

**Thermo Scientific
Orion® Process
ROSS® pHR Electrode
User Guide**



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Preface

This instruction manual serves to explain the use of the Thermo Scientific Orion® pH/Process ROSS® electrode 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 electrode 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.

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

Visit us on the web at www.thermoscientific.com/processwater

Safety Information



The Thermo Scientific Orion pH/Process ROSS electrode shall be installed and operated only in the manner specified. Only a skilled, trained or authorized person should carry out installation, setup and operation of the sensor system.

Before using the electrode, make sure that the cable is connected as specified. Failure to do so may result in permanent damage to the electrode or controller.

Protection against electric shock will be achieved only by observance of the corresponding installation rules.

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1. Introduction

1.1. General Information

Thank you for purchasing a Thermo Scientific Orion pHR Process ROSS electrode. This electrode has many enhanced features that offer superior performance in process applications. The pHR electrode utilizes ROSS pH technology providing precise and accurate pH measurement and rapid accurate response between temperature changes.

The product is designed for continuous use in 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 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 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.

1.2. Intended use

The pHR Process ROSS electrode is designed to continuously measure pH and temperature in aqueous solutions in accordance with the technical product specifications in Section 2.3 of this manual.

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.

Other prerequisites for appropriate use include:

- Observing the instructions, notes and requirements set out in this instruction manual.
- Observing all local safety regulations.
- Observing all warnings and cautions in the documentation regarding all products used in this measurement system, including the pH electrode, mounting hardware, analyzer electronics and cabling.
- Observing the prescribed environmental and operational conditions.
- Observing chemical compatibility with all wetted materials.

1.3. Safety Instructions

pHR Process ROSS electrodes should be installed and operated only by personnel familiar with the electrode and qualified for such work.

A defective electrode should be returned for repair or replacement. Contact Thermo Fisher Scientific to obtain a Return Material Authorization (RMA) number.



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

1.4. Removal from Service / Correct Disposal of the Electrode

Removal from Service

Disconnect the cable wiring from the controller terminal block.
Remove the electrode from the mounting hardware.

Correct Disposal of Unit

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

2. Product Description

2.1. Electrode Description

Thermo Scientific Orion pH/Process ROSS electrodes use a serviceable double junction reference to maximize lifetime in continuous industrial applications. It utilizes ROSS chemistry which provides the most accurate measurement system and rapid response between temperature extremes

The ground rod and encapsulated preamplifier construction reduce the effects of ground loops and allow the pH signals to be transmitted up to 3,000 feet. The ground rod material is titanium. A replaceable heavy-duty salt bridge makes it simple to refurbish the electrode when necessary.

The salt bridge offered is a PEEK® material

A reference reservoir filled with buffered ROSS solution minimizes the effects of dilution and extends the life of the reference electrode.

The temperature element is embedded in the pH electrode housing and is used to compensate the pH measurement.

The electrode is available with an integral pre-amplifier. The standard cable lengths for units with an integral preamplifier are 10, 20 and 30 feet. It is recommended that a junction box and extension cable be used for longer cable runs.

The standard cable length for units without an integral pre-amplifier is 15 feet.

The pH/Process ROSS electrode comes in a 1.0-inch diameter body style. NPT threaded electrodes are used for standard pipe tees and immersion mount applications.



Standard 1.0-inch Sensor Body

PEEK® Body with NPT threads for immersion and insertion applications.

2.2. Compatible Analyzers and Controllers

The pHR Process ROSS electrode uses the combination measurement technique with a serviceable double junction reference to ensure longer life. The electrode is available with an integral pre-amplifier to reduce signal interference and allow longer cable runs. Electrode cables have either 5 or 7 wires, depending on whether it has the integral pre-amplifier or not. The wires are designed for terminal block connection and each wire must be individually connected. All analyzers are rated NEMA 4X for outdoor use as long as proper mounting and conduit practices are used.

2.2.1. *AquaPro Multi-Input Intelligent Process Analyzer*

The Thermo Scientific AquaPro Multi-Input Intelligent Process Analyzer is a highly flexible analysis platform that can perform a wide range of process applications. All versions of the pHR Process ROSS electrodes can be used. The AquaPro Analyzer has color graphic display and data logging functions. It has four channels and can be configured by the parameters you require with the ability to display all four channels at once. The AquaPro Analyzer features a user-friendly interface and easy-to-use menus in up to seven languages. There are two isolated current outputs per channel parameter, three relays with an additional three optional, PID control and digital protocol options for remote measurement. The AquaPro Analyzer has simple interface to PLC, SCADA and other PC –based control systems with data supported protocols such as MODBUS TTU over RS485 or RS232, DeviceNet, Profibus, Ethernet/IP, Modbus TCP and CANopen. It is rated for outdoor use and can be pipe, panel or wall mounted. Input power options of 24 VDC and Line Power (100 VAC to 240 VAC) are available with the AquaPro Analyzer.



Figure 2.1: AquaPro Multi-Input Intelligent Process Analyzer

2.2.2. *AV88 Universal Analyzer*

Thermo Fisher Scientific offers the AV88 Universal Analyzer. With the pH personality module installed, all pHR Process ROSS electrodes can be used. The analyzer has a very intuitive menu system that makes it easy to navigate through measurement, calibration, configuration and diagnostic display options. Two current outputs, two relays, PID control, and optional digital host communications are provided. Host communications make it possible to integrate all electrode functions remotely with any computer system while allowing local control through the AV88 keypad. Supported host communications protocols include Modbus RTU, DeviceNet, Modbus TCP, Ethernet/IP, CANopen and Profibus. The AV88 enclosure is rated for outdoor use and can be mounted to wall, a panel or a pipe. Input power options of 24 VDC and Line Power (90 VA VAC) are available with this Analyzer.



Figure 2.2: AV88 Universal Analyzer

2.3. Specifications

All pH Process ROSS electrodes are rated for continuous use in industrial and municipal process applications. Construction variables of electrode type, ground rod material, electrode body material, temperature element and cable length are described in Sections 5 of this manual. Specifications shown here are general in nature and assume that the proper materials have been chosen for the application.

