

Smart TOC Sensor



THORNTON

Leading Pure Water Analytics

5000TOC Sensor

Fast, continuous measurements

No reagents or chemicals needed

No moving parts

Meets USP Ω 643 Ω , Ω 645 Ω ,

EP 2.2.44, and JP requirements

Compact wall-mount sensor design



Continuous On-Line Measurements Total Organic Carbon Monitoring

METTLER TOLEDO

Features

- On-line continuous measurements, no batch measurement cycle
- 770MAX Smart Sensor interface
- Two TOC Sensors connect to one 770MAX, with four channels remaining for other available sensors
- Local LED Sensor status indication
- Integrates standard 770MAX Multiparameter Instrument features with specific TOC sensor functions
 - UV Lamp run time status
 - UV Lamp ON/OFF control
 - Fault and Error messages for TOC measurement
 - TOC Sensor key lock function for safe operation
 - Auto start function allows TOC Sensor to start automatically after power interruption

Benefits

- Continuous flow design provides rapid TOC response with complete oxidation
- No gases or reagents to handle, store or replace and no moving parts minimize routine maintenance and service intervals
- Smart sensor design reduces installation and setup time
- Real-time continuous monitoring for precise data trending and better process control
- Wide dynamic operating range meets the needs of pure and ultrapure