Analytical Sensors

THORNTON

Leading Pure Water Analytics

ISM™ Sensors for M800 & M300 Transmitters

- UniCond™ Conductivity/Resistivity
- pH/ORP
- Dissolved Oxygen
- Ozone

ISM

Digital Liquid Analysis Sensors

Optimized for Pure Water Treatment

METTLER TOLEDO

ISM™ Digital Analytical Sensors
with plug and measure capability

METTLER TOLEDO THORNTON M800 and M300 ISM process analytical instrumentation provides reliable, accurate measurements of conductivity/resistivity, pH/ORP, dissolved oxygen and dissolved ozone. On-board digital measurement and "Intelligent Sensor Management™" technology provide the utmost in convenience and control of sensor performance.

Quick and easy installation thanks to "Plug and Measure" capabilities

Operational errors at the transmitter are virtually eliminated since all relevant status and configuration information is automatically transferred from the sensor to the transmitter during startup. UniCond™ conductivity/resistivity sensors provide exceptionally wide measurement range, reducing inventory and variety of spare sensors.

Sensor Features and Benefits

- ISM Sensors are immediately recognized at installation
- Measurements are available within seconds of connection
- ISM capabilities communicate type, model, serial number, full calibration data, plus historical data with M800
- Sensors can be pre-calibrated in the laboratory and then installed in-situ
- On-line sensor diagnostics assure continuous process surveillance
- Historical calibration and exposure information enables real-time predictive maintenance programs with M800

Applications

Pure water treatment for ultrapure semiconductor rinsing, critical power/steam makeup and pharmaceutical waters

Semiconductor processing in rinsers and wet benches with precise resistivity measurement and temperature compensation

Power plant cycle chemistry and stator cooling monitoring with especially accurate temperature compensation for specific and cation conductivity and pH plus very low maintenance dissolved oxygen measurement

Pharmaceutical water monitoring to meet USP, EP, and JP conductivity requirements

Reclaim, recycle and wastewater treatment for the above industry applications for contaminant detection, diversion and neutralization

Contents by Parameter

UniCond™ Conductivity/Resistivity Sensors with ISM™

UniCond™ conductivity/resistivity sensors for the Thornton M800 and M300 ISM provide exceptionally wide measurement ranges due to their advanced built-in measuring circuit. The on-board measuring circuit eliminates interference from leadwire resistance and capacitance. Only digital signals go back to the transmitter. Advanced measuring techniques further contribute to superior accuracy over the expanded range.

Sensor Selection Criteria

- Conductivity or resistivity range – resistivity (Mohm-cm) = 1/conductivity (µS/cm)
- Mounting type – Insertion or submersion
- Pipe connection type and size
- Chemical compatibility, including cleaning and disinfection processes. Rely on process experience or consult Thornton for unusual process composition. PEEK is compatible with ozone and other oxidizers. Monel is recommended for exposure to hydrofluoric acid.
- Temperature requirements, including steam and/or hot chemical cleaning

Specifications

Cell Constant Accuracy	0.01 cm^{-1} sensor: ± 1% 0.1 cm^{-1} sensors: ± 1% for 0.02-5,000 µS/cm; ±3% > 5,000 µS/cm
Cell Constant Repeatability	± 0.25%;
Temperature Sensor	Pt1000 RTD, IEC 60751, Class A, with NIST-traceable calibration
Temperature Accuracy	± 0.1 °C at 25 °C;
Maximum Sensor Distance	300 ft (91m)
Finish (Sanitary 0.1 cm^{-1} Sensors)	Ra 8 microinches (0.2 micrometers), 316L SS is electropolished
Insulator Material	PEEK
Connector	IP65, mates with 58 080 27X series cable

Fitting	Insertion Length "X" in (mm)	Fitting/Body Material	Range (µS/cm)*	Cell Const. (cm^{-1})	Electrode Material	Max Pressure/Temp Psig (bar) at °F (°C)	Part No.
3/4" NPTM	1.35 (34)	PTFE®/SS	0.02-50,000	0.1	Titanium	250 (17) at 200 (93)	**58 031 404**
3/4" NPTM	5.19 (132)	PTFE®/SS	0.02-50,000	0.1	Titanium	250 (17) at 200 (93)	**58 031 409**
3/4" NPTM	1.35 (34)	PTFE®/SS	0.02-50,000	0.1	Monel	250 (17) at 200 (93)	**58 031 407**
3/4" NPTM	5.19 (132)	PTFE®/SS	0.02-50,000	0.1	Monel	250 (17) at 200 (93)	**58 031 408**
1/2"NPTM	1.14 (29)	PTFE®/SS	0.02-50,000	0.1	Titanium	250 (17) at 200 (93)	**58 031 406**
3/4" NPT	2.38 (86)	PTFE®/SS	0.002-500	0.01	Titanium	250 (17) at 200 (93)	**58 031 410**
1.5" Tri-Clamp®	3.38 (86)	Titanium	0.02-50,000	0.1	Titanium	203 (14) at 266 (130) & 450 (31) at 77 (25)	**58 031 413**†
1.5" Tri-Clamp®	3.38 (86)	316L SS	0.02-3,000	0.1	316L SS		**58 031 414**†
2" Tri-Clamp®	4.13 (105)	316L SS	0.02-3,000	0.1	316L SS		**58 031 415**†

