Two-Parameter System

THORNTON

Leading Pure Water Analytics

Two Sensor Inputs:

- pH / ORP
- Dissolved Oxygen
- Conductivity
- Resistivity
- % Concentration
- Temperature
- % Rejection

2000 Two-Parameter Measurement System

METTLER TOLEDO

Key Features

- NIST & ASTM traceable factory calibration
- Plug-in NIST traceable calibrators for field calibration
- Two 4-20mA outputs scaled linear or bi-linear
- Accurate 3-wire temperature measurement-no startup calibration required
- Selectable, application-specific temperature compensation
- USP <645> compatibility with non-compensated measurement

Benefits

- Single instrument model for broad choice of measurements
- Wide conductivity/resistivity rangeability enables sensor calibration in ASTM standard solutions even for high purity applications
- Unique dissolved oxygen sensor options provide extremely high performance and long life
- Variety of pH/ORP preamp connections enable wide choice of sensors

Applications

Semiconductor rinse waters frequently require very low dissolved oxygen content as well as high resistivity to minimize oxidation and contamination of active surfaces. A single 2000 provides both measurements.

Reverse osmosis systems often require monitoring of feedwater pH or chlorine level by ORP in addition to the conductivity of the feed or permeate. The 2000 can accommodate any of the combinations.

Power plant cycle chemistry uses pH, specific & cation conductivity, ORP and dissolved oxygen to ensure that proper levels of phosphate, ammonia/amine and/or oxygen scavenger are maintained, to minimize corrosion. The 2000 can be used to measure and display a pair of values on a single sample stream on one instrument, reducing installation and operating costs.

Cooling towers and scrubbers often require both pH and conductivity control. Operation at high cycles of concentration may coat or foul conventional conductivity sensors. The 2000 provides the choice of pH sensors, plus four-electrode conductivity sensors, which are much less affected by fouling, giving accurate measurement under adverse conditions with just one instrument.

Recycle and Water treatment systems may require pH, ORP, conductivity, and/or TDS measurement on the same stream. A 2000 can efficiently meet the needs of such a system.

Many other applications are readily monitored and controlled by this flexible system.

Temperature Compensation

Conductivity temperature compensation capabilities include highly accurate application-specific algorithms for high purity water, power industry cation and specific conductivity, chemical concentrations, and special semiconductor rinse solutions. Linearly compensated and non-temperature compensated measurements are also available.

pH temperature compensation includes conventional Nernst electrode temperature compensation for the changing output of pH sensors. It also provides solution temperature compensation for the changing ionization of high purity water samples.

Functional

Con./Res. Ranges:	0.01 Constant Sensor:	0.002 to 200 µS/cm; 5000 Ω-cm to 500 MΩ-cm
	0.1 Constant Sensor:	0.02 µS/cm to 2000 µS/cm; 500 Ω-cm to 50 MΩ-cm
	50 Constant Sensor:	100 µS/cm to 1.0 S/cm; 1.0 Ω-cm to 0.01 MΩ-cm
	4-electrode Sensor:	10 µS/cm to 650,000 µS/cm; 1.54 Ω-cm to 0.1 MΩ-cm (244-63x Series) Readout in S/m is selectable
	TDS:	0 to 100,000 ppm with appropriate sensors
	Concentrations:	HCl: 0-20%, NaOH: 0-15%, H_2SO_4: 0-20%
pH & ORP Ranges:	-1 to 15 pH, -1250 to +1250 mV	
D.O. Ranges:	0-10,000 µg/L or ppb (dissolved oxygen) with auto-ranging	
Temp. Range:	-40 °C to 200 °C, -40 to 392 °F	
Resolution:	0.001 µS/cm, 0.001 MΩ-cm, 0.1 °C, 0.01 pH, 1 mV, 0.1 ppb, 0.1µg/L dissolved oxygen	
Con./Res. Inputs:	From Thornton conductivity sensors with Pt1000 RTD, via accessory patch cord	
pH, ORP, D.O. Inputs:	From Thornton sensors with preamp and Pt1000 RTD, via accessory patch cord.	
Con. Temp. Comp.:	Automatic, referenced to 25 °C for resistivity, conductivity, % rejection and TDS. Field selectable for standard high purity (Thornton/Light), cation, ammonia/ETA (power industry), 75% isopropyl alcohol, and ethylene glycol. Non-temperature compensated measurement, to meet USP <645> requirements. Concentration measurements also include specialized compensation for the specific material.	
pH Temp. Comp.:	Conventional (Nernst) electrode temperature compensation plus adjustable solution temperature compensation for high purity water.	
D.O. Temp. Comp.:	Dissolved Oxygen temperature compensation for membrane permeability and oxygen solubility.	

Outputs

Setpoints/Alarms:	Four controlled setpoints can be set as high or low limits (or USP limit for conductivity). Any relay can be activated by multiple setpoints.
Relays:	Standard: 2 mechanical SPDT, 5 amp at 250 VAC or 30 VDC resistive load; Optional, additional: 2 AC-only, solid state, SPST, 1.5 amp, 250 VAC resistive load, 10 mA minimum. All relays are potential-free and have individually adjustable delay and hysteresis (deadband).
Analog output Signals:	Two optional powered 4-20 mA outputs (recalibratable to 0-20 mA), 500 ohm load maximum, freely scalable to any parameter and range; isolated from input and from ground. Linear or bi-linear scaling.
Serial output:	RS232, maximum distance of 50 feet (15 m); RS422, maximum distance of 4000 feet (1220 m); field selectable up to 19.2 kbaud. External isolation required except with 0.1/cm conductivity sensors.