Measuring Range.....	0 to 14 pH
Resolution	0.01 pH
Operating Temperature	-5°C to 95°C
Maximum Pressure	100 PSIG @ 95°C
Maximum Flow Rate.....	10 ft/second
Standard Electrode Cable Lengths	15 ft (no pre-amplifier) or 10 ft, 20 ft and 30 ft (with pre-amplifier)
Maximum Transmission Distance	3,000 ft (914 m) – with integral pre-amplifier



The electrode will arrive with a protective cap that keeps the electrode hydrated.

If the electrode is taken out of operation and requires storage, it should be stored in pH electrode storage solution, RCS03. For short-term storage, put several drops of storage solution on the absorbent material in the protective cap and replace the cap on the sensor. This keeps the process electrode and salt bridge moist.

For extended storage, repeat the above short-term storage procedure every 2 to 4 weeks, depending on the surrounding environmental conditions.



Make sure all wetted materials are compatible with process chemicals at operating temperatures and pressures.

3. Installation

Thermo Scientific Orion pH/Process ROSS Electrodes have NPT threads on the front and on the back of the electrode body. These electrodes have a 1.0-inch diameter and can be threaded into standard 1.0 inch pipe extensions and tees. These standard NPT threads are used for a majority of immersion and insertion applications.

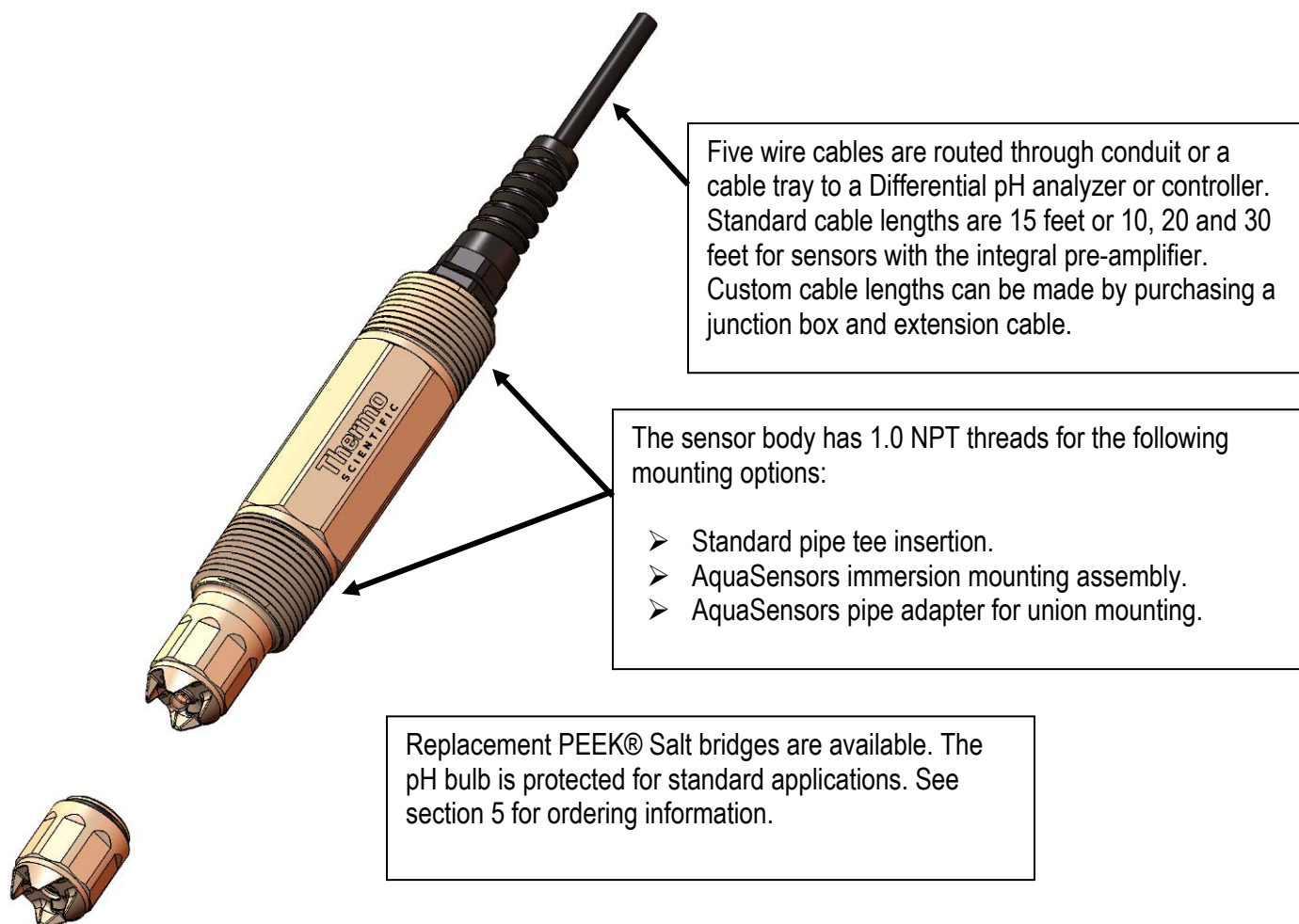


Figure 3.1: 1.0 inch pH Sensor with Replaceable Salt Bridge

3.1. Electrode Body Dimensions

The pHR Process ROSS electrode is offered in a 1.0-inch diameter electrode body (Fig 3.2).

