sensors

Measurement	Range	Resolution	Units
pH	0 to 14 pH	0.01 pH	pH
ORP	+/- 2000 mV	1 mV	mV
Toroidal	0 to 2 S/cm	1 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
1.0 2-cell Conductivity	0 to 2000 $\mu$ S/cm	0.1 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
0.1 2-cell Conductivity	0 to 500 $\mu$ S/cm	0.01 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
0.05 2-cell Conductivity	0 to 250 $\mu$ S/cm	0.01 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
0.01 2-cell Conductivity	0 to 50 $\mu$ S/cm	0.001 $\mu$ S/cm	$\mu$ S/cm, M $\Omega$ *cm, ppm, %
RDO Pro Optical DO	0 to 50 ppm; 0 to 500% saturation	0.1 ppm	ppm, %
DO (ppm)	0 to 40 ppm	0.1 ppm	ppm, %
DO (ppb)	0 to 20 ppm	1 ppb; 0.001 ppm	ppb, ppm, %
Low Turbidity	0 to 200 NTU	0.001 NTU	NTU
High Turbidity	0 to 4000 NTU	0.1 NTU	NTU
Ozone	0 to 10 ppm	0.1 ppm	ppm
Free Chlorine	0 to 10 ppm	0.01 ppm	ppm
Suspended Solids	0 to 10,000 ppm	1 ppm	ppm, mg/L, %
Temperature**	-5 to 200°C	0.1°C	°C/°F

\*\*Note: Temperature type is selectable from PT1000, PT100, NTC300, NTC30K, or Manual. The default element is PT1000.

## Functions and Features

- One to four sensors for optimal cost per measurement point.
- Temperature measurement for all sensors (standard).
- NEMA 4X Enclosure for indoor/outdoor use.
- Wall, Pipe, and ½ DIN Panel Mounting options.
- Large, high-visibility color graphics display.
- Math Functions for % rejection, % pass, and others.
- Data and Event Logs for four channels for 30 days (Standard).
- Front panel USB port for easy data log extraction, quick system configuration, and field software upgrades.
- Calibration, System Setup, Diagnostics, and Service Menus.
- Two 4 to 20 mA loop outputs per sensor (up to eight).
- Three Form C Relays for Alarm, Control, and Wash (Standard).
- Option for three additional Form C Relays with optional Relay Card.
- PID function for process control.
- Digital protocol options for remote measurement, calibration, setup, and diagnostics: Modbus, DeviceNet, Ethernet IP.
- Six cable ports for standard conduit and cordgrip fittings.

## Mounting Options

- Wall Mount with Quick Disconnect mounting plate.
- ½ DIN Panel Mount.
- Pipe/Hand rail mount (vertical and horizontal).

## Interface

- Display: 4.3 Inch Color Graphics with High Contrast.
- Keypad: Seven Key menu navigation.

## Environmental Conditions

- Suitable for use in Class I, Division 2, Groups A, B, C, and D hazardous locations, or nonhazardous locations only.
- Ambient operating temperature range: -20 to 60 °C.
- Ambient storage temperature range: -20 to 60°C.
- Maximum Relative humidity: 95% non-condensing.
- Meets NEMA 4X requirements for outdoor use.
- For industrial use.

## Interchangeable Modules

Factory installed function cards can be reconfigured in the field.

Slot 1: pH,ORP,Conductivity,DO,Ozone,Turbidity,Chlorine,SS

Slot 2: pH,ORP,Conductivity,DO,Ozone,Turbidity,Chlorine,SS

Slot 3: pH,ORP,Conductivity,DO,Ozone,Turbidity,Chlorine,SS

Slot 4: pH,ORP,Conductivity,DO,Ozone,Turbidity,Chlorine,SS, Host Comms, 3 Optional relays.

Power: AC or DC

## 4 to 20 mA Current Loops

- Two isolated current loops per sensor (standard)
- Setup as 0 or 4 to 20 mA
- 0.01 mA Resolution
- Each output assignable to sensor, temperature, or Math
- PID control function w/ pH or conductivity
- Loop power provided by AquaPro

## Relays

- Three Form C Relays (Standard): 1A, 250 VAC
- Three Form C Relays (Optional): 1A, 250 VAC
- Normally Open and Normally closed contacts
- Assignable to any measurement, temperature, or math function in the system
- Setup Functions Include: Alarm, Control, and Timer



**Warning :** Exposure to some chemicals may degrade the sealing properties of materials used in the Sealed Relay Device.