Performance

Con./Res. Accuracy:	± 0.5% of reading or ± 0.5 ohm, whichever is greater; ± 0.25 °C
pH/ORP Accuracy:	± 0.02 pH, ± 2 mV, ± 0.3 °C
D.O. Accuracy:	See Sensor
Con./Res. Repeatability:	± 0.5% of reading, ± 0.13 °C
pH Repeatability:	± 0.01 pH, ± 1 mV, ± 0.2 °C
Ratings/approvals:	Meets CE requirements; UL & cUL Listed
Analog output accuracy:	± 0.05 mA within 15-30°C ambient

Environmental

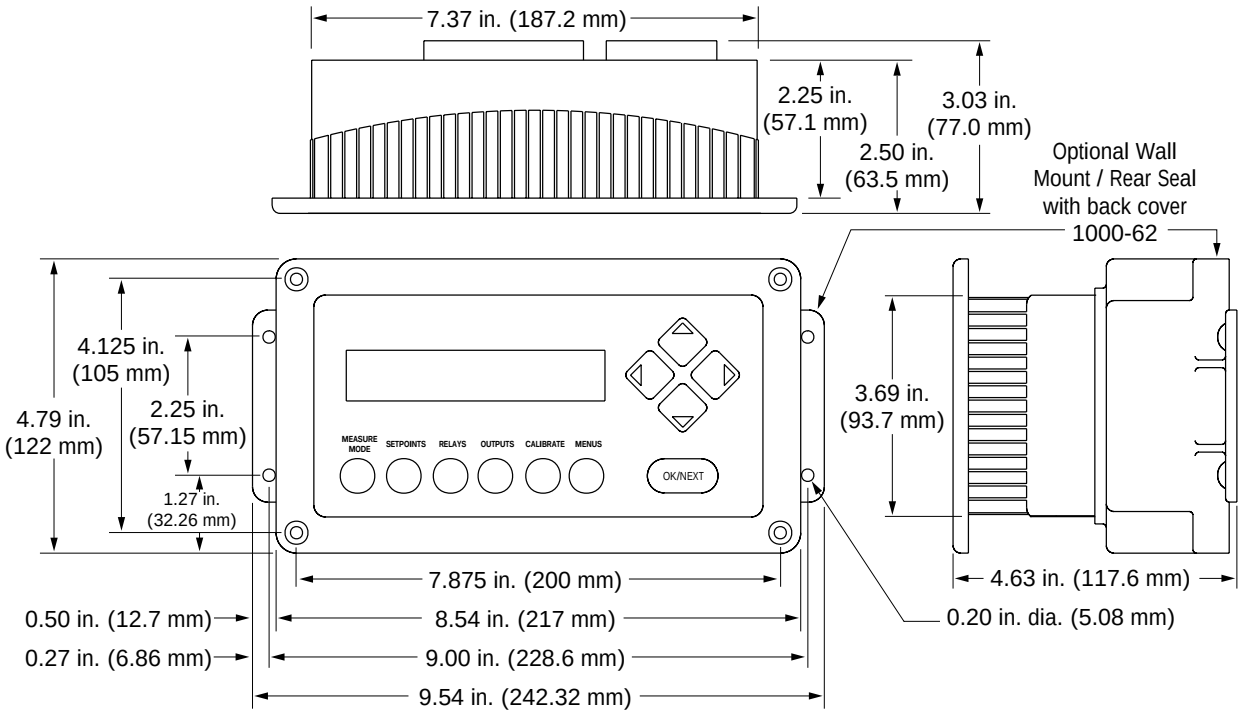
Storage temp.:	-40 to 70 °C (-40 to 158 °F)
Operating temp.:	-10 to 55 °C (14 to 131 °F)
Humidity:	0 to 95% RH, non-condensing
General:	If the equipment is used in a manner not specified by Thornton Inc, the protection provided by the equipment may be impaired. For indoor use, Pollution degree 1.
UL Electrical Environment:	Installation (overvoltage) Category II

Enclosure

Display:	16 character backlit LCD (4.8 x 9.6 mm)
Keypad:	11 flush, tactile feedback keys
Material:	ABS-PC polymer alloy
Panel cutout:	3.78 x 7.56" (96 x 192 mm) DIN
Wall mount:	Available with accessory back cover
Pipe mount:	For 1-1/2 to 4" vertical pipe, accessory bracket used with back cover
Weight:	1.9 lb. (0.9 kg)
Rating:	NEMA 4X, IP65 panel mount and accessory back cover
Sensor cable length:	200 ft (61 m) max; 50 ft (15 m) max for 4-electrode conductivity

Power

Line:	90-130 VAC or 180-250 VAC, 50-60 Hz, 12W maximum; or 12-30 VDC, 300 mA steady state, 600 mA inrush. DC power must be isolated from earth ground.
Memory retention:	On power loss all programmed values are retained in non-volatile memory without batteries



2000 Sensor Compatibility

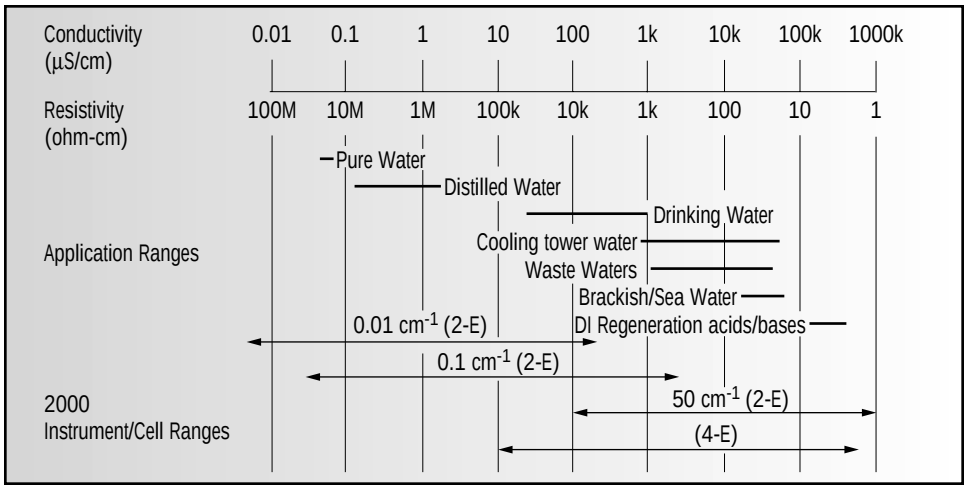
Channel A Input

Channel B Input	Sensors	pH	ORP	Conductivity 0.01 & 0.1 cm^{-1}	Conductivity 50 cm^{-1}	Conductivity 4-E	D.O.
	pH	•	•	•	•	•	•
	ORP	•	•	•	•	•	•
Conductivity	0.01 & 0.1 cm^{-1}	•	•	•			•
Conductivity	50 cm^{-1}	•	•				•
Conductivity	4-E	•	•				•
	D.O.	•	•	•	•	•	

Dots indicate compatibility. 4E = 4 electrode conductivity sensor

Calibrator Kit 1865-0X

Application and Sensor Ranges



VP Calibrator Adapter
58 080 102

2000 Two Parameter Analyzer Models

Relays	Analog Outputs	Power	Part No.
2 SPDT mechanical	0	110VAC (24 VDC)	**6820-1**
2 SPDT mechanical	0	220VAC (24 VDC)	**6820-2**
2 SPDT mechanical	2	110VAC (24 VDC)	**6822-1**
2 SPDT mechanical	2	220VAC (24 VDC)	**6822-2**
2 SPDT mechanical & 2 solid state, AC only	2	110VAC (24 VDC)	**6842-1**
2 SPDT mechanical & 2 solid state, AC only	2	220VAC (24 VDC)	**6842-2**

2000 operates as a 4-wire transmitter with either AC or DC power. DC power must be isolated from earth ground and from other instruments.