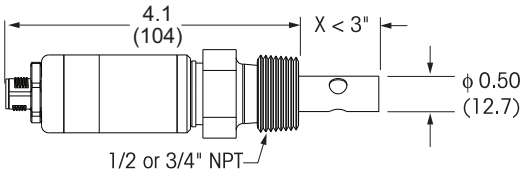
* Megohm-cm = 1/µS/cm

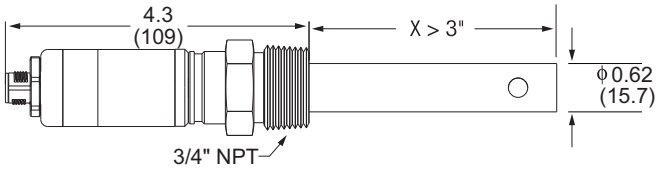
† FDA compliant materials with certification to meet EN10204 3.1B. & USP <88> Class VI

® Tri-Clamp is a registered trademark of Apha Laval

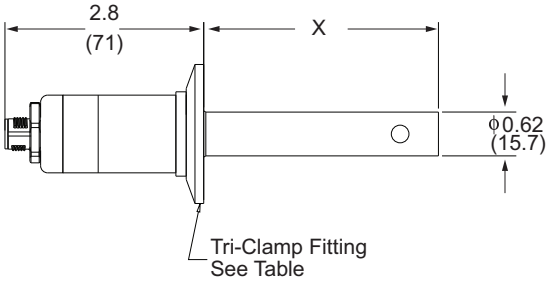
UniCond™ Conductivity/Resistivity Sensors

NPT 0.01 and 0.1 Constant





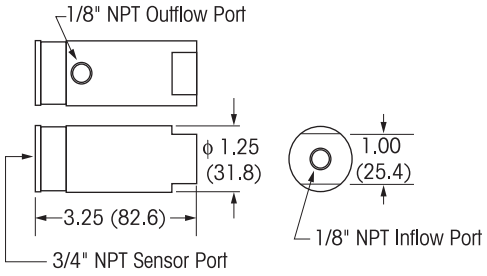
Sanitary 0.1 Constant



316SS Flow Housing*

58 084 000

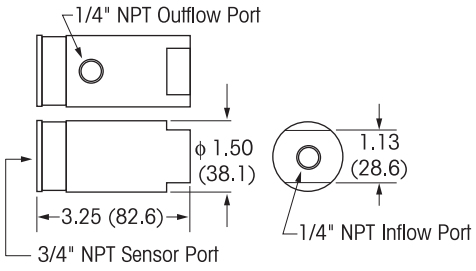
(1000-30)



PVDF Flow Housing*

58 084 001

(1000-31)



*For 0.1 constant, ¾" NPT short conductivity sensors only

Dimensions: inches (mm).

UniCond™ Conductivity/Resistivity Sensor Cables

For connections between Thornton ISM conductivity sensors and ISM instruments.

Length	Part No.
1 ft (0.3 m)	**58 080 270**
5 ft (1.5 m)	**58 080 271**
10 ft (3 m)	**58 080 272**
15 ft (4.5 m)	**58 080 273**
25 ft (7.6 m)	**58 080 274**
50 ft (15.2 m)	**58 080 275**
100 ft (30.5 m)	**58 080 276**
150 ft (45.7 m)	**58 080 277**
200 ft (61 m)	**58 080 278**
300 ft (91 m)	**58 080 279**

Conductivity Standard Solutions

Provided for sensor verification, recalibration or validation, conductivity standards are produced, analyzed, and documented in the METTLER TOLEDO THORNTON ISO 9001certified facility. Production is done with processes similar to those used to calibrate high-accuracy Thornton conductivity sensors. Standards are provided with label and certificate with lot number, certified value, expiration date, plus ASTM and NIST traceability data. These standards are analyzed and used at equilibrium with the atmosphere.

Standard	Accuracy	Shelf Life	Part No.
25 µS/cm, 500 mL, HCl	± 3%	6 mo	**58 078 001**
100 µS/cm, 500 mL, KCl	± 1%	12 mo	**58 078 002**
1000 µS/cm, 500 mL, KCl	± 1%	12 mo	**58 078 003**
10,000 µS/cm, 500 mL, KCl	± 1%	12 mo	**58 078 004**
100,000 µS/cm, 500 mL, KCl	± 1%	12 mo	**58 078 005**

UniCond™ Conductivity Sensor Calibration Module

- Provides the unique capability to calibrate the digital UniCond™ sensor measuring circuit to meet USP <645> and other regulatory requirements
- Includes resistances for all ranges of conductivity/resistivity and temperature
- Connects between UniCond™ conductivity sensor and an ISM transmitter
- With NIST-traceable certificate of calibration
- Enables an efficient QA program
- Patent pending

Description	Accuracy	Part No.
ISM Conductivity Calibration Module	± 0.08%	**58 082 305**

ISM™ pH and ORP Sensors

Thornton offers ISM pH sensors with a platinum solution ground that can also provide ORP measurement at the ISM transmitter. A variety of housings match installation requirements.

