

**Thermo Scientific AquaSensors™
AnalogPlus™ Toroidal
Conductivity Sensors
User Guide**



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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 serves to explain the use of the Thermo Scientific AnalogPlus Toroidal Conductivity sensor 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 sensor due to improper use.

Contact Information

To contact Thermo Scientific AquaSensors 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.thermo.com/processwater

Safety Information



The Thermo Scientific AnalogPlus Toroidal Conductivity sensor 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 sensor, make sure that the sensor cable is connected as specified. Failure to do so may result in permanent damage to the sensor 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

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 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 AnalogPlus Toroidal Conductivity sensor is designed to continuously measure conductivity and temperature in aqueous solutions in accordance with the technical product specifications in Section 2.2 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 conductivity sensor, mounting hardware, analyzer electronics and cabling.
- Observing the prescribed environmental and operational conditions.
- Observing chemical compatibility with all wetted materials.

1.3. Safety Instructions



The AnalogPlus Toroidal Conductivity sensor should be installed and operated only by personnel familiar with the sensor and qualified for such work.

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

No modifications to the AnalogPlus Toroidal Conductivity sensor 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 Sensor

Removal from Service

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

Correct Disposal of Unit

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

2. PRODUCT DESCRIPTION

AnalogPlus Toroidal Conductivity sensors are used for continuous monitoring of conductivity from 0 $\mu\text{S}/\text{cm}$ to 2,000,000 $\mu\text{S}/\text{cm}$ with 1 $\mu\text{S}/\text{cm}$ resolution. The system also measures temperature from -10°C to 200°C .

These sensors work well in many applications where two electrode conductivity sensors do not work well. They do not foul easily in applications where sensors are coated with grease, oils or scaling. AnalogPlus toroidal sensors are designed to work well in clean-in-place applications and the sensor body does not easily crack or leak after temperature cycling like some other products on the market.

These sensors are designed for applications that require Union Tee Insertion, Ball Valve Insertion, Immersion, and Triclamp mounting. To reduce cost these sensors are offered in CPVC material for applications where high temperature and chemical resistance are not needed. PEEK® material is used in applications where temperatures are generally above 70°C , where greater chemical resistance is needed or where food grade sensors are used.



Figure 2.1: Toroidal Conductivity Sensor with $\frac{3}{4}$ -Inch NPT threads for Union Tee, Ball Valve Insertion and Immersion Mounting.

Shown in PEEK® body material.



Figure 2.2: Toroidal Conductivity Sensor with 2-inch Sanitary Flange (Tri-clamp).

Shown in PEEK® body material and 316 Stainless Steel Flange.

Toroidal Conductivity Sensors operate by inducing an alternating current in a solution and measuring the magnitude of this current to determine conductivity. As shown in Figure 2.3 the conductivity analyzer's oscillator circuit drives Coil 1. Coil 1 then induces an alternating current in the solution. This signal is picked up by Coil 2, which is then measured by the analyzer electronics and processed to display conductivity.

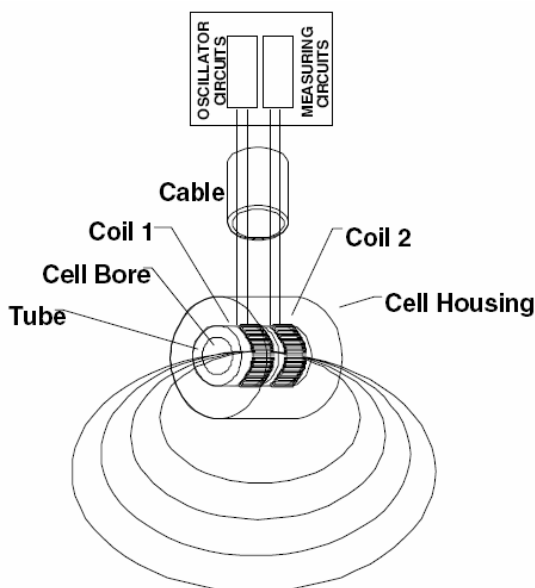


Figure 2.3: Toroidal Conductivity Sensor Measurement

AnalogPlus Toroidal Sensors have standard cable lengths of 10, 20 and 30 feet. Maximum cable length in applications where standard measurements are in the milliSiemens range is 300 feet. When measurements below 1000 $\mu\text{S}/\text{cm}$ are needed the maximum recommended cable length is 50 feet.