Accessories

Description	Part No.
Wall Mount NEMA 4X, IP65 Back Cover	**1000-62**
Pipe Mount Bracket (1-1/2 to 4" vertical pipe)*	**1000-63**

* Requires back cover above.

Sensor Patch Cords

Length	Standard Part No.	VP* Part No.
1 ft (0.3 m)	**1001-67**	-
5 ft (1.5 m)	**1005-67**	**58 080 201**
10 ft (3 m)	**1010-67**	**58 080 202**
15 ft (4.5 m)	**1015-67**	**58 080 203**
25 ft (7.6 m)	**1025-67**	**58 080 204**
50 ft (15.2 m)	**1050-67**	**58 080 205**
75 ft (23 m)	-	**58 080 206**
100 ft (30.5 m)	**1110-67**	**58 080 207**
150 ft (45.7 m)	**1115-67**	**58 080 208**
200 ft (61 m)	**1120-67**	**58 080 209**

One cord is required for each sensor except 240-217, -218, -220. 4-electrode conductivity sensors are limited to 50 ft. (15.2 m)
* For VP Conductivity sensors only (see page 6 table, third column); NOT for pH, ORP or dissolved oxygen sensors.

58 080 20X*
VP Patch Cord

1XXX-67
Std. Patch Cord

2000 Plug-in Calibrators - NIST Traceable, ± 0.08% Accuracy

Description				Part No.
High Resistivity/Low Conductivity Kit (includes 1864-05, -06, -12)				**1865-05**
Cal. Value	**2E Range**	**4E Range**	**Temperature**	
500k Ω	5M Ω-cm, 0.2 µS/cm	5M Ω-cm, 0.2 µS/cm	104 °C	**1864-05**
50k Ω	0.5M Ω-cm, 2 µS/cm	200k Ω-cm, 5 µS/cm	0 °C	**1864-06**
open	∞ Ω-cm, 2 µS/cm	∞ Ω-cm, 2 µS/cm	25 °C	**1864-12**
Low Resistivity/High Conductivity Kit (includes 1864-07, -08, -09)				**1865-06**
Cal. Value	**2E Range**	**4E Range**	**Temperature**	
5k Ω	50k Ω-cm, 20 µS/cm	20k Ω-cm, 50 µS/cm	104 °C	**1864-07**
500 Ω	5k Ω-cm, 200 µS/cm	2k Ω-cm, 500 µS/cm	0 °C	**1864-08**
short	0 Ω-cm, ∞ µS/cm	0 Ω-cm, ∞ µS/cm	25 °C	**1864-09**
Full range kit (contains calibrators 1864-05, -06, -07, -08, -09 and -12)				**1865-07**

Adapter, VP to Standard connector for calibrating a channel with VP patch cord, 58 080 102.

Sensor Selection Criteria

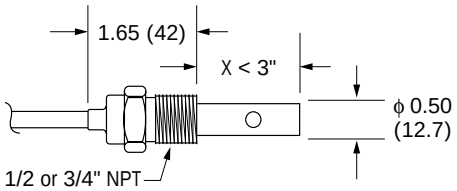
- Conductivity or resistivity range — resistivity (Mohm-cm) = 1/conductivity (µS/cm)
- Mounting type — Insertion, retractable or submersion
- Pipe connection type and size
- Suspended solids — four-electrode sensors have flat surfaces which are less likely to accumulate solids and are easier to clean than others.
- Chemical compatibility, including cleaning and disinfection processes. Rely on process experience or consult Thornton for unusual process composition. PEEK is recommended for exposure to ozone and other oxidizers. Monel is recommended for exposure to hydrofluoric acid.
- Temperature requirements, including steam and/or hot chemical cleaning

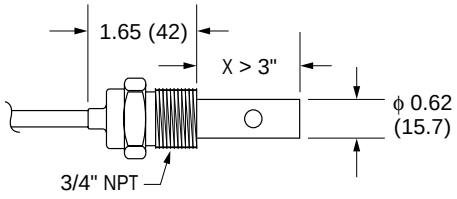
Cell Constant Accuracy: ±1% except ±5% system accuracy for 244-Series
Cell Constant Repeatability: ±0.25% except ±2% for 244-Series
Temperature Sensor: Pt1000 RTD, except thermistor for 240-501
Temperature Accuracy: ±0.1°C at 25 °C, except 240-501
Cable Jacket Material: 240-Series - PVC, 80 °C rating ; 243-Series - Teflon, 200 °C rating
Maximum Sensor Distance: 200 ft (60 m) except 50 ft (15 m) for 244-Series
Surface Finish (sanitary sensor): Ra 8 microinches (0.2 micrometers), 316L SS is electropolished