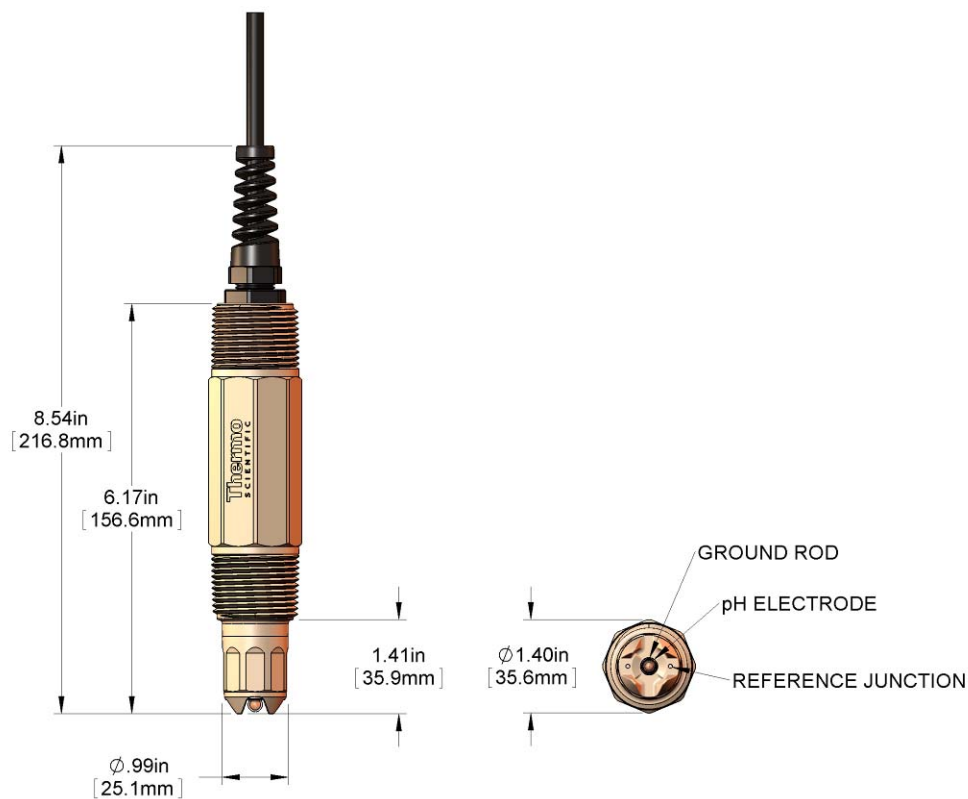


Figure 3.2: 1.0 Inch Diameter Body
Dimensions: IN (mm)

3.2. Important Points to Remember During Installation

To insure accurate measurements when installing a new electrode it is important to remember a few simple steps to avoid damage and to keep the pH measurement reliable.



Save the protective cap and use it to keep electrodes moist whenever the electrode is removed from service.



DO NOT USE PIPE SEALANT. Pipe sealants may not provide adequate sealing or may react with different plastic materials. Use Teflon thread tape.



DO NOT OVER TIGHTEN!
Maximum torque: 65 lbs·in (7 N·m)



The electrode should be positioned at least 15° up from horizontal. This will insure that entrained air does not form a pocket around the electrode head.



If the electrode does not calibrate, refer to Section 4 to review maintenance, refurbishment and troubleshooting options.

3.3. Wiring Overview

There are two different methods for electrical connection between the electrode and a pH controller: either direct or through a junction box. For ease of maintenance it is recommended that any cable run over 30 feet employ an indirect connection with a junction box and an extension cable.

3.3.1. *Direct Connection*

1. Insert the electrode cable through a watertight cord grip or conduit into the AV88 or AquaPro Controller. It is recommended that conduit holes on the bottom side of the controller be used for this purpose.
2. Connect the electrode wires to the controller terminal block as outlined in the controller manual.

3.3.2. *Indirect Connection (Using a Junction Box)*

1. Insert the electrode cable and the interconnect cable through a watertight cord grip or conduit into the junction box that has a terminal strip designed to make the proper connections.
2. Connect both the electrode cable wires and the interconnect wires to the terminal strip.
3. Insert the interconnect cable through a watertight cord grip or conduit into the controller.
4. Connect the electrode wires to the controller terminal block as outlined in the controller manual.



Be sure that the wire colors of the electrode cable match those of the interconnect cable on either side of the terminal strip.



Route the interconnect cable through grounded metal conduit to minimize electrical noise that may interfere with the electrode signal.

3.3.3. Connections for Electrodes with Integral Pre-Amplifier

The pHR Process ROSS electrode with an integral pre-amplifier has 6 wires and a shield.



Figure 3.3: pH sensor hook-up

Wire	Function
Red	pH Active Electrode
Green	pH Reference Electrode
Blue	+ V
White	- V
Black	Ground
Yellow	Temperature
Clear	Earth Ground

3.3.4. Connections for Electrodes without Integral Pre-Amplifier

The pHR Process ROSS electrode without an integral pre-amplifier has 5 wires.



Figure 3.4: pH sensor hook-up – No integral pre-amplifier

Clear	pH Active Electrode
Black	pH Reference Electrode
White	Temperature
Red	Temperature
Green	Solution Ground

3.4. Electrode Mounting

3.4.1. *Pipe Tee Mounting*

The 1.0 inch diameter body of the pHR Process ROSS electrode is threaded into standard pipe tees. Normally available pipe tees vary widely in construction dimensions. CPVC pipe tees are most generally available with schedule 80 walls and AnalogPlus electrodes generally fit as shown here. Pipe tees made of stainless steel with schedule 40 walls will sit lower in the pipe.