Specifications

Measuring Electrode	Glass pH, platinum ORP/solution ground
Reference Electrode	Silver-silver chloride with double junction or equivalent
Temperature Compensator	NTC included in all sensors
pH Range	0-14
Maximum Flow	10 ft/s (3 m/s)
Maximum Cable Lengths	65 ft. (20 m)

A complete pH or ORP installation requires **1** an electrode, **2** a housing and **3** an AK9 cable, from each of the tables below. No preamp is required. Each installation requires an M300 ISM or M800. In the table below, double lines divide groups of compatible electrodes and housings.

Electrode (1)

Application	Rating	Fitting / Material	Part No.
pH & ORP, general purpose,high pressure	See housing limits	Pg 13.5 glass, platinum	**52 005 381** 4260i-SG-120
pH & ORP, general purpose,& moderately pure water*	0-100 °C 60 psi (4 bar)	Pg 13.5 glass, platinum	**52 005 373** 3250i-SG-120
pH & ORP, retractable	See housing limits	Pg 13.5 glass, platinum	**52 005 382** 4260i-SG-225

Housing (2)

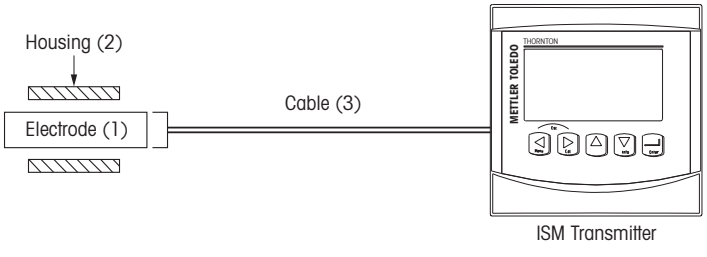
	Part No.
3/4″ NPT insertion or submersion** / CPVC 100 psi (7 bar) at 20 °C & 30 psi (2 bar) at 80 °C	**53 300 021**
3/4″ NPT insertion or submersion** / PVDF 87 psi (6 bar) at 20 °C & 15 psi (1 bar) at 100 °C	**52 401 520**
1″ weld tee / PVC / 50 psi (3.5 bar) at 60 °C	**58 084 014 (41 722 3001)**
Retractable 1-1/2″ NPT / CPVC / 75 psi (5 bar), 80 °C	**58 084 002 (1000-40)**
Retractable 1-1/2″ NPT / PVDF / 75 psi (5 bar), 100 °C	**58 084 003 (1000-41)**
Retractable 1″ NPT / 316 SS / 100 psi (7 bar), 100 °C	**58 084 004 (1000-42)**

* For use with moderately pure waters (conductivity 5-50 µS/cm) use 53 300 021 housing in 3/4" NPT earth-grounded metal pipe tee with flow <100 mL/min and discharge to open drain. For higher purity and/or higher accuracy in pure water see the pHure Sensor™, pages 8-9.

** For insertion in plastic pipe, use 3/4 x 1″ reducing bushing and 1″ pipe tee. For submersion w/plastic pipe, use 3/4 x 1″ reducing coupling and 1″ pipe.

AK9 pH/ORP Cable (3)

Cable Length		Part No.	
1 m	(3.3 ft)	**59 902 167**	**(10 000 0102)**
3 m	(9.8 ft)	**59 902 193**	**(10 000 0302)**
5 m	(16.4 ft)	**59 902 213**	**(10 000 0502)**
10 m	(32.8 ft)	**59 902 230**	**(10 000 1002)**
20 m	(65.6 ft)	**59 300 204**	**(52 300 204)**