Fitting	Insertion length "X" in (mm)	Cable Length ft (m)/ Connector	Fitting Material	Range (µS/cm)*	Cell Const. (cm-1)	Electrode Material	Insulator Material	Max Pressure/Temp Psig (bar) at °F (°C)	Part No.
3/4" NPTM	1.35 (34)	1.5 (0.5)/S	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-201**
3/4" NPTM	5.19 (132)	1.5 (0.5)/S	Teflon/SS	0.02-2000	0.1	Titanium	PPS	250 (17) at 200 (93)	**240-202**
3/4" NPTM	1.35 (34)	1.5 (0.5)/S	Teflon/SS	0.02-2000	0.1	Monel	PEEK	250 (17) at 200 (93)	**240-203**
3/4" NPTM	5.19 (132)	1.5 (0.5)/S	Teflon/SS	0.02-2000	0.1	Monel	PPS	250 (17) at 200 (93)	**240-204**
3/4" NPTM	5.19 (132)	1.5 (0.5)/S	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-206**
3/4" NPTM	1.15 (29)	None/S	PVDF	0.02-2000	0.1	Titanium	PEEK	100 (7) at 203 (95) & 500 (34) at 77 (25)	**240-207**
Retractable for 1000-4X housing†††	2.75 (70)	None/S	SS	0.02-2000	0.1	316L SS	PEEK	58 (4) at 268 (131) & 100 (7) at 203 (95) & 250 (17) at 77 (25)	**240-212**
1/2" NPTM	1.14 (29)	1.5 (0.5)/S	Noryl	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-213**
3/4" NPTM	1.14 (29)	1.5 (0.5)/S	Noryl	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-214**
3/4" NPTM	1.35 (34)	10 (3)/S	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-215**
1/2" NPTM	1.14 (29)	1.5 (0.5)/S	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-216**
3/4" NPTM	1.35 (34)	20 (6.1)***	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-217**
1/2" NPTM	1.14 (29)	10 (3)***	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-218**
3/4" NPTM	1.35 (34)	30 (9)***	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-220**
3/4" NPTM	2.38 (60)	1.5 (0.5)/S	Teflon/SS	0.002-200	0.01	Titanium	PEEK	250 (17) at 200 (93)	**240-101**
1.5" Tri-Clamp	3.38 (86)	1.5 (0.5)/S	Titanium	0.02-2000	0.1	Titanium	PEEK		**243E221**†
1.5" Tri-Clamp	3.38 (86)	1.5 (0.5)/S	316L SS	0.02-2000	0.1	316L SS	PEEK	150 (10) at 311 (155) &	**243E223**†
2.0" Tri-Clamp	4.13 (105)	1.5 (0.5)/S	316L SS	0.02-2000	0.1	316L SS	PEEK	450 (31) at 77 (25)	**243E227**†
DN25BBS	4.13 (105)	1.5 (0.5)/S	316L SS	0.02-2000	0.1	316L SS	PEEK		**243E301**†
1" NPTM	4.90 (125)	1.5 (0.5)/S	PVDF/ Epoxy	100-1,000K	50	Graphite	Epoxy	100 (7) at 200 (93)	**240-501**
3/4" NPTM	1.35 (34)	1.5 (0.5)/VP	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-231**
3/4" NPTM	5.19 (132)	1.5 (0.5)/VP	Teflon/SS	0.02-2000	0.1	Titanium	PEEK	250 (17) at 200 (93)	**240-236**
1.5" Tri-Clamp	3.35 (85)	None/VP	316L SS	0.02-2000	0.1	316L SS	PEEK	150 (10) at 311 (155) &	**243E233**†
2.0" Tri-Clamp	4.10 (104)	None/VP	316L SS	0.02-2000	0.1	316L SS	PEEK	450 (31) at 77 (25)	**243E237**†
1.5" Tri-Clamp	1" (25)	None/VP	PEEK	10-650,000	4-E	316L SS†	PEEK	200 (14) at 122 (50) &	**244-633**††
2" Tri-Clamp	1" (25)	None/VP	PEEK	10-650,000	4-E	316L SS†	PEEK	70 (5) at 302 (150)	**244-634**††
1" NPTM	1.1" (28)	None/VP	PEEK	10-650,000	4-E	Hastelloy C†	PEEK		**244-630**††
1" NPTM**	1.1" (28)	None/VP	CPVC	10-650,000	4-E	316L SS†	CPVC	50 (3.5) at 176 (80) &	**244-631**††
1" NPTM**	1.1" (28)	None/VP	CPVC	10-650,000	4-E	Hastelloy C†	CPVC	100 (7) at 77 (25)	**244-635**††

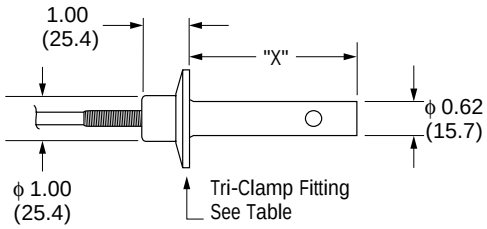
* Megohm-cm=1/(µS/cm)
** 1" NPTM insertion and 1" NPTM submersion
*** tinned leads--no patch cord required
S = Standard connector used with 1XXX-67 patch cords only.
† includes material certification to meet EN10204 3.1B.
†† 4-Electrode Sensor, maximum patch cord length 50 ft. (15 m).
††† See pages 8-9 for 1000-4X Series retractable housing (also used for pH & ORP)
VP = Vario Pin sealed connector used with 58 08020X patch cords only. (58 080 101 3-ft adapter cable can connect an existing 1XXX-67 patch cord to a VP sensor.)