These toroidal sensors can be connected to any AV88 Universal analyzer that is configured with a toroidal conductivity personality module. The sensor can also be connected to any GLI International Model 33, Model 53, Model 63 or PRO series electrodeless conductivity analyzer.

The AV88 analyzer configured for toroidal conductivity has a full featured menu with measure, calibrate, configure and diagnostic functions. The enclosure is 3.5 inches square and has a NEMA 4X rating. It can be wall, pipe or panel mounted.



Figure 2.4: AV88 Toroidal Conductivity Analyzer

The parts of the sensor are outlined below:

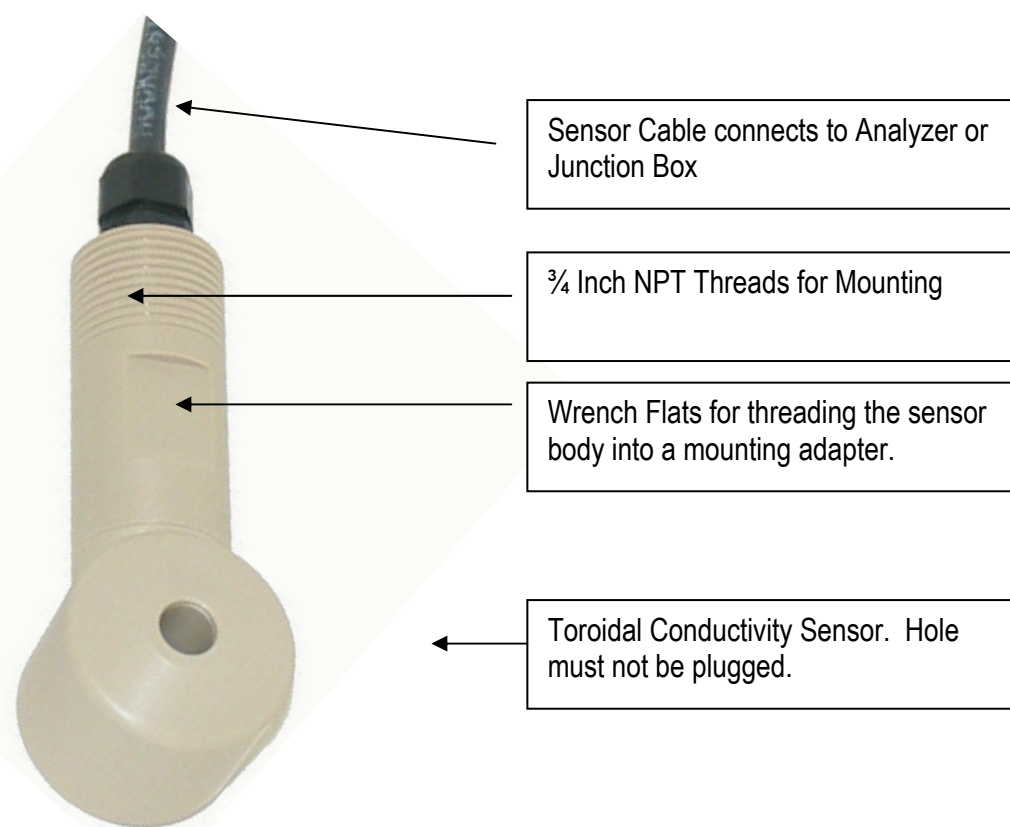


Figure 2.5: Toroidal Conductivity Sensor Parts

Product Highlights:

- 0 to 2,000,000 $\mu\text{S}/\text{cm}$ Measurement Range
- 1 $\mu\text{S}/\text{cm}$ resolution
- Integral temperature measurement for compensation
- Fast response
- PEEK® and CPVC body material options.
- Resists cracking common in CIP (clean-in-place) applications
- Union Tee Insertion, Ball Valve Insertion, Immersion and Sanitary Mount

2.1. Specifications

Wetted Materials.....	Sensor Body – CPVC or PEEK® O-Ring Seals - Viton®
Operating Temperature.....	PEEK®: 14°F to 392°F (-10°C to 200°C) CPVC: 14°F to 176°F (-10°C to 80°C)
Maximum Pressure.....	PEEK®: 200 psi @ 392°F (13.8 bar at 200°C) CPVC: 100 psi @ 176°F (6.9 bar at 80°C)
Maximum Flow Rate.....	10 ft/sec (3 m/sec)
Measuring Range.....	0 to 2,000,000 µS/cm
Resolution.....	4.5 significant digits
Standard Sensor Cable Length.....	10 ft (3 m)
Maximum Transmission Distance.....	300 ft above 1000 µS/cm, 50 ft below 1000 µS/cm
Sensor Cable	5 conductor cable with XLPE (cross-linked polyethylene jacket; rated to 150°C (302°F)).