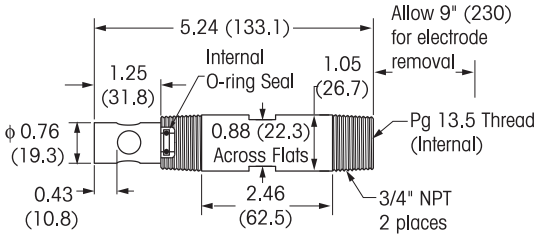


ISM™ pH and ORP Sensors

Electrodes

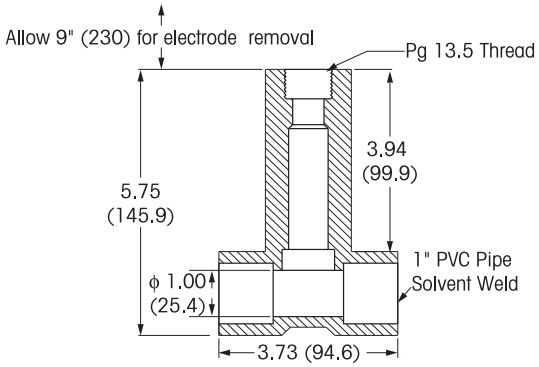
Housings

53 300 021



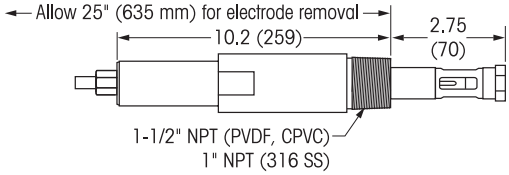
53 300 021 & 52 401 520

58 084 014
(41 722 3001)



58 084 014
(41 722 3001)

58 084 002
(1000-40)



58 084 00X
(1000-4X)

Dimensions: inches (mm).

pHure Sensors™ with ISM™

Applications for pure water pH measurement

Reverse osmosis – pH adjustment of clean recycle water or between membranes in two pass systems to optimize rejection rates

Power plant cycle chemistry – monitoring and controlling pH levels to comply with guidelines and minimize corrosion and scaling

pH measurement in low-conductivity waters requires special precautions. It must be made on a side-stream sample in a closed, metal, flow-through chamber with low flowrate and discharge to open drain. This assures a sample uncontaminated by carbon dioxide from the air, low and constant sample pressure at the reference electrode, and electrical shielding to promote stability. The sample line should be short and small in diameter to minimize sample delays and to minimize waste of pure water. Additional stability is obtained with a dual high-impedance measuring circuit that includes a solution ground.

Key to pure water pH measurements has been the use of a flowing-junction type of reference electrode which forces electrolyte through the reference junction to provide the same conditions in various samples. The flowing junction produces nearly the same potential in pure water as in the much more conductive calibrating buffer solutions. However, a flowing junction requires some form of electrolyte reservoir that can make installation, service and calibration more cumbersome and increases cost.

The METTLER TOLEDO THORNTON pHure Sensor™ uses a special internally-pressurized gel electrolyte reference electrode to produce similar results to a flowing junction but with much more convenient installation and maintenance. The electrode also includes a low resistance pH glass membrane, an integral, fast-responding NTC, and an AK9 connection. The mating ISM instrument accommodates the measuring circuit with solution ground for maximum stability. The flow housing provides a controlled flow path with minimum volume to encourage power plant corrosion particles to flush through instead of accumulating as with a large flow bowl.

All components of the pHure Sensor™ have been optimized for performance and value and conform to ASTM Standard D5128. Various lengths of cable can be selected to provide flexibility in locating the sensor. No preamplifier is required.

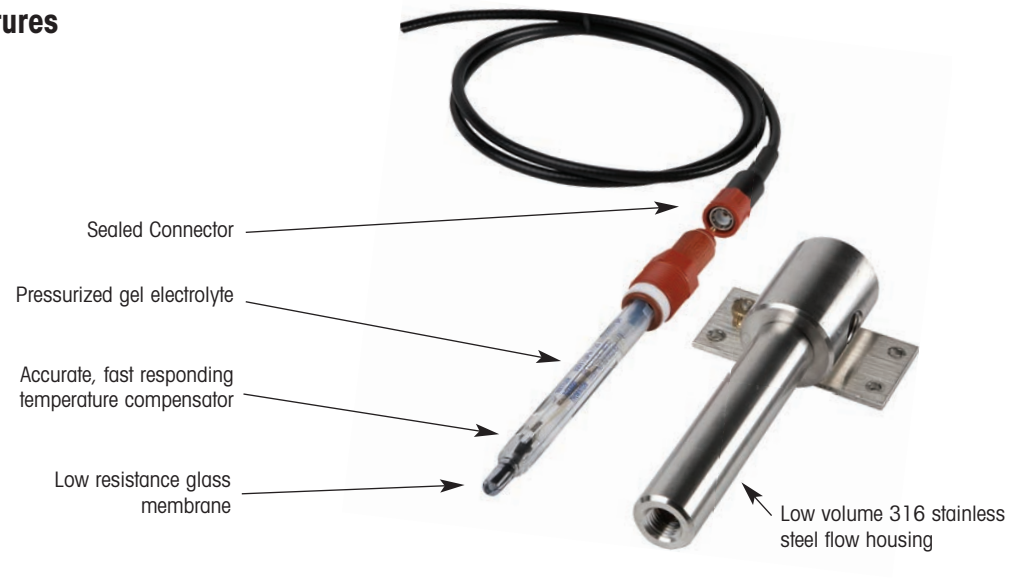
Specifications

Wetted Materials	316 SS, glass, silicone rubber
Process Connections	1/4" NPTF in/out
Flow Housing Volume	5 mL with electrode in place
Maximum Pressure	Atmospheric pressure for optimum stability; operational 0-35 psig (0-2.5 bar); can safely withstand 100 psig (7 bar)
Sample Temperature	32-176 °F (0-80 °C), short term to 212 °F (100 °C)
Sample pH	1-11
Sample Flowrate	50-150 mL/min
Sample Conductivity	> 0.8 µS/cm for highest accuracy
Connection	AK9 cable from sensor directly to instrument, included
Components Included	52 003 821 combination pH electrode, 58 084 010 (02385) flow housing and AK9 cable