NPT 0.01 and 0.1 Constant

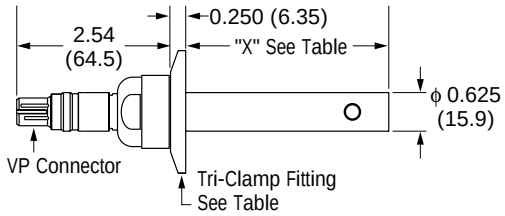




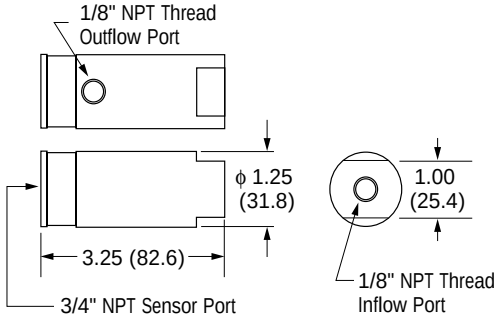
Sanitary 243E22X



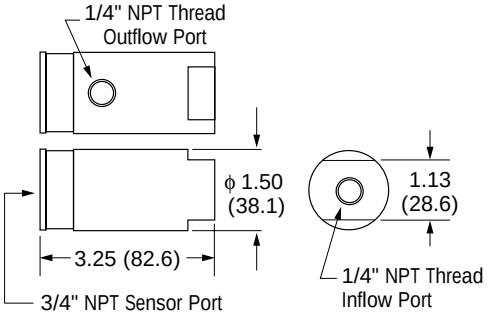
Sanitary 243E23X



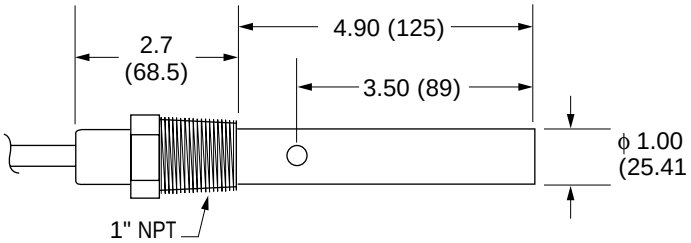
316SS Flow Chamber 1000-30



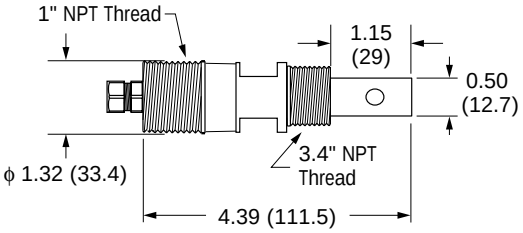
PVDF Flow Chamber 1000-31



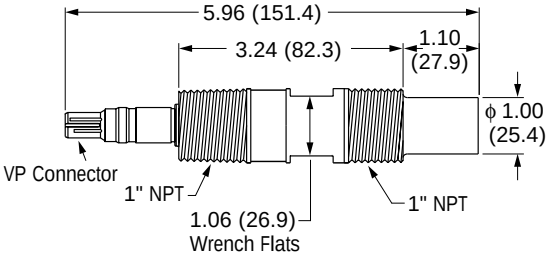
50 Constant 240-501



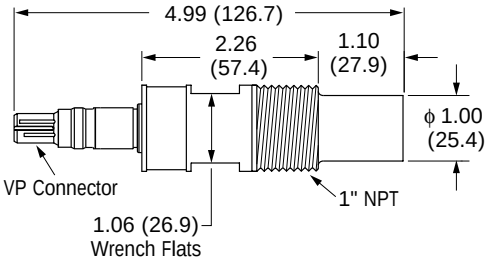
Submersion 0.1 Constant



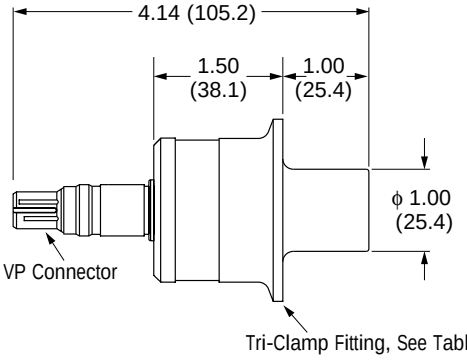
NPT 4-Electrode 244-631 & -635



NPT 4-Electrode 244-630



Sanitary 4-Electrode 244-633 & 244-634



Dimensions: inches (mm)

Thornton offers two series of pH and ORP sensors: detachable and integral.
- **Detachable** sensors have an electrical connector directly on the electrode body, allowing more flexible and lower cost electrode replacement, separate from the preamplifier. A variety of housings, including retractable models are only available in this series. See below.
- **Integral** sensors have the preamplifier built into the connector at the end of the sensor cable and all have integral NPT process connections (no housings) for simple installation and low initial cost. See pages 10-11 for this series.

Measuring electrode: Glass or antimony pH, platinum ORP
Reference electrode: Silver-silver chloride with double junction or equivalent
Temperature compensator: Pt1000 included in all pH sensors; not in ORP sensors
Maximum flow: 10 ft/s (3 m/s)
Maximum cable lengths: 300 ft (91 m) patch cord, 15 ft. (5 m) preamp cable

2000 Detachable pH and ORP Sensors

A complete pH or ORP installation requires **1** an electrode, **2** a housing and **3** a preamp from each of the tables below. In addition, each installation requires a patch cord and instrument. Double lines divide groups of compatible electrodes and housings.

Electrode (1)				Housing (2)	
Application	**Rating**	**Fitting / Material / Connection**	**Part No.**	**Connection / Material / Rating**	**Part No.**
pH, general purpose, low cost	30psi (2 bar) at 60 °C	PG13.5 / polysulfone & glass / VP	**52 000 512**	3/4"NPT insertion or submersion** / CPVC / 100psi (7 bar) at 80 °C	**53 300 021**
pH, general purpose high pressure	See housing limits	PG13.5 / glass / VP	**52 002 146**		
pH, general purpose & moderately pure waters*	100 °C 36psi (2.5 bar)	PG13.5 / glass / VP	**52 001 419**	3/4"NPT insertion or submersion** / PVDF / 100psi (7 bar) at 110 °C	**52 401 520**
ORP, general purpose & moderately pure water	0-100 °C 36psi (2.5 bar)	PG13.5 / glass & Pt / S8	**10 505 3339**		
ORP, general purpose, high pressure	See housing limits	PG13.5 / glass & Pt / S8	**10 505 3288**	1" weld tee / PVC / 50psi (3.5 bar) at 60 °C	**41 722 3001**
pH, general purpose high chemical resistance	0-100 °C 100psi (7 bar) at 65 °C 50psi (3.5 bar) at 100 °C	1" NPT insertion or 1" NPT submersion / PVDF & glass / VP	**41 453 3102**	user's 1-1/2" tee and reducing bushing for insertion, or 1" coupling & pipe for submersion	**none required**
pH, Retractable	See housing limits	PG 13.5 retractable / Glass / VP	**52 002 147**	Retractable 1-1/2" NPT / CPVC / 75psi (5 bar), 80 °C	**1000-40**
				Retractable 1-1/2" NPT / PVDF / 75psi (5 bar), 100 °C	**1000-41**
ORP, Retractable	See housing limits	PG 13.5 retractable / Glass & Pt / S8	**10 505 3255**	Retractable 1" NPT / 316SS / 100psi (7 bar), 100 °C	**1000-42**

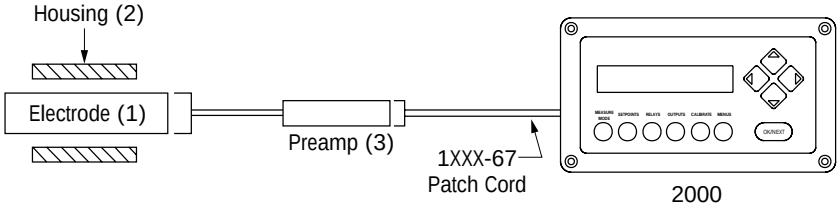
* For use with moderately pure waters (conductivity 2-50 µS/cm) use 53 300 021 housing in 3/4" NPT earth-grounded metal pipe tee with flow <100 mL/min and discharge to open drain. For higher purity and/or higher accuracy in pure water see the 363-110 sensor, pages 10-11.