3.4.2. *Recommended Tee Mounting Configurations*

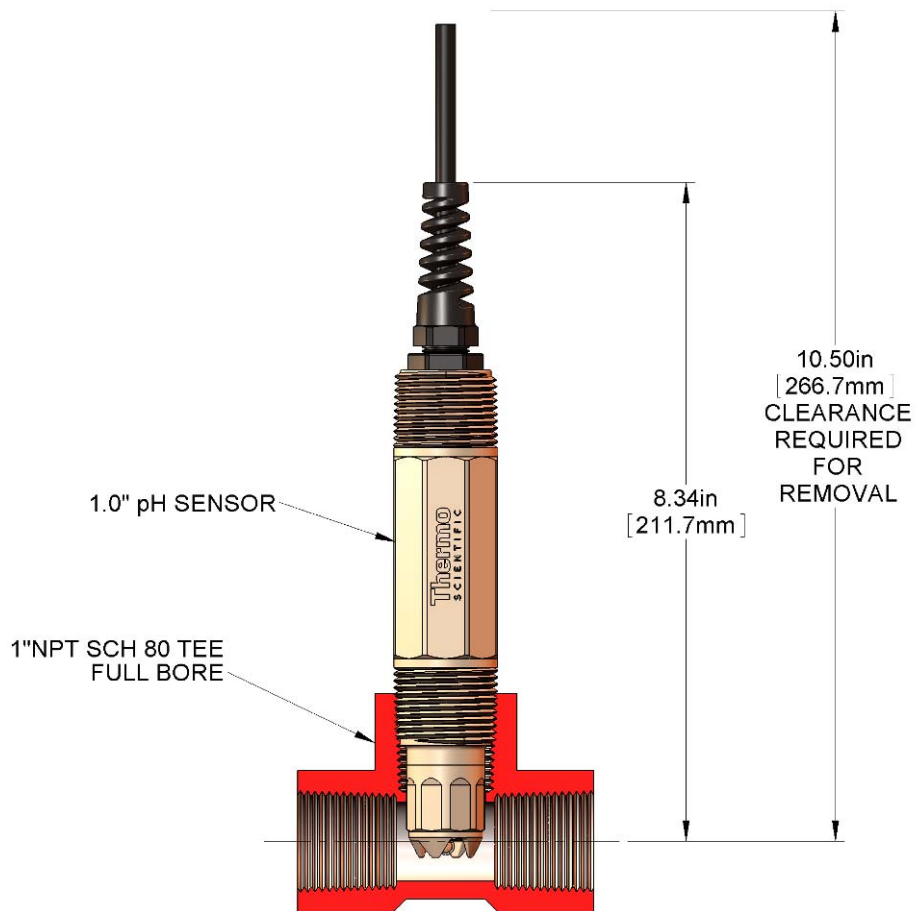


Figure 3.5: 1.0 Inch Sensor Mounted in Schedule 80 PVC Tee

3.4.3. Detailed Pipe Tee Installation Instructions

1. Wiring:
 - a. Route the cable either through conduit or on a cable tray.
 - b. Insert the electrode cable into the controller through a watertight cord grip or conduit fitting.
 - c. Connect the electrode wires into the controller terminal block as shown in the controller manual.

2. Calibrate:
 - a. Remove the protective cap from the electrode head and make sure moisture is present and that the salt bridge has not dried out. If the protective cap is dry, the electrode should be hydrated in storage solution, RCS03, for at least 1 hour prior to calibration.
 - b. If the electrode has been in a sample that is different from the temperature of the calibration buffers it is important to allow the electrode to come to equilibrium with the buffer temperature. Failure to do so will result in faulty calibration. Allow 2 minutes for each 10°C temperature difference between the standardization buffers and the solution the electrode has been in.
 - c. Calibrate the pH electrode as explained in the controller manual. It is recommended to use a 2-point buffer calibration upon installation of the electrode. For optimum results it is also recommended that the calibration be done in a controlled environment with a stir plate. Subsequent calibrations should be scheduled based on process demands.
 - d. If measurement response time is slow or if the electrode will not calibrate, refer to Section 4 for maintenance, refurbishment and troubleshooting suggestions.

3. Mount:
 - a. Apply Teflon® tape to the electrode body threads.
 - b. Either remove the cable from the analyzer or if there is enough slack, reverse twist the cable (counter-clockwise) by 4 turns so that the cable is not over stress when threading it into the tee.
 - c. Insert the electrode into the tee and slowly turn clockwise until secure. Tighten the electrode with a wrench until snug to prevent leaking. Be sure the pipe remains full when the electrodes are installed.

3.4.4. Union Mounting

Union mount hardware makes it easy to remove and insert the electrode for applications where calibration and/or cleaning is frequent.

Union Mount Advantages

- ✓ No cable twisting during installation or removal.
- ✓ Quick disconnect.
- ✓ Optimal positioning of sensing surface.
- ✓ Trouble-free installation.
- ✓ Easy maintenance.

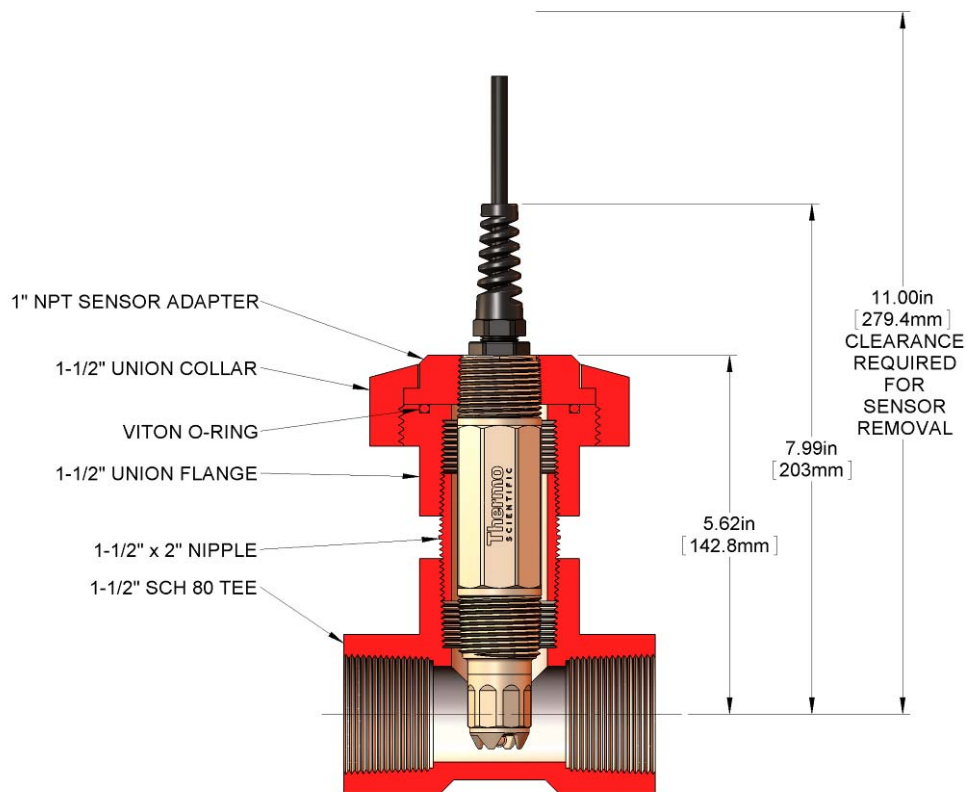


Figure 3.5: Union Mounting
1.0 Inch Sensor Body

3.4.5. Detailed Union Mount Installation Instructions

1. Wiring:
 - a. Apply Teflon® tape to the front electrode body threads and pass the cable through the adapter. Thread the adapter onto the electrode clockwise until it is secure.
 - b. Pass the retaining collar over the cable and onto the adapter with the threads facing the electrode.
 - c. Route the cable either through conduit or on a cable tray.
 - d. Insert the electrode cable into the controller through a watertight cord grip or a conduit.
 - e. Connect the electrode wires into the controller terminal block as shown in the controller manual.