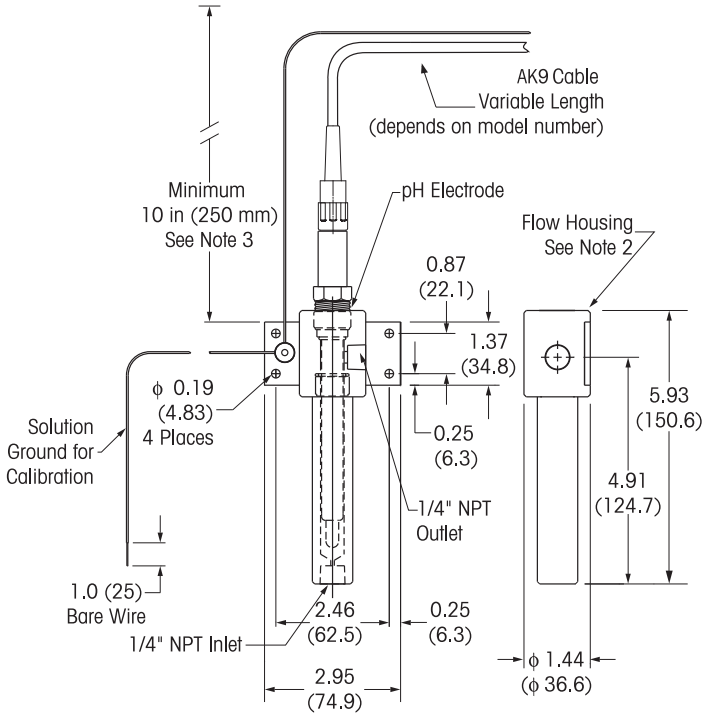
Description	Part No.
pHure Sensor™ with 3 ft (1 m) cable	**58 032 406**
pHure Sensor™ with 10 ft (3 m) cable	**58 032 407**
pHure Sensor™ with 16 ft (5 m) cable	**58 032 408**
pHure Sensor™ with 33 ft (10 m) cable	**58 032 409**
Replacement ISM combination electrode with temperature compensator	**52 003 821**

pHure Sensors™ with ISM™

pHure Sensor™ Features



pHure Sensor™ Dimensions



Notes:

1. Dimensions: inches (mm)
2. Electrode/Flow housing assembly must be in upright position as shown.
3. Allow at least 10 in. (250 mm) clearance to remove sensor.

pH and ORP Accessories

pH and ORP (Redox) Standard Buffer Solutions	Part No.
pH Buffer, 4.01, 250 mL	**51 340 057**
pH Buffer, 7.00, 250 mL	**51 340 059**
pH Buffer, 9.21, 250 mL	**51 300 193**
pH Buffer, 10.00, 250 mL	**51 340 056**
ORP Buffer, 220 mV, 6 x 250 mL	**51 340 081**

High Performance ISM™ DO Sensors

Thornton's High Performance ppb-level dissolved oxygen measurement capability excels in demanding low ppb-level applications. It provides a precise zero and a highly accurate response over the entire range of measurement. This allows the sensor to perform well at any level as well as providing very fast response to changes from one level to another.

Features

- Plug & measure capability
- Very fast response
- Intelligent Sensor Management®
- Low maintenance with drop-in modular membrane
- Excellent long-term stability

The polarographic probe uses a gas-permeable membrane through which oxygen passes to produce an electrochemical reaction and current flow in direct proportion. The membrane is stainless steel mesh-reinforced PTFE for exceptional durability. Behind that membrane is the platinum cathode where oxygen reacts to produce the measurement signal. The cathode is surrounded by a guard electrode which prevents stray oxygen from the sides of the membrane or inside of the probe from adding to the signal. The guard ring is the key to the very rapid downscale response. The electrochemical reaction is completed at the silver anode. Full temperature compensation accounts for effects on both membrane permeability and solubility of oxygen in water.

Applications

Power plant cycle chemistry monitoring of DO enables control of oxygen scavenger with phosphate, caustic or all-volatile treatment. With oxygenated treatment it can be used to regulate oxygen feed. Compliance with cycle chemistry guidelines and specifications for DO can be assured with this very accurate and responsive measuring system. Cycling plants can benefit from its rapid downscale response, assuring real-time reporting of even the fastest deoxygenation during startup.

Semiconductor ultrapure water for some processes requires low DO levels to prevent oxidation of wafer surfaces between stages. The ISM transmitter can provide a solid ppb-level DO measurement plus a simultaneous resistivity measurement in the same instrument.