** 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.

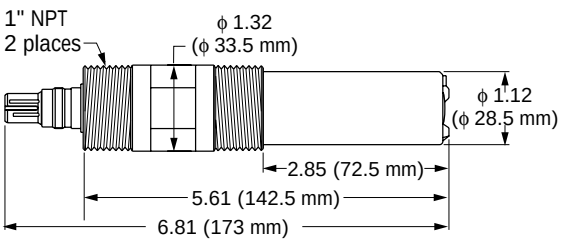
Preamp (3)

Connector	Cable Length	Part No.
pH		
VP	1 m	**1000-93**
VP	3 m	**1000-94**
VP	5 m	**1000-95**
ORP		
AS9	1 m	**1000-85**
AS9	3 m	**1000-02**
BNC	0.1 m	**1000-77**

AS9 preamp connector mates with S8 electrode connector.



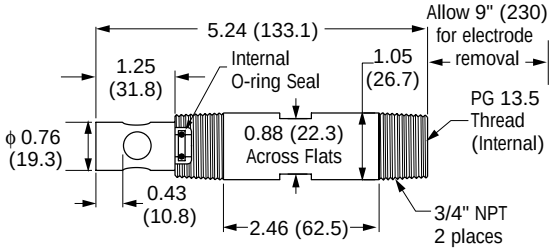
Electrodes



41 453 3102 Electrode

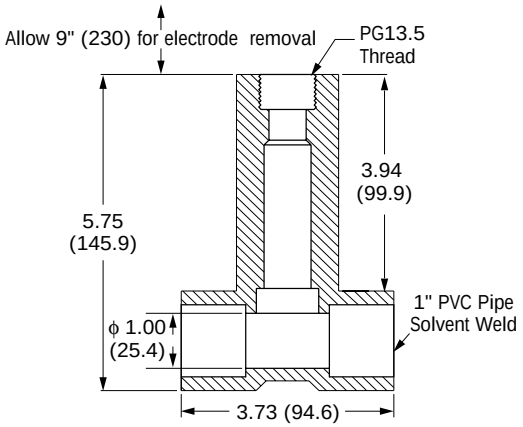
10 505 3339
10 505 3288
52 000 512
52 001 419
52 002 146
41 453 3102
52 000 506

Housings



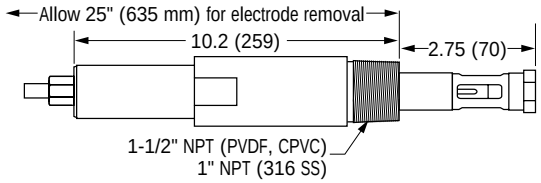
53 300 021 & 52 401 520

53 300 021



41 722 3001

41 722 3001



1000-4X

1000-41

Preamps

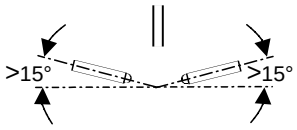
1000-93

1000-77

Dimensions: inches (mm)

General Purpose pH Sensor In-Line Installation
Because pH sensors require periodic calibration, install them in a side stream with isolation valve(s) for convenient access, wherever possible. Also where possible, provide discharge to an open drain for optimum life and performance.

In any arrangement, pH sensors must be mounted upright or at least 15° above horizontal as shown.



High purity pH measurements
pH measurement in high purity waters requires special precautions. It must be made on a side-stream sample in a flow-through chamber or metal pipe tee with flowrate less than 100 mL/min and discharge to open drain. This assures a sample uncontaminated by contact with air and minimal, constant sample pressure at the reference electrode. The sample line should be short and small in diameter to minimize sample delays and to minimize waste of high purity water.

The stability and accuracy of measurement decreases as sample water purity increases (as conductivity decreases below 50 µS/cm). Best performance is obtained with the 363-110 sensor, page 10 but it is more fragile and has a more involved installation. Moderate performance can be obtained with the 52 001 419 electrode and housing, page 8.

2000 Integral pH and ORP Sensors

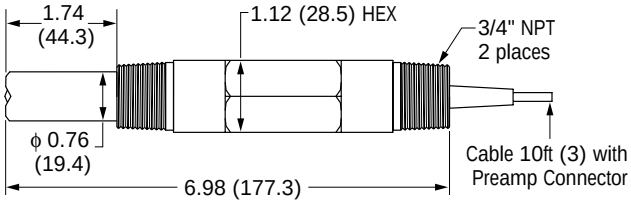
Integral pH and ORP sensors are designed for simple mounting with dual NPT threaded ends for in-line, submersion, or flow through mounting (with pipe tee). The flat surface and sealed double junction reference electrode reduce maintenance. The preamplifier is built into the cable connector.

The 363-110 high purity pH sensor provides a sealed flow chamber to prevent carbon dioxide contamination from the air. Stainless steel construction shields the electrode and eliminates sensitivity. A combination pH sensor with reservoir-fed, flowing junction reference electrode gives stable performance in high purity water and buffer solutions.

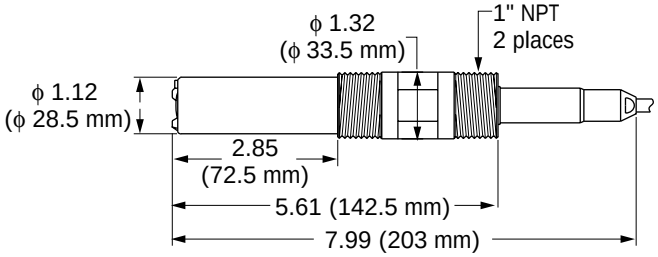
Measurement	Material	Process Connection	Maximum Pressure	Maximum Temp	Range	Cable Length Preamp	Part No.
pH, General Purpose	CPVC, Ceramic	3/4" NPTM Insertion or Submersion*	100psi (7 bar) at 113°F (45°C) 45psi (3 bar) at 176°F (80°C)		0-12pH	10ft (3m) w/preamp	**363-101**
pH, General Purpose, hi temp	PPS, Ceramic	3/4" NPTM Insertion or Submersion*	100psi (7 bar) at 122°F (50°C) 50psi (3 bar) at 212°F (100°C)		0-12pH	10ft (3m) w/preamp	**363-132**
pH, General Purpose	PVDF	1" NPTM Insertion or Submersion*	100psi (7 bar) at 149°F (65°C) 50psi (3.5 bar) at 212°F (100°C)		0-13pH	5ft (1.5m) w/preamp	**363-131**
pH, High Purity for samples <40µS/cm	316 SS Silicone Rubber	1/4" FNPT Flow Chamber	Atmospheric operation; 60 psig (4 bar) for safety	32-140°F (0-60°C)	0-12pH	5ft (1.5m) w/preamp	**363-110**
Replacement pH Electrode for 363-110	316 SS	See above	See above	32-140°F (0-60°C)	0-12pH	5ft (1.5m) w/BNC connector	**1000-76**
pH, Antimony for HF service only	CPVC, Ceramic	3/4" NPTM Insertion or Submersion*	100psi (7 bar) at 113°F (45°C) 45psi (3 bar) at 176°F (80°C)		1-9pH	10ft (3m) w/preamp	**363-201**
ORP, Platinum	CPVC, Ceramic	3/4" NPTM Insertion or Submersion*	100psi (7 bar) at 113°F (45°C) 45psi (3 bar) at 176°F (80°C)		±1500mV	10ft (3m) w/preamp	**363-501**

* For insertion mounting in plastic tee, use next larger size tee and reducing bushing. For submersion mounting, use 3/4 x 1" coupling with 1" support pipe.