2. Calibrate:
 - a. Remove the protective cap from the electrode head and make sure moisture is present and that the salt bridge has not dried out. If the protective cap is dry, the electrode should be hydrated in storage solution, RCS03, for at least 1 hour prior to calibration.
 - b. If the electrode has been in a sample that is different from the temperature of the calibration buffers it is important to allow the electrode to come to equilibrium with the buffer temperature. Failure to do so will result in faulty calibration. Allow 2 minutes for each 10°C temperature difference between the standardization buffers and the solution the electrode has been in.
 - c. Calibrate the pH electrode as explained in the controller manual. It is recommended to use a 2-point buffer calibration on installation of the electrode. For optimum results it is also recommended that the calibration be done in a controlled environment with a stir plate. Subsequent calibrations should be scheduled based on process demands.
 - d. If measurement response time is slow or if the electrode will not calibrate, refer to Section 4 for maintenance, refurbishment and troubleshooting suggestions.

3. Mount:
 - a. Inspect the O-ring on the union-mounting threaded flange for imperfections or particles of dirt that may prevent the O-ring seal from seating properly.
 - b. Carefully insert the electrode into the Thermo Scientific AquaSensors union mounting tee. Turning the retaining collar clockwise and hand tighten until snug. Be sure the pipe remains full when the electrode is installed.

3.4.6. Immersion Mounting

For immersion mounting applications the electrode is threaded on to the end of a pipe and wired into a junction box at the other end. An extension cable is then wired from the junction box to the controller. The standard pipe length is 7 feet and the assembly is often mounted onto a hand rail assembly for easy repositioning of the electrode in a pond or tank.

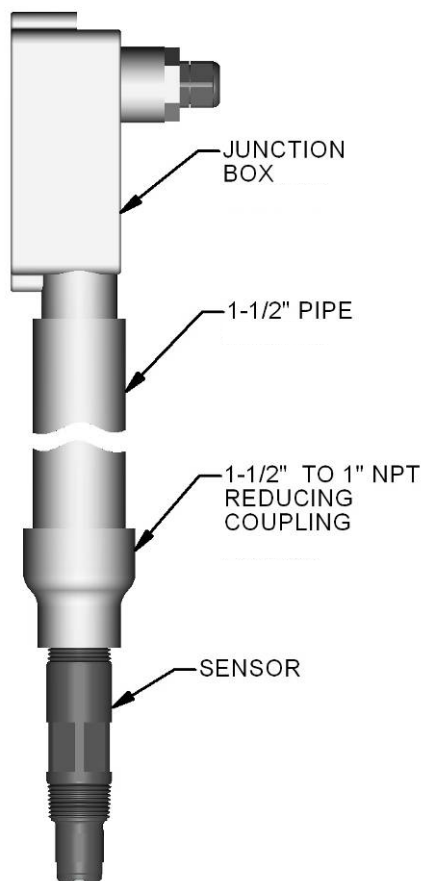


Figure 3.7: Immersion Mount Assembly
1.0 Inch Sensor Body

This immersion mount assembly can be ordered by itself, with a hand rail mounting assembly or with a ball float that keeps the electrode as a fixed distance below the surface of the water.

Part numbers for the three assemblies is shown in the following table.

Assembly	1.0 Inch Sensor Part Number
Immersion Assembly	MH3083
Immersion Assembly w/Swivel Rail Mounting	MH1242
Immersion Assembly w/Swivel and Ball Float	MH1252

3.4.7. Detailed Immersion Mount Installation Instructions

1. Wiring:
 - a. Route the electrode cable through the 1.5 inch extension pipe.
 - b. Apply Teflon® tape to the electrode threads.
 - c. Attach the electrode to the NPT coupling by turning the electrode in a clockwise direction until secure.
 - d. Either route the cable directly to the controller or splice the wires in a junction box and use an extension cable.
 - e. Insert the cable into the controller through a watertight cord grip or a conduit fitting.
 - f. Connect the electrode wires into the controller terminal block as shown in the controller manual.
2. Calibrate:
 - a. Remove the protective cap from the electrode head and make sure moisture is present and that the salt bridge has not dried out. If the protective cap is dry, the electrode should be hydrated in storage solution, RCS03, for at least 1 hour prior to calibration.
 - b. If the electrode has been in a sample that is different from the temperature of the calibration buffers it is important to allow the electrode to come to equilibrium with the buffer temperature. Failure to do so will result in faulty calibration. Allow 2 minutes for each 10° C temperature difference between the standardization buffers and the solution the electrode has been in.
 - c. Calibrate the pH electrode as explained in the controller manual. It is recommended to use a 2-point buffer calibration on installation of the electrode. For optimum results it is also recommended that the calibration be done in a controlled environment with a stir plate. Subsequent calibrations should be scheduled based on process demands.
 - d. If measurement response time is slow or if the electrode will not calibrate, refer to Section 4 for maintenance, refurbishment and troubleshooting suggestions.
3. Mount:
 - a. Secure the pipe assembly so that the electrode is fully immersed in the process. Handrail mounting hardware and ball float assemblies can be ordered from Thermo Fisher Scientific.



Be sure that the wire colors of the electrode cable match those of the interconnect cable on either side of the terminal strip.



Do not route the interconnect cable conduit where there are AC or DC power cables which create electrical noise that may interfere with the electrode signal.



Route the interconnect cable through metal conduit to minimize electrical noise that may interfere with the electrode signal.

3.4.8. Ball Valve Mounting

1 Inch Electrodes: pHR Process ROSS electrodes have 1.0 Inch NPT threads and can be installed in 1.5 inch and 2 inch ball valve assemblies. The threads on the back of the electrode mate with threads on the end of an o-ring sealed pipe inside the ball valve assembly.