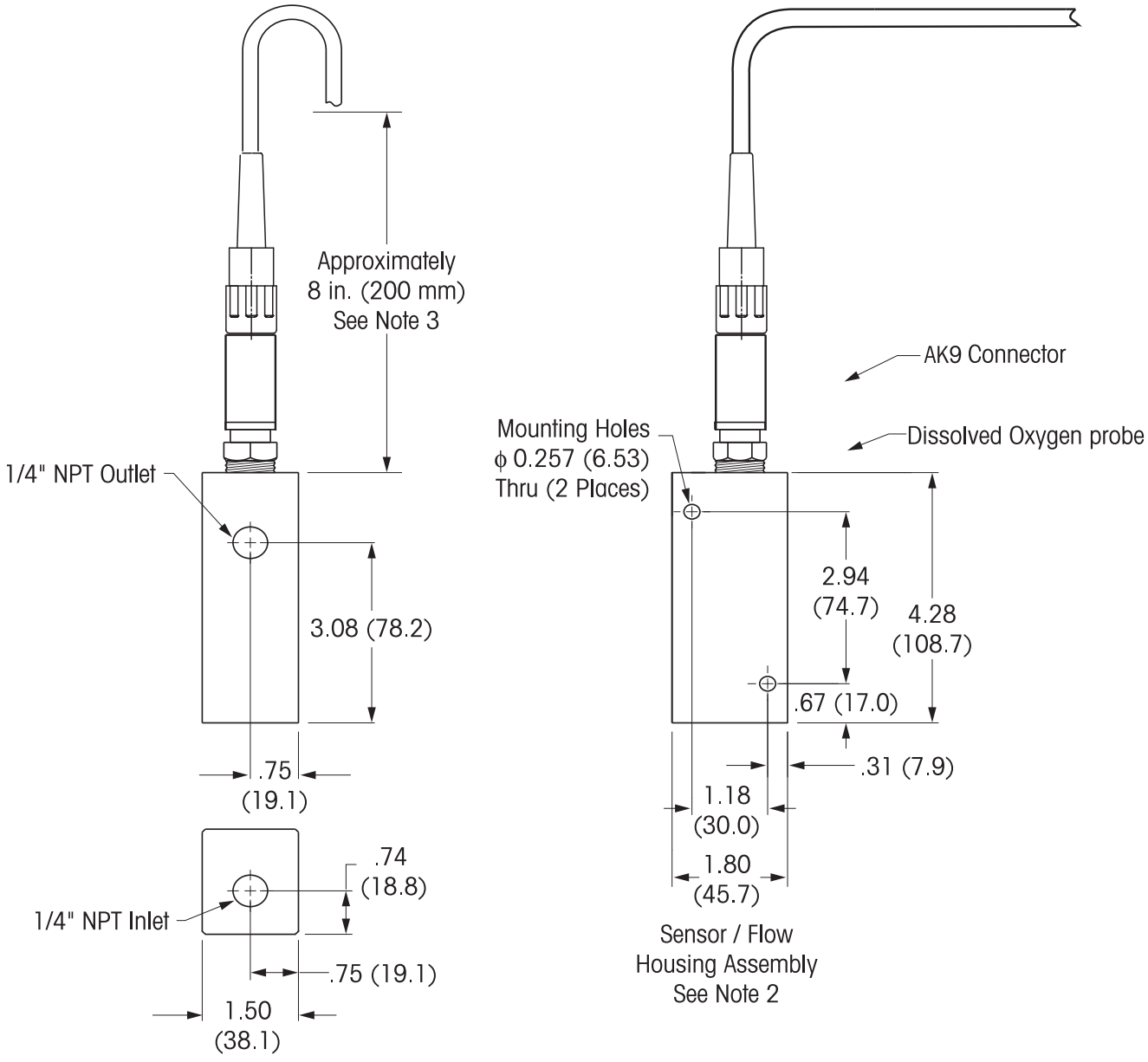
Pure water treatment systems with deaerators to produce water for the above applications can be reliably monitored with the M300 ISM system. The second measurement channel is available for conductivity, resistivity, pH or ORP monitoring.

Specifications

Sample Flowrate	50-1,000 mL/min
Sample Temperature	0-60 °C (32-140 °F) for temperature compensation; can tolerate 100 °C
Sample Pressure	0-5 bar (72 psig)
Sample Connections	1/4″ NPT
Wetted Materials	Polyacetal flow housing, polyphenylene sulfide probe body, PTFE membrane reinforced with stainless steel and silicone rubber, Viton and silicone rubber o-rings
Cable Length	Probe to instrument, 3 to 33 ft (1 to 10 m)
Weight	1 kg (2 lb) with flow housing
Response Time	98% response in 90 seconds
Operating Range	0-10,000 ppb (µg/L)
System Accuracy	± 1% of reading or 1 ppb, whichever is greater; ± 0.5 °C
Components Included	52 201 209 ISM DO Probe with spare electrolyte, 58 084 009 (17490) Housing, AK9 Cable