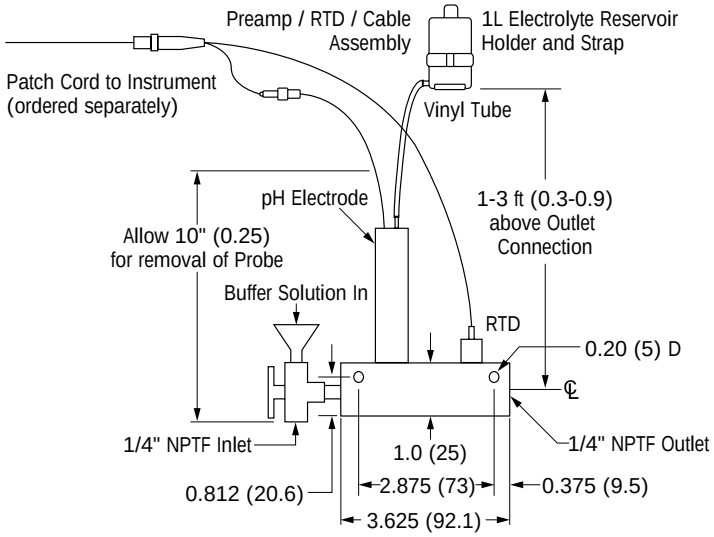
363-101, 363-132, 363-201 pH and 363-501 ORP 3/4"NPT Sensors



363-131 pH 1" NPT PVDF Sensor



363-110 High Purity pH Sensor Assembly



All integral sensors include a preamp built into the cable connector.

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

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 Teflon 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 cathode.

Full temperature compensation accounts for effects on both membrane permeability and solubility of oxygen in water.

Features

- Very fast response
- High accuracy
- Low maintenance with drop-in modular membrane
- Excellent long-term stability

Applications

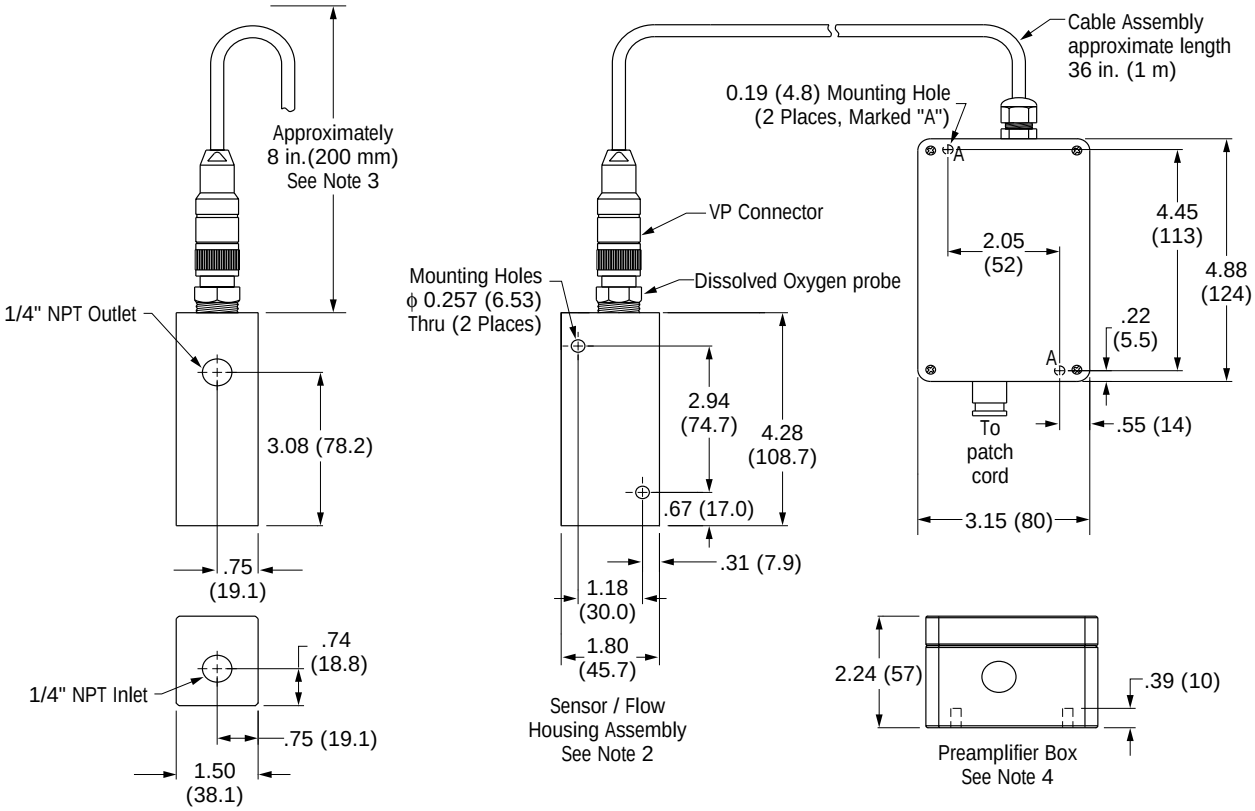
Power plant cycle chemistry monitoring of DO enables control of oxygen scavenger with phosphate, caustic or all-volatile treatment. With oxygenated treatment it can be used to regulate oxygen feed. Compliance with cycle chemistry guidelines and specifications for DO can be assured with this very accurate 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 2000 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 2000 system. The second measurement channel is available for conductivity, resistivity, pH or ORP monitoring.

Sample flowrate:	50 - 1000 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, Teflon membrane reinforced with stainless steel and silicone rubber, Viton and silicone rubber o-rings.
Cable length:	Probe to preamp, 3 ft (1 m); preamp to instrument, 1 to 300 ft (0.3 to 91 m) with patch cord ordered separately
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
Spare parts:	Replacement electrolyte included

Description	Part No.
DO Probe, preamp & flow housing	**367-210**
Maintenance kit (electrolyte and 4 membranes)	**52 200 024**



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.
4. Orient preamplifier box with VP cable at the top.