3. Mounting Hardware

The $\frac{3}{4}$ -inch AnalogPlus Toroidal Conductivity Sensor is mounted using the $\frac{3}{4}$ -inch NPT threads on the back of the sensor body. The toroidal sensor head has a 1.44-inch diameter, which requires that it be inserted into pipes with a minimum 2-inch diameter. The hole in the sensor head should always be aligned with process flow.

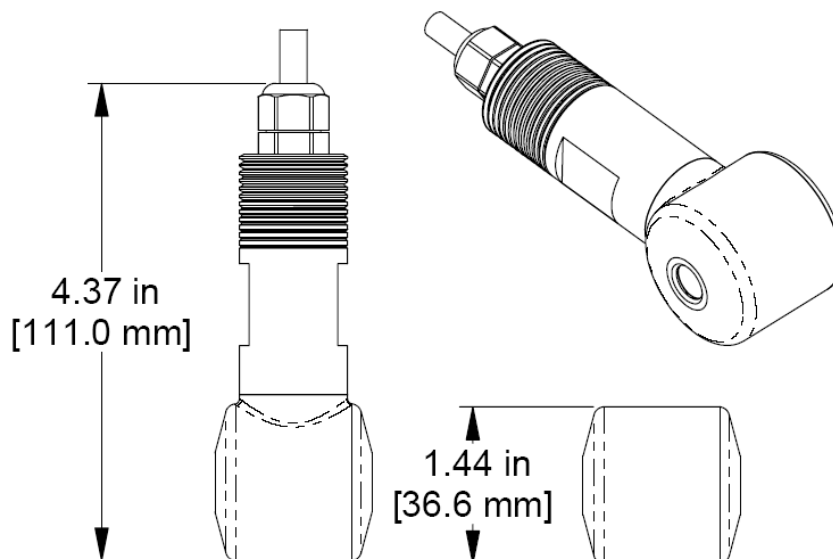


Figure 3.1: $\frac{3}{4}$ -Inch NPT Toroidal Conductivity Sensor Dimensions

To mount this sensor into a pipe, Thermo Scientific AquaSensors 2-inch union tee or ball valve hardware is used. For immersion mounting Thermo Scientific AquaSensors immersion mount hardware with handrail mounting and ball float is available.

Sanitary mounting is available with the 2-inch flange mount version of the AnalogPlus Toroidal sensor.

3.1. Union Tee

2-inch Union mount hardware makes it easy to remove and insert the sensor for applications where calibration and/or cleaning is frequent. The sensor should be aligned so that the donut hole is in line with the process flow as shown below.