Description	Part No.
DO probe, flow housing & 3 ft (1 m) cable	**58 037 404**
DO probe, flow housing & 10 ft (3 m) cable	**58 037 405**
DO probe, flow housing & 16 ft (5 m) cable	**58 037 406**
DO probe, flow housing & 33 ft (10 m) cable	**58 037 407**
Replacement DO Probe	**52 201 209**
Maintenance kit (electrolyte & 4 membranes)	**52 200 024**

High Performance ISM™ Dissolved Oxygen Sensors



Notes:

1. Dimensions: inches (mm) unless noted otherwise
2. Sensor/Flow housing assembly must be in upright position as shown
3. Allow approximately 8 in. (200 mm) clearance to remove sensor

ISM™ Dissolved Ozone Sensors

Thornton's highly reliable dissolved ozone measurement capability uses a proven sensor design with rapid and accurate response to ozone concentrations. At the low end, its excellent sensitivity gives positive detection of zero ozone after destruction by UV light.

Features

- Rapid, accurate response
- Positive zero detection
- Low maintenance with drop-in modular membrane
- Plug & measure operation

The polarographic probe uses a gas-permeable membrane through which ozone passes to produce an electrochemical reaction and current flow in direct proportion. The membrane is reinforced silicone for durability. It is pre-mounted in a membrane cartridge which allows exceptionally easy replacement of electrolyte and membrane when necessary. Behind the membrane is the platinum cathode where ozone reacts to produce the measurement signal. The electrochemical reaction is completed at the silver anode. Full temperature compensation accounts for effects of both membrane permeability and solubility of ozone in water.

Applications

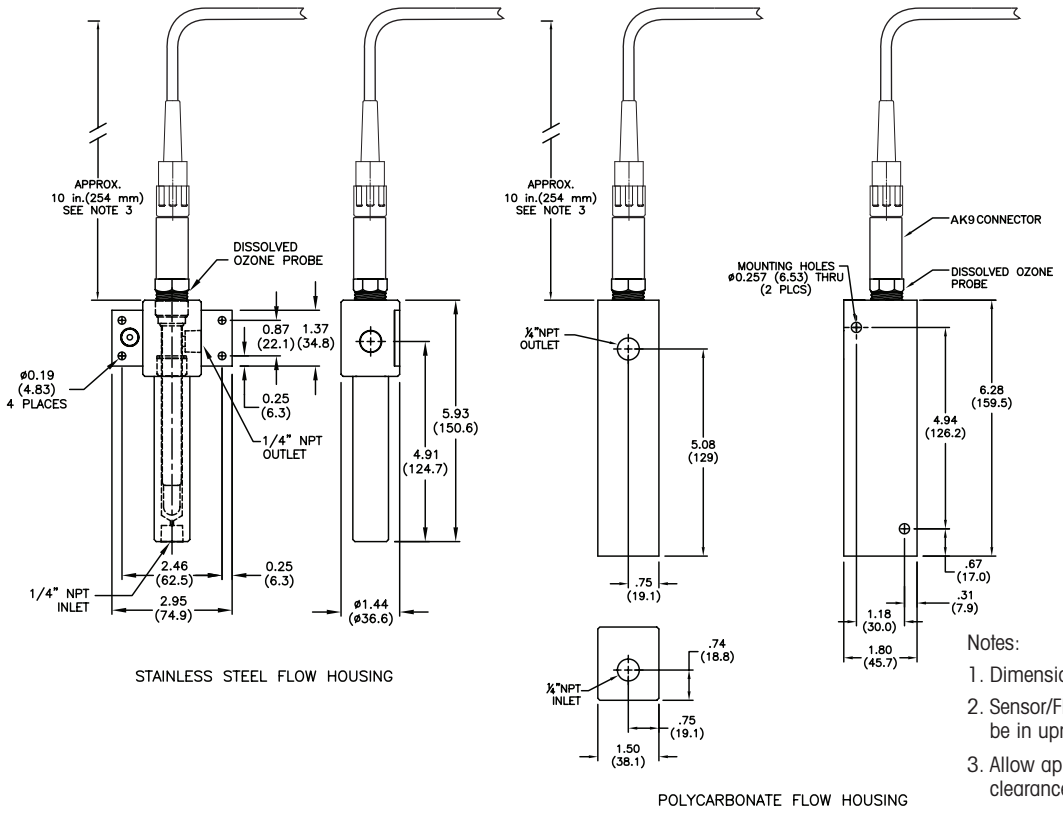
Pharmaceutical water systems can assure complete sanitization by controlling ozonation based on an ozone measurement downstream of the storage tank. To guarantee removal of all ozone downstream of UV destruction (and satisfy the 'no added substances' requirement), a second ozone measurement can confirm a zero level. When the entire distribution system is ozonated with the UV lights off, a third measurement at the return of the distribution piping can show when an adequate ozone level has been achieved throughout the loop. Thornton M300 instrumentation can monitor two points for ozone and/or conductivity with the same instrument.