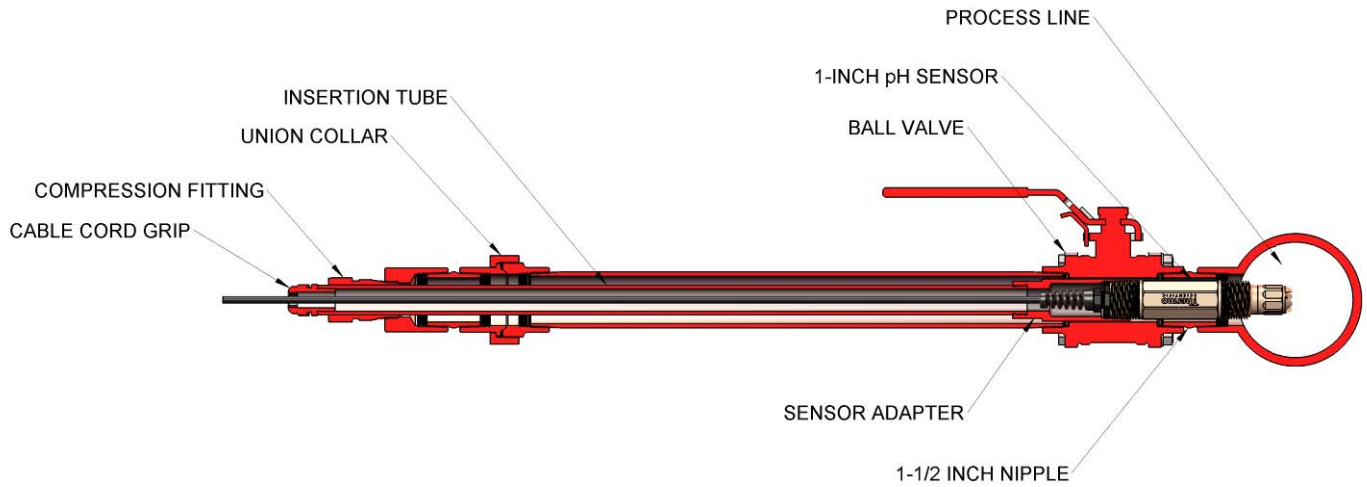


Figure 3.8: pH Sensors for Ball Valve Applications

3.4.9. Wash Head Accessory

In application where the electrode head is quickly fouled with sediment, a wash head assembly can be attached. The head slips on the body of the electrode and the wash nozzle is aligned with the glass pH electrode. A single screw is tightened to secure the wash head to the electrode. A hose is connected from the wash head to an air compressor or water source valve that is controlled by an AV88 wash relay that is programmed with a wash interval and duration.

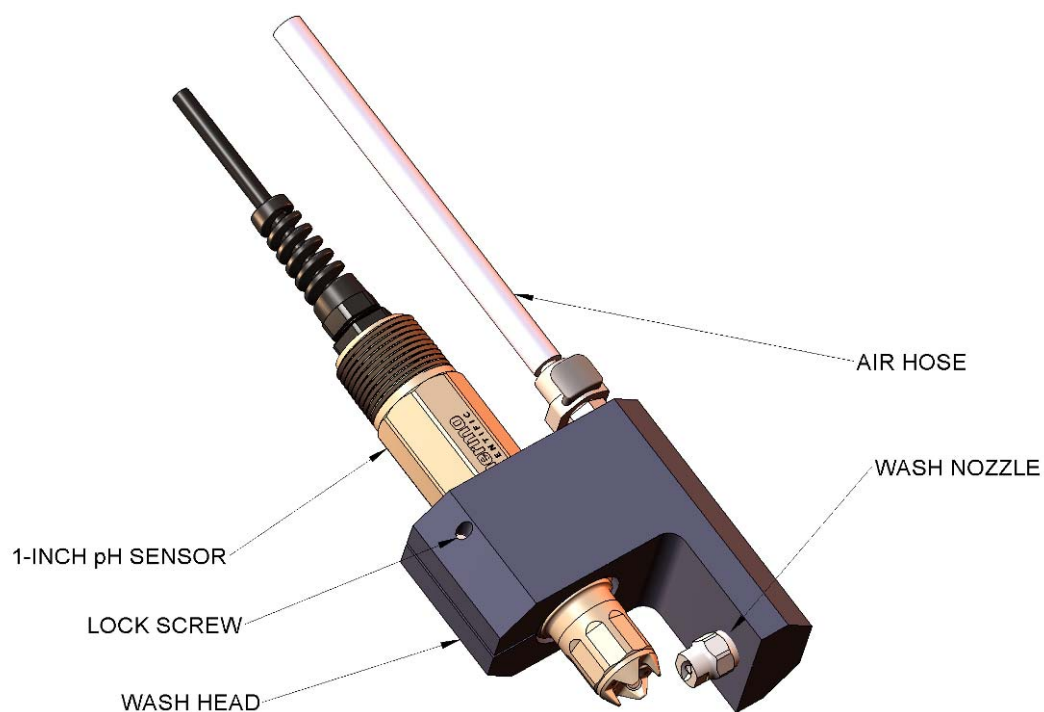


Figure 3.9: pH Sensor with Wash Head Attached

4. pH Electrode Maintenance

4.1. Cleaning the pH Electrode

1. In order to maintain an accurate measurement value, the electrode will need occasional cleaning and maintenance. The maintenance interval will be dictated by the process in which it is installed. The harsher the process, the more often the electrode will require maintenance. Regular maintenance will yield a longer electrode life.
2. The electrode cleaning procedure is as follows:
 - a. Remove electrode from service and rinse or spray it with warm water to remove heavy deposits.
 - b. Soak the electrode in a container of hot detergent water for one hour. Do not use detergents that contain oily skin softeners like aloe or lanolin that can coat the glass electrode. Alconox® and Dawn™ dishwashing liquid work well.
 - c. Use a soft-bristled brush, such as a soft toothbrush, and hot detergent water to scrub the entire electrode end of the electrode, being careful not to scratch or break the glass electrode.
 - d. Rinse the electrode end with clean warm water.
 - e. If deposits are still present on the glass electrode repeat the cleaning procedure. In the case of lime or other mineral deposits a weak solution (about 0.1 M) of hydrochloric acid may be used. In some cases, a dilute solution (about 10:1) of water and chlorine bleach or a solution of water and EDTA may also work. Stubborn oil or grease deposits may require cleaning with a solvent such as acetone or alcohol. Protein deposits may be cleaned with a pepsin-based cleaning solution. Bacterial or mold growth may be removed with dilute chlorine bleach.



Caution: Ensure that dangerous chemical reactions will not occur between process deposits and cleaning solutions. Compounds of cyanide and hydrochloric acid will react and pose health risks. Cyanide is often used in electroplating and in gold refining. If in doubt about potential chemical reactions, check with a chemist before cleaning.

3. Before returning the electrode to service, allow it to soak in storage solution, RCS03, at ambient temperature for about an hour to stabilize the pH electrode and the salt bridge.
4. After cleaning the electrode, calibrate electrode per instructions in the controller manual.
5. Reinstall electrode in process.