## Digital Protocol Options to Host

- Modbus RTU
- DeviceNet
- CANopen
- Ethernet /IP

## Power Supply

**AC Power Option:** 100 to 240 V, 50/60Hz, 0.4A Max @ 25°C

**DC Power Option:** 24 VDC, 0.4 A Ma

# 14

## Regulatory Compliance

### European Union



The European voltage models of this product meet all the applicable requirements of the European Directives and therefore display the CE Marking. These Directives are captured in the EU Declaration of Conformity which may be obtained from the manufacturer.

### United Kingdom



The European voltage models of this product meet all the applicable requirements of the United Kingdom Directives and therefore display the UKCA Marking. These Directives are captured in the UKCA Declaration of Conformity which may be obtained from the manufacturer.

### Product Safety

This product family has been tested to applicable product safety standards by a Nationally Recognized Test Laboratory (NRTL) and may bear the NRTL's mark of safety compliance to those applicable standards.

The maximum limit of 10 mA shall not be exceeded when tested according to Clause 5.5 (Measurement of protective conductor current) of EN 50678 VDE 0701.

# Electromagnetic Compatibility

## FCC Statement (USA)



This device complies with Part 15 Subpart B of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Canadian ISED IC Notice

This ISM digital apparatus complies with Canadian ICES-003, Class A.  
 Cet appareil ISM est conforme la norme NMB-001 du Canada, Classe A.

# Material Content and Evaluation of Chemicals

## REACH - Europe

Thermo Fisher Scientific is committed to meeting all compliance obligations to evaluate, communicate, and register any Substances of Very High Concern (SVHC), and finding alternates where appropriate.

## RoHS - Europe

Thermo Fisher Scientific is determined to reduce the impact we have on the environment, and so can declare that this product complies with the European Parliament's RoHS2 (Restriction of Hazardous Substances) Directive 2011/65/EU, and 2015/863 Annex II (*RoHS2 Amendment*) with respect to the limitation of the following substances:

- Lead (0.1 %)
- Mercury (0.1 %)
- Cadmium (0.01 %)
- Hexavalent chromium (0.1 %)
- Polybrominated biphenyls (PBB) (0.1 %)
- Polybrominated diphenyl ethers (PBDE) (0.1 %)
- *Bis(2-ethylhexyl) phthalate (DEHP) (0.1 %)*
- *Butyl benzyl phthalate (BBP) (0.1 %)*
- *Dibutyl phthalate (DBP) (0.1 %)*
- *Diisobutyl phthalate (DIBP) (0.1 %)*



Our compliance is witnessed by written declaration from our suppliers and/or component testing. This confirms that any potential trace contamination levels of the substances listed above are below the maximum level set by the latest regulations or follow established exemptions of the regulation due to their application.

## RoHS – China

This product complies with the requirements of the legislative act Administration on the Control of Pollution Caused by Electronic Information Products (ACPEIP). A label of conformance, such as one of the following, may be found on the product:



A declaration may be obtained from the manufacturer with greater detail of this conformance.

## End of Life Care

Some considerations and suggestions are listed below for proper disposal of this product. While addressing these actions for safe recycling and disposal, please follow all guidelines, Safety Data Sheets (SDS), or regulations applicable to your country and region.

- This product has materials and components that may be recycled or reused according to local guidelines and regulations.
- Remove any batteries present before disposal. Batteries, battery packs, and accumulators should not be disposed of as unsorted household waste. Please use the public collection system to return, recycle, or treat them in compliance with the local regulations.

**WEEE Compliance.** This product is required to comply with the European Union’s Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol. Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on our compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to applicable directives are available at [www.thermofisher.com/](http://www.thermofisher.com/)



Thermo Fisher Scientific  
Water Analysis Instruments  
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[thermoscientific.com/processwater](http://thermoscientific.com/processwater)

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