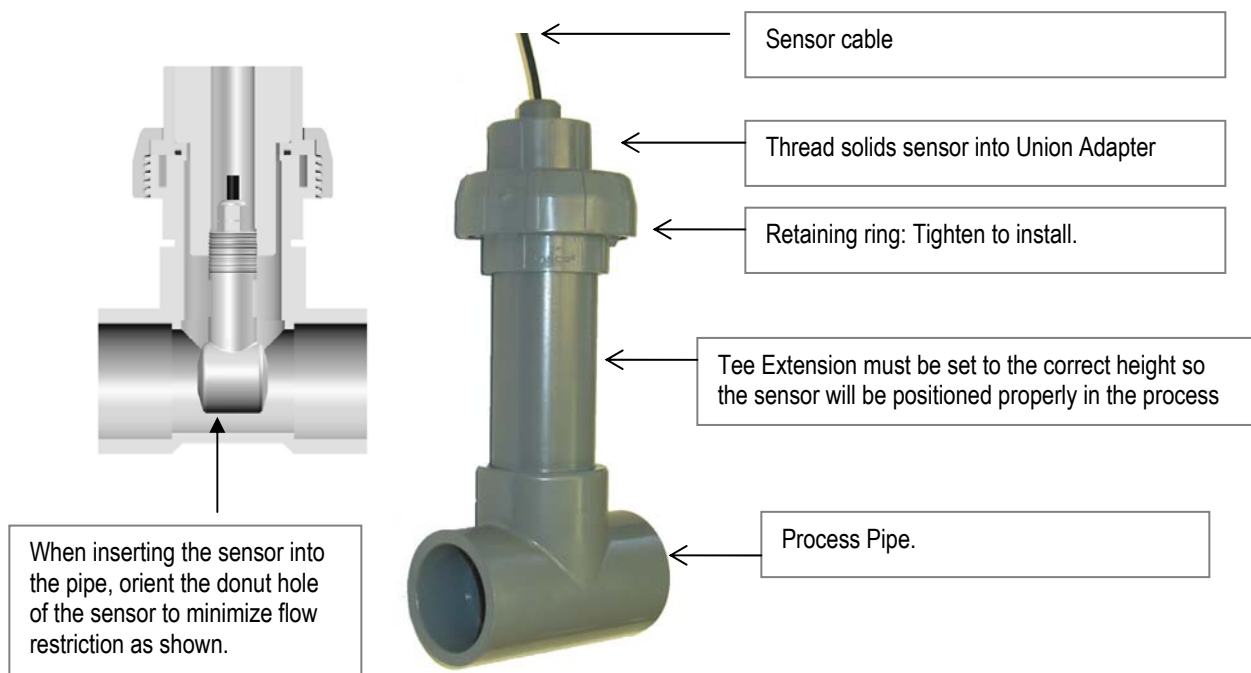


Figure 3.2: Union Mounting

Union Mount Advantages

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

Detailed Union Mount Installation Instructions

1. Wiring:
 - a. Apply Teflon® tape to the rear sensor body threads and pass the cable through the adapter. Thread the adapter onto the sensor clockwise until it is secure.
 - b. Pass the union collar over the cable and onto the adapter with the threads facing the sensor.
 - c. Route the cable either through conduit or on a cable tray.
 - d. Insert the sensor cable into the AV88 Analyzer through a watertight cord grip. Conduit holes are provided for the cord grip on the bottom of the Analyzer.
 - e. Connect the sensor wires into the AV88 sensor terminal block as shown in the AV88 manual.
2. Calibrate:
 - a. Power the AV88 Analyzer and allow the sensor to run for 15 minutes before attempting calibration.
 - b. Allow the sensor temperature to come to equilibrium with the outside temperature before attempting calibration.
 - c. Calibrate the Toroidal Conductivity sensor as explained in the AV88 manual. Subsequent calibrations should be scheduled based on process demands.
3. Mount:
 - a. Assemble the lower portion of the mounting hardware by threading the pipe nipple into the threaded flange and the tee. Apply Teflon® tape to the threads.
 - b. 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.
 - c. Carefully insert the sensor into the Thermo Scientific AquaSensors union-mounting tee. Make a mark on the mounting adapter to make it easier to align the sensor hole with process flow. Turning the retaining collar clockwise and hand tighten until snug. Be sure the pipe remains full when the sensor is installed.

3.2. Immersion Hardware

For immersion mounting applications the sensor 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 analyzer. The standard pipe length is 7 feet and the assembly is often mounted onto a handrail assembly for easy repositioning of the sensor in a pond or tank.

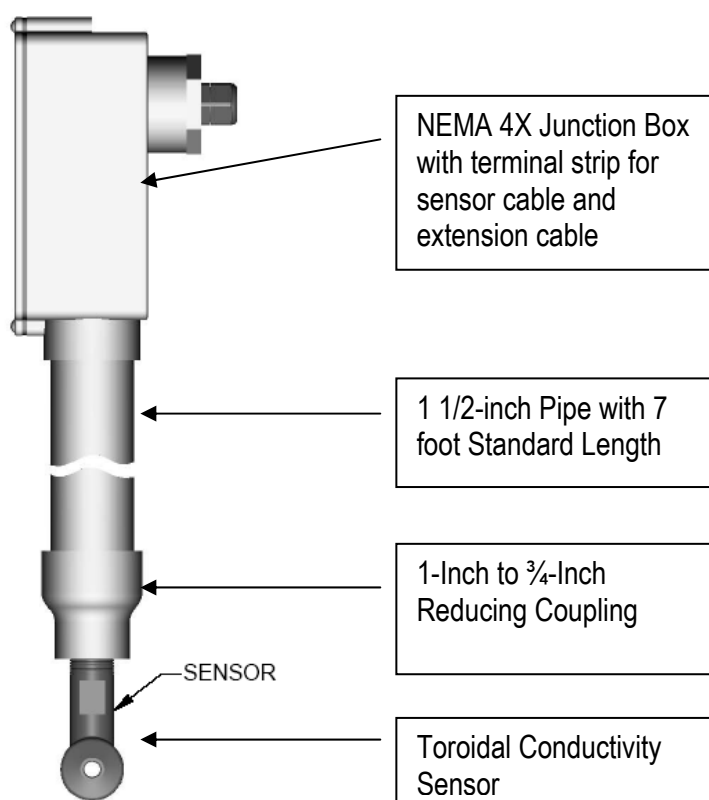


Figure 3.3: Immersion mounting assembly

This immersion mount assembly can be ordered by itself, with a handrail mounting assembly or with a ball float that keeps the sensor at a fixed distance below the surface of the water.

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

Assembly	Part Number
Immersion Assembly	MH3083-T
Immersion Assembly w/Swivel Rail Mounting	MH1242-T
Immersion Assembly w/Swivel and Ball Float	MH1252-T

3.3. Ball Valve Hardware

The sensor can be installed in a 2-inch ball valve assembly with a 3/4-inch adapter. The threads on the back of the sensor mate with threads on the end of an adapter inside the ball valve assembly. In applications where solids may adhere to the sensor, back flushing of the process pipe may be necessary to avoid binding of the sensor in the ball valve when retracting the sensor.

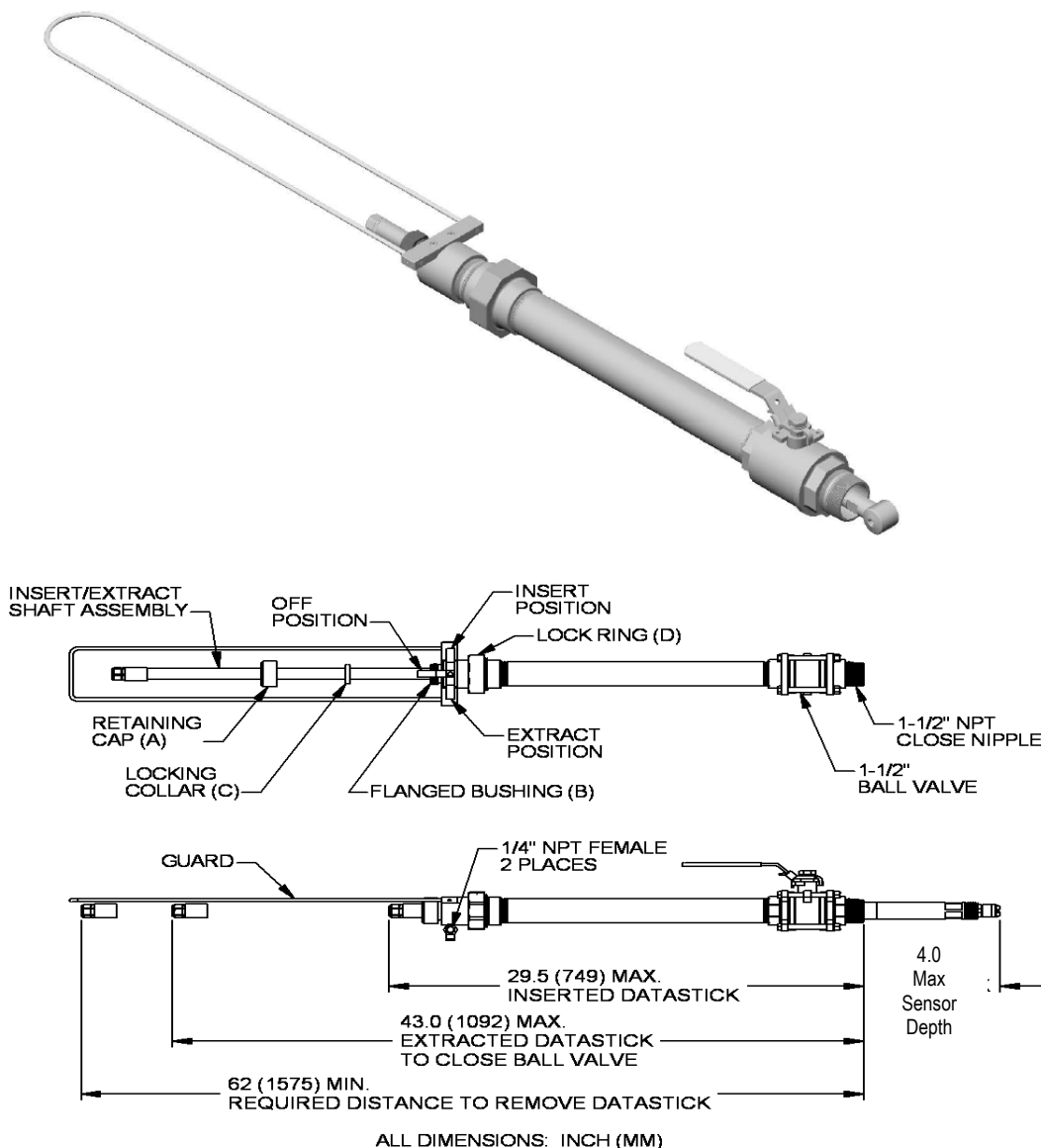


Figure 3.4: Ball Valve Assembly with Sensor Retracted and Inserted

3.4. Sanitary Mount (Triclamp) Hardware

The 2-inch flange mounted toroidal conductivity sensor is inserted in any 2-inch tri-clamp pipe fitting as shown. Orient the sensor donut with the process flow as shown. Secure the sensor with a triclamp retaining collar on the short-branch of a sanitary tee.

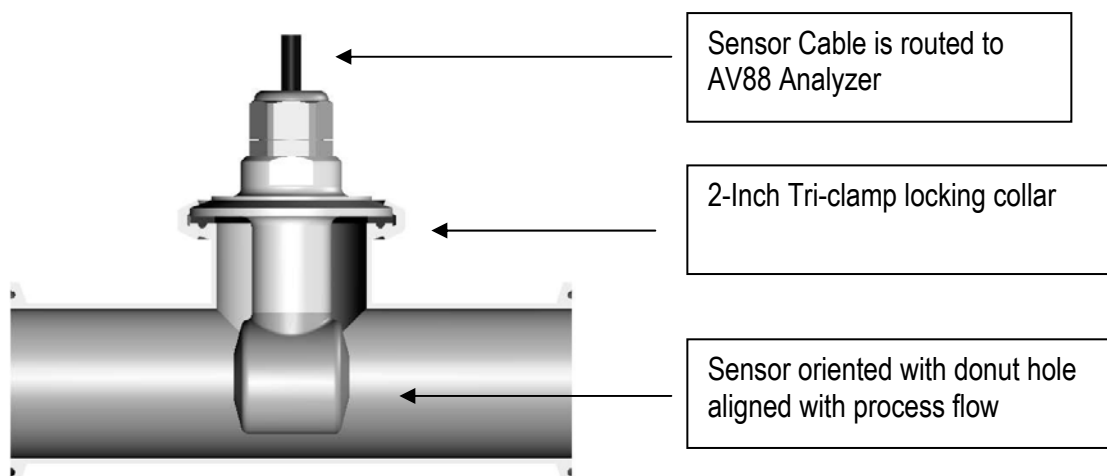




Figure 3.5: Ball Valve Mounting Assembly Retracted and Inserted.

Detailed Sanitary Mount Installation Instructions

1. Wiring:
 - a. Route the cable either through conduit or on a cable tray.
 - b. Insert the sensor cable into the AV88 Analyzer through a watertight cord grip. Conduit holes are provided for the cord grip on the bottom of the AV88.
 - c. Connect the sensor wires into the AV88 sensor terminal block as shown in the AV88 manual.
2. Calibrate:
 - a. Power the AV88 Analyzer.
 - b. Calibrate the Toroidal Conductivity sensor as explained in the AV88 manual. Subsequent calibrations should be scheduled based on process demands.
3. Mount:
 - a. Insert the sensor into the adapter making sure the front O-ring on the sensor is seated.
 - b. Thread the retaining collar into the adapter and tighten with a wrench until the face of the sensor head is flush with the adapter and the O-ring forms a seal.
 - c. Place a sanitary gasket on the branch flange.
 - d. Insert the sensor with the adapter into the branch of the tee; be sure the pipe remains full while installing to minimize trapped air and that the sensor donut hole is parallel to the pipe.
 - e. Install and tighten the sanitary clamp to retain the sensor and adapter in the tee.

	Route the interconnect cable through metal conduit to minimize electrical noise that may interfere with the sensor signal.
	Do not route the interconnect cable conduit where there are AC or DC power cables which create electrical noise that may interfere with the sensor signal.

4. Wiring

There are two different methods for electrical connection between the sensor and the conductivity controller: either direct or through a junction box.

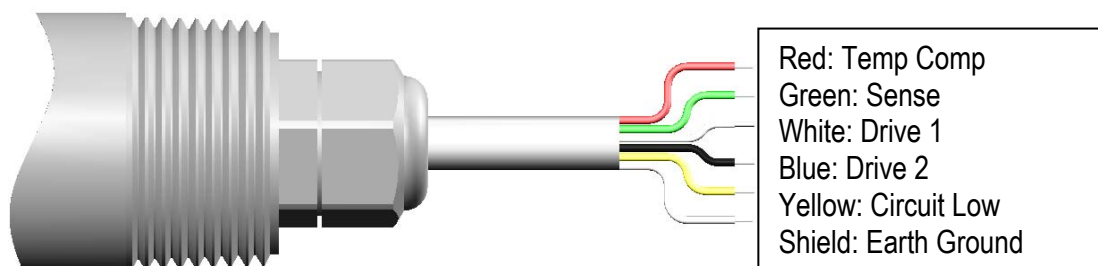


Figure 3.1: Toroidal Sensor Hook-Up

Direct Connection

1. Insert the sensor cable through a watertight cord grip into the AV88 Analyzer. Conduit holes are found on the bottom of the AV88 Analyzer for this purpose.
2. Connect the sensor wires to the AV88 Analyzer as outlined in the analyzer manual.

Indirect Connection (Using a Junction Box)

1. Insert the sensor cable and the interconnect cable through a watertight cord grip into the junction box that has a terminal strip designed to make the proper connections.
2. Connect both the sensor cable wires and the interconnect wires to the terminal strip.
3. Insert the interconnect cable through a watertight cord grip into the AV88 Analyzer. Conduit holes are found on the bottom of the AV88 Analyzer for this purpose.
4. Connect the sensor wires to the AV88 as outlined in the analyzer manual.



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



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

5. TOROIDAL CONDUCTIVITY SENSOR MAINTENANCE

5.1. Cleaning the Toroidal Conductivity Sensor Head

1. In order to maintain an accurate measurement value, the sensor will need occasional maintenance. The maintenance interval will be dictated by the process in which it is installed. The harsher the process, the more often the sensor will require maintenance. Regular maintenance will yield a longer sensor life.
2. The sensor cleaning procedure is as follows:
 - a. Remove sensor from service and rinse or spray it with warm water to remove heavy deposits. The donut hole must be clean and nicks or cuts in the body of the sensor must be avoided.
 - b. Soak the sensor in a container of hot detergent water for one hour.
 - c. Use a soft-bristled brush, such as a soft toothbrush, and hot detergent water to scrub the entire sensor body.
 - d. Rinse the sensor with clean warm water.
 - e. If deposits are still present on the sensor body repeat steps 2 and 3. 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. After cleaning the sensor, calibrate sensor per instructions in the AV88 Analyzer manual.
4. Reinstall sensor in process.

5.2. Toroidal Conductivity Sensor Troubleshooting

General Inspection

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

1. Inspect the integrity of the sensor. If the sensor donut hole is plugged, clean it out.
2. Inspect the sensor cable for damage to the outer jacket. Any cuts or kinks may damage signal connections.
3. Inspect terminal block connections to be sure wires are not corroded or loose.
4. Make sure all sensor 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.
5. The sensor should be immersed in a solution of known conductivity solution.
6. Establish that the analyzer electronics are working correctly by verifying operation with another sensor.

If the sensor passes the general inspection, there are three basic tests that can verify sensor operation: The Temperature Measurement Test, the Conductivity Short Test and the Conductivity Span Test. If the sensor passes these tests it should be ready for service.

Temperature Test

Disconnect the RED and YELLOW sensor wires from the analyzer. Use an ohmmeter to measure the resistance between those wires. The meter should display a resistance corresponding to the sensor temperature as outlined in the following table.

Sensor Temperature	5°C	15°C	25°C	35°C	45°C
Thermistor Resistance	1020 Ω	1058 Ω	1097 Ω	1136 Ω	1175 Ω

If the measured resistance is within 20 to 40 ohms of the expected value, the element should be satisfactory. If not, please consult the factory.



If after cleaning and refurbishment sensors still have slow responses, low measurement slopes or are seriously abraded or scratched, they must be replaced. Contact your local distributor or call Thermo Fisher Scientific Customer Service.

Conductivity Short Test

1. Disconnect the WHITE and BLUE sensor wires from the analyzer terminal block while leaving the other wires connected. Connect the (+) lead of an ohmmeter to the WHITE wire and the (-) lead of the ohmmeter to the BLUE wire.
2. The ohmmeter should read 1 to 2 ohms.

After testing, the WHITE and BLUE wires should be reconnected to the analyzer terminal block.

Conductivity Span Test

1. The sensor can be tested by passing a wire through the donut hole to a substituting a resistor (or resistance decade box) for the process to determine if the system is reading correctly.
2. Connect the leads from the resistor (or properly adjusted decade box) to the electrodes.

Process Conductivity	100,000 μS	2000 μS	1000 μS	200 μS
Nominal Resistance	40 Ω	2000 Ω	4000k Ω	40,000 Ω

6. TOROIDAL CONDUCTIVITY ORDER INFORMATION

Model Number			
ST Toroidal Conductivity Sensor. Cable connects to any AV88 Universal Analyzer or most standard conductivity analyzers. ¼ inch NPT and sanitary mounting. Integral temperature.			
Body Material			
2 CPVC (Low Cost, All-Purpose)			
3 PEEK® (Food Grade, High Temperature)			
Cable Length			
10 10 Feet			
20 20 Feet			
30 30 Feet			
xx Where xx = Number of Feet			
Mounting Options			
B 2-Inch Sanitary Flange (316 Stainless Steel with PEEK® sensor head)			
C 3/4-Inch NPT			

ST			
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Analyzers	Description	Part Number
AV88 Universal Analyzer	2 outputs, 2 relays, PID. AC power. ¼ DIN.	AV88EB0C2
	2 outputs, PID, Modbus. 24VDC. ¼ DIN.	AV88EB4A1

Mounting Hardware	Description	Part Number
2" Union Mount Assembly	Stainless Steel CPVC	MH3031-T MH3032-T
Immersion Assembly	7 ft PVC extension with junction box – 3/4" Sensors	MH3083-T
Immersion Assembly w/Swivel Rail Mounting	7 ft PVC extension with junction box – 3/4" Sensors With swivel hand rail mount.	MH1242-T
Immersion Assembly w/Swivel and Ball Float	7 ft PVC extension with junction box – 1" Sensors With swivel hand rail mount and inflatable float.	MH1252-T
2" Ball Valve Assembly	Low Pressure, CPVC Low Pressure, Stainless Steel High Pressure, CPVC High Pressure, Stainless Steel	MH1172-T MH1171-T MH1182-T MH1181-T
2" Tri-Clamp Assembly	2" Tri-Clamp tee, gasket and clamp, Stainless Steel	MH1261-T
Junction box	For extension cables. Terminal strip included.	JBOX01
Extension Cable	AnalogPlus Extension cable	APECxx; xxx=ft

Product	Description	Part Number
Solutions		
1000uS/cm Solution	1000 µS/cm Conductivity Calibration Solution – 500ml bottle	SOL1000
2000uS/cm Solution	2000 µS/cm Conductivity Calibration Solution – 500ml bottle	SOL2000
5000uS/cm Solution	5000 µS/cm Conductivity Calibration Solution – 500ml bottle	SOL5000

7. Limited Warranty

TOROIDAL CONDUCTIVITY SENSOR WARRANTY/REPLACEMENT PLAN

Thermo Fisher Scientific warrants its AnalogPlus™ Toroidal Conductivity sensors 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 according to the proration schedule listed in this limited warranty. 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.

Control Number: W1003 Rev: 12/04

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 Customer Service 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.

Thermo Fisher Scientific

Environmental Instruments

Process Water Instruments



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