4.2. pH Electrode Refurbishment

4.2.1. Replacing the Salt Bridge and Reference Solution

1. If the electrode head has been cleaned (see section 4.1.2) and calibration cannot be achieved, replace the salt bridge and reference solution
2. Hold the electrode firmly with the electrode tip facing upwards. Remove the existing salt bridge by using an adjustable wrench and turning it counterclockwise. Dispose of the salt bridge using an approved method.



Handle gently and wear gloves and protective clothing as the reference cell solution can cause staining to your clothing. These can be removed with Stain Lifter solution, catalog number 510015.

3. Pour out the old reference cell solution. Rinse the reservoir with distilled or deionized water. Remove any drops of water remaining.
4. Slowly fill the reservoir with pHR reference cell solution so it just covers the reference o-ring.



Do not overfill. Overfilling will lead to excessive pressures that will affect the junction potentials of the reference.

5. Slowly screw the new salt bridge clockwise onto the electrode head until secure. Tighten the salt bridge with an adjustable wrench until snug.



Do not over tighten.
Maximum torque: 10 lbs·in (1.13 N·m)

6. After replacing the salt bridge, calibrate the electrode according to the instructions in the controller manual.
7. If the electrode still does not calibrate correctly, call technical support at 800-225-1480 as you might need to replace the electrode.

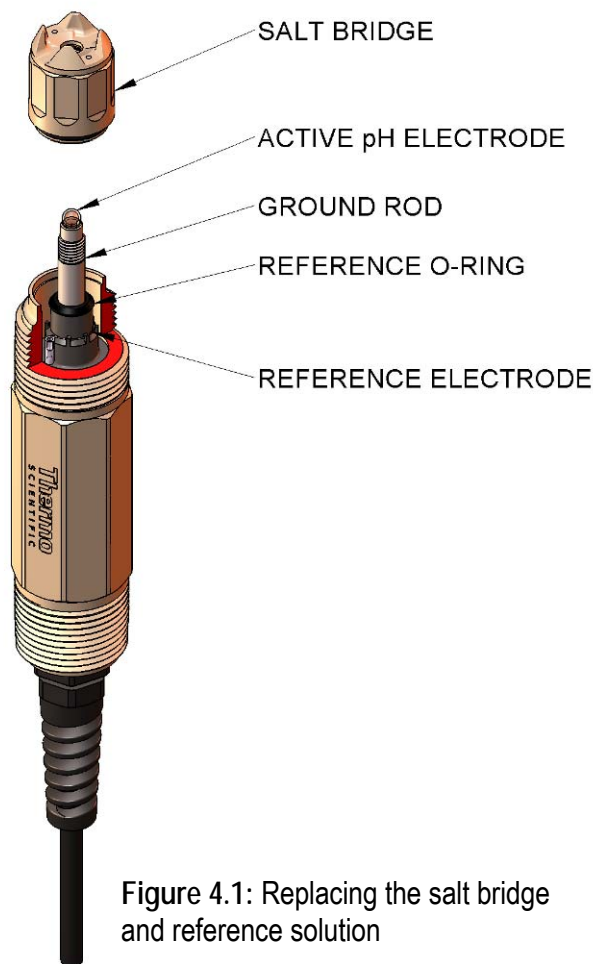


Figure 4.1: Replacing the salt bridge and reference solution

4.3. pH Electrode Troubleshooting

4.3.1. *General Inspection*

If the electrode is not providing reasonable signals to the analyzer, check the following:

1. Inspect the integrity of the glass electrodes. If the electrode is broken, replace the sensor.
2. Inspect the integrity of the salt bridge junctions. Be sure that they are clean and moist. If the salt bridge has been allowed to dry out it may be necessary to replace the salt bridge and reference cell solution.
3. Inspect the electrode cable for damage to the outer jacket. Any cuts or kinks may damage signal connections.
4. Inspect terminal block connections to be sure wires are not corroded or loose.
5. Make sure all electrode wires are connected to the correct places on the analyzer terminal block. Depending on the analyzer, some terminal block jumpers may be required and it is common to put those jumpers in the wrong place.
6. The electrode should be immersed in a solution of known pH and you should read back the value.
7. Establish that the analyzer electronics are working correctly by verifying operation with another electrode.



Note: Any new electrode that has been in storage for more than a few days should be soaked in tap water or a solution of known pH for at least 30 minutes before reviewing measurement performance.



Note: The salt bridge of any pH electrode in storage must be kept moist at all times. Protective caps should be filled with Thermo Scientific storage solution for best performance. The protective cap should be placed securely over the sensor head.

If the electrode passes the general inspection, there are three basic tests that can verify proper operation of the pH electrode, the temperature measurement, the pH offset, the pH span and the pH span on electrode power. If electrode passes these tests it should be ready for service.

4.3.2. *Temperature measurement*

Use an ohmmeter to measure the resistance between the BLACK and YELLOW wires. The meter should measure a resistance corresponding to the electrode temperature as outlined in the table below.

If the electrode is configured without the integral pre-amplifier, disconnect the RED and WHITE electrode wires from the analyzer. If the electrode is configured with the integral pre-amplifier, disconnect the BLACK and YELLOW wires from the analyzer. Use an ohmmeter to measure the resistance between the RED and WHITE wires. The meter should measure a resistance corresponding to the electrode temperature as outlined in the table below.

Electrode Temperature	5°C	15°C	25°C	35°C	45°C
Thermistor Resistance	1019 Ω	1058 Ω	1096 Ω	1135 Ω	1173 Ω

If the measured resistance is within 10 to 20 ohms of the expected value, the element should be satisfactory. If not, please consult the factory.

4.3.3. *pH Offset Test (Electrodes with Integral Pre-Amplifier Only)*

1. Disconnect the RED and GREEN electrode wires from the analyzer terminal block while leaving the other wires connected. Connect the (+) lead of a millivolt meter to the RED wire and the (-) lead of the millivolt meter to the GREEN wire.
2. Place the electrode in 7 pH buffer. Stir the electrode for 10 to 15 seconds and then allow the electrode to stabilize in solution for about 2 minutes. The meter should read 0.0mV +/- 50 mV. If the reading is higher or lower than specified, replace the salt bridge and filling solution and try again. If on the second attempt the offset does not meet specification, replace the electrode.

4.3.4. *pH Span Test (Electrodes with Integral Pre-Amplifier Only)*

If the RED and GREEN wires have already been disconnected to run the offset test, skip step 1.