Semiconductor ultrapure water ozone sanitization can be controlled by monitoring the ozone concentration downstream of the ozonator and UPW storage tank. To be sure all ozone has been decomposed after UV lights, a second ozone measurement can confirm a zero level. Thornton multiparameter capability can provide solid ppb-level ozone measurements plus simultaneous resistivity measurements in the same instrument.

Bottled Water Systems monitor ozonation levels to be sure of proper sanitization of the water, which in turn sanitizes the bottle and seal. Continuous measurement and control to proper ozone levels is a key quality practice that promotes consistent good taste and long shelf life. Thornton equipment can provide this measurement continuously at minimal cost.

Beverage Systems frequently use ozonated water in place of chemicals for the clean-in-place (CIP) operations when changing between flavors. Instead of using acids, caustic or chlorine, ozone can provide the cleaning and disinfection without risk of objectionable residuals or byproducts. Ozone monitoring and control are essential to enable repeatable CIP operations. Thornton instrumentation meets these requirements cost effectively.

ISM™ Dissolved Ozone Sensors



Notes:

1. Dimensions in parenthesis are millimeters
2. Sensor/Flow housing assembly must be in upright position as shown
3. Allow approximately 10 in. (254 mm) clearance to remove sensor

Specifications

Sample Flowrate	200 - 500 mL/min with housing; 1-3 ft/s (0.3-1 m/s) without housing
Sample Temperature	5-50 °C (41-122 °F) for measurement, probe can withstand 100 °C (212 °F)
Sample Pressure	Normal operation, atmospheric; can withstand 3 bar (45 psig)
Sample Connections	1/4" NPT
Wetted Materials	Polycarbonate or 316 SS flow housing, 316 SS probe, silicone rubber membrane
Cable Lengths	3 ft (1 m) to 33 ft (10 m) with VP cable
Weight	0.5 kg (1 lb) with flow chamber
Response Time, T90*	30 s
Operating Range	0-5,000 ppb (µg/L); 0-5.00 ppm (mg/L) short term; 0-500 ppb(µg/L); 0-0.5 ppm (mg/L) continuous
Relative System Accuracy	± 4% of reading or 3 ppb, which ever is greater; 0.5 °C
Included Parts	Probe with spare electrolyte, 17743 (58 084 012) Polycarbonate or 02385 (58 084 010) SS flow housing and AK9 cable as specified

* Upscale response may be slower if sensor has recently been exposed to high ozone concentration.

Description	Model 6510i Part Number
ISM Ozone sensor with PC housing, 1 m cable	**58 041 436**
ISM Ozone sensor with PC housing, 3 m cable	**58 041 437**
ISM Ozone sensor with PC housing, 5 m cable	**58 041 438**
ISM Ozone sensor with PC housing, 10 m cable	**58 041 439**
ISM Ozone sensor with SS housing, 1 m cable	**58 041 446**
ISM Ozone sensor with SS housing, 3 m cable	**58 041 447**
ISM Ozone sensor with SS housing, 5 m cable	**58 041 448**
ISM Ozone sensor with SS housing, 10 m cable	**58 041 449**
Maintenance Kit (4 membranes & electrolyte)	**52 201 218**
Replacement Probe	**52 201 226**

M800 ISM™ Transmitters

Sensors described in this data sheet are used with the full feature series of M800 Transmitters which are available in a ½ DIN wall/panel/pipe mount enclosure. Two and four-channel multiparameter models meet the requirements of diverse monitoring applications. Two additional inputs for pulse-type flow sensors are standard.

Features:

- Color touchscreen display
- On-line sensor diagnostics and predictive maintenance with iMonitor
- ISM Plug & Measure input for all parameters
- Supports Intelligent Sensor Management®
- Universal AC/DC power supply
- Menus available in English, French, German, Italian, Spanish, Portuguese, Russian, Japanese, Chinese and Korean
- Two Internal PID controlers
- Plug-in terminals for easy wiring
- Dynamic Lifetime Indicator (DLI) uses historical calibration and exposure data to enable real-time predictive maintenance display

See M800 technical datasheet 52 121 822 for more details

M300 ISM™ Transmitters

Sensors described in this data sheet are used with M300 ISM Transmitters which are available in both ¼ DIN panel mount and ½ DIN wall/panel/pipe mount configurations. Single-channel and two-channel multiparameter models meet the requirements of basic monitoring applications.

Features:

- ISM Plug & Measure input for all parameters
- Supports Intelligent Sensor Management®
- Four-line back-lit display
- On-line pH sensor diagnostics
- Universal AC/DC power supply
- Menus available in English, French, German, Italian, Spanish Portuguese, Russian, Japanese
- Internal PID control
- Plug-in terminals for easy wiring

See M300 ISM datasheet ML0140 for more details

www.mt.com/thornton

Visit for more information

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ML0139 Rev.E 07/12

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