Thornton's long-life dissolved oxygen measurement capability uses an industry-proven sensor design with major improvements in longevity. An especially durable membrane and controlled internal electrochemistry allow many years of operation with no internal maintenance.

Self-polarized electrodes minimize upsets from power interruption. Full temperature compensation accounts for effects on both membrane permeability and solubility of oxygen in water.

Features

- Very low maintenance
- Excellent long-term stability
- Industry-proven sensor technology
- No interference from hydrogen in stator cooling applications.

Applications

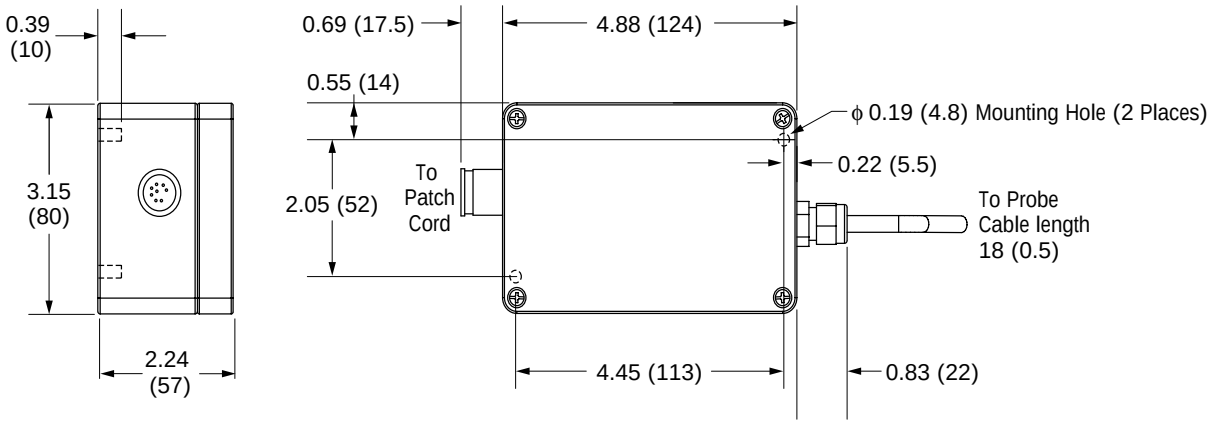
Power plant cycle chemistry monitoring of DO enables control of oxygen scavenger with phosphate, caustic or all-volatile treatment. With oxygenated treatment it can be used to regulate oxygen feed. Compliance with cycle chemistry guidelines and specifications for DO can be assured with this reliable, long-term measuring system.

Semiconductor ultrapure water for some processes requires low DO levels to prevent oxidation of wafer surfaces between stages. The 2000 system can provide a solid ppb-level DO measurement plus a simultaneous resistivity measurement in the same instrument.

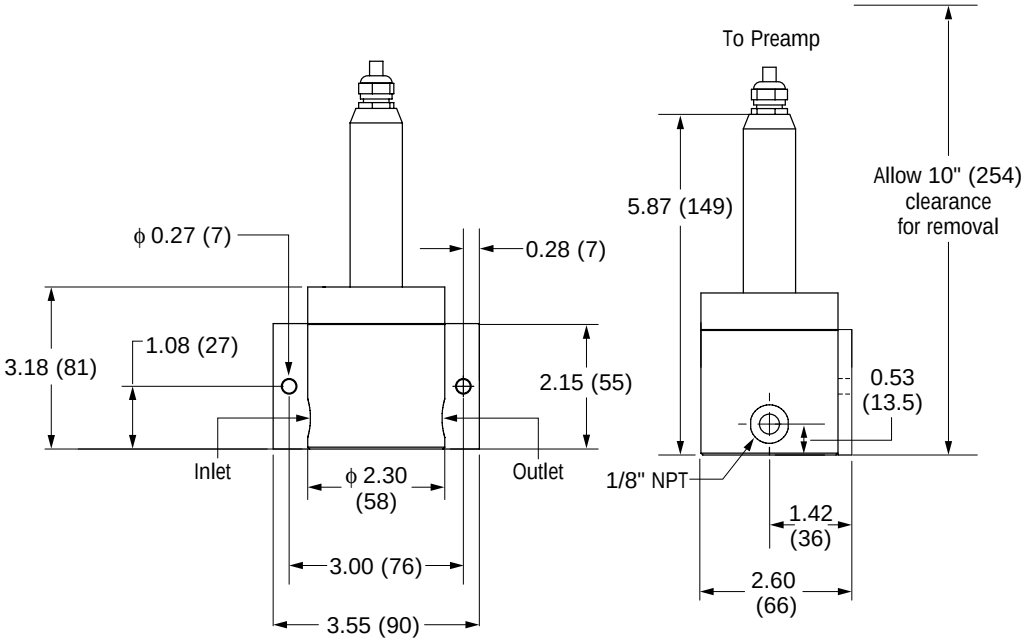
Pure water treatment systems with deaerators to produce water for the above applications can be reliably monitored with the 2000 system. The second measurement channel is available for conductivity or resistivity pH or ORP monitoring.

Sample flowrate:	50 - 2000 mL/min
Sample temperature:	5 - 50 °C (41 - 122 °F)
Sample pressure:	Normal operation, atmospheric; can withstand 3 bar (45 psig)
Sample connections:	1/8" NPT
Wetted materials:	Polyacetal flow chamber, 316 stainless steel and polyacetal probe, HDPE membrane
Cable length:	Probe to preamp, 1.5 ft (0.5 m); preamp to instrument, 5 to 200 ft (1.6 to 61 m) with patch cord ordered separately
Weight:	1.5 kg (3 lb) with flow chamber
Response time:	Within range, 20 seconds for 90% response; from air calibration, dependent on air exposure time
Operating range:	0 - 10,000 ppb (µg/L) with auto-ranging
System accuracy:	± 2% reading or 1 ppb, whichever is greater; ± 0.5 °C
Spare parts:	Maintenance kit of 7 membranes, and replacement electrolyte, Part No. 91008 included.

Description	Part No.
ppb DO Probe & flow chamber	**367-110**



Orient preamp box with probe cable at top.



Dimensions: inches (mm)

240-212
&
1000-41

240-201
&
1000-30

243E223

240-401

240-501

240-202

240-201

243E233

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