1. Disconnect the RED and GREEN electrode wires from the analyzer terminal block while leaving the other wires connected. Connect the (+) lead of a millivolt meter to the RED wire and the (-) lead of the millivolt meter to the GREEN wire.
2. Rinse the electrode in clean water. Put the electrode in 4 pH buffer. Stir the electrode for 10 to 15 seconds and then allow the electrode to stabilize in solution for about 2 minutes. The meter should read a change of at least -150mV from the offset reading. For example, if the offset is +20mV the reading in 4 pH buffer should be at least -130mV.

After testing offset and span, the RED and GREEN wires should be reconnected to the analyzer terminal block.

5. pHR Electrodes and Hardware for 1.0-Inch Bodies

Catalog Number	Description	Contains Pre-amplifier	Cable Length
SH36A9E115	pHR Process ROSS Electrode, 1 inch PEEK body. Cable with stripped leads, integral titanium ground rod & PT1000 temperature element. Replaceable salt bridge and reference solution. Standard 1-inch NPT mounting	No	15 feet
SH36A9E210	pHR Process ROSS Electrode, 1 inch PEEK body. Cable with stripped leads, integral titanium ground rod & PT1000 temperature element. Replaceable salt bridge and reference solution. Standard 1-inch NPT mounting	Yes	10 feet
SH36A9E220	pHR Process ROSS Electrode, 1 inch PEEK body. Cable with stripped leads, integral titanium ground rod & PT1000 temperature element. Replaceable salt bridge and reference solution. Standard 1-inch NPT mounting	Yes	20 feet
SH36A9E230	pHR Process ROSS Electrode, 1 inch PEEK body. Cable with stripped leads, integral titanium ground rod & PT1000 temperature element. Replaceable salt bridge and reference solution. Standard 1-inch NPT mounting	Yes	30 feet

Mounting Hardware	Description	Part Number
1.5" Union Mount Assembly	Tee with locking collar, 316 Stainless Steel	MH3041
	Tee with locking collar, CPVC	MH3042
1" Tee	Schedule 40, Stainless Steel	MH3011
	Schedule 80, CPVC	MH3022
Immersion Assembly	7 ft PVC extension with junction box – 1" Electrodes	MH3083
Immersion Assembly w/Swivel Rail Mounting	7 ft PVC extension with junction box – 1" Electrodes With swivel hand rail mount.	MH1242
Immersion Assembly w/Swivel and Ball Float	7 ft PVC extension with junction box – 1" Electrodes With swivel hand rail mount and inflatable float.	MH1252
1.5" Ball Valve Assembly	Low Pressure, CPVC	MH1112
	Low Pressure, Stainless Steel	MH1111
	High Pressure, CPVC	MH1122
	High Pressure, Stainless Steel	MH1121
Tri-Clamp Tee Assembly	2" Tri-Clamp tee, gasket and clamp, Stainless Steel	MH1261
Junction box Extension Cable	For extension cables. Terminal strip included. AnalogPlus extension cable	JBOXX01 APECxx; xx=ft
Wash Hardware	Attach purge block to electrode body. Works with compressor & AV88 wash relay.	MH1132

6. pH Solutions and Salt Bridge Replacements

Product	Description	Part Number
Solutions 4 pH buffer 7 pH buffer 10 pH buffer pHR Cell Solution – 60ml pH storage solution Stain Lifter Solution – 60ml	For Calibration – 500ml bottle For Calibration – 500ml bottle For Calibration – 500ml bottle For electrode reference chamber – 60ml bottle Place in storage caps to keep glass electrode wet – 60ml bottle For cleaning stains from reference cell solution – 60ml bottle	PHSOL4 PHSOL7 PHSOL10 RCPHR-60 RCS03 510015
Salt Bridges PEEK, Protected Qty 1 PEEK, Protected Qty 3	For all pHR Process ROSS electrodes. Quantity 1 For all pHR Process ROSS electrodes. Quantity 3	SBPHR-1 SBPHR-3
Storage cover	Comes with sponge to keep stored sensor electrodes wet	SBC01

7. Limited Warranty

pHR PROCESS ROSS ELECTRODE WARRANTY/REPLACEMENT PLAN

Thermo Fisher Scientific warrants its Thermo Scientific Orion pHR Process ROSS electrodes against material and workmanship defect for a period of one year from the date of shipment.

In the event that a defect is discovered during the warranty period, 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.

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.

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8. Terms and Conditions

Terms and Conditions of Sale

The following terms and conditions will be presumed acceptable unless changes are made in writing and accepted by both parties in a reasonable amount of time.

Any standard or boilerplate terms and conditions supplied with a written purchase order will not be applicable unless accepted in writing by both parties.

Quotations: All quotations shall be in writing. Written quotations shall be valid for 30 days from the date issued. Verbal quotations or price lists are not valid.

Pricing: All pricing is in US Dollars. Thermo Fisher Scientific reserves the right to change pricing without notice.

Terms: Payment terms are net 30 days from the date of invoice with approved credit. Thermo Fisher Scientific reserves the right to deny credit or revoke previously extended credit. Past due accounts are subject to interest charges. Other acceptable payment terms are cash, certified check, money order, credit card or letter of credit confirmed by any United States of America bank. Other payment terms are not valid unless accepted in writing.

Sales taxes shall be included on the invoice unless a valid tax exemption certificate is supplied.

Return Material Authorization: Contact Thermo Fisher Scientific for a Return Material Authorization (RMA) number. Items returned without an RMA number will be rejected.

All returned merchandise must be in unused, resalable condition, and must not be contaminated with hazardous materials.

Cancelled orders must be returned within 30 days of the date on the invoice and shall be subject to expenses incurred that may include, but are not limited to, inspection and restocking fees. Items returned within 60 days shall be subject to a restocking charge that is equal to 15% of the purchase price. Items returned after more than 60 days shall be subject to a restocking charge equal to 25% of the purchase price. Thermo Fisher Scientific reserves the right to reject any return that is not under warranty after 60 days. Non-stock items are normally not returnable.

Transportation: Orders are shipped FOB Thermo Fisher Scientific, or factory, by the most efficient means available. Appropriate charges, such as freight and insurance will be added to invoices. All shipments will be insured. Goods damaged in shipment must be reported by the recipient to the freight carrier for claims.

Control Number: TC1001 Rev: 9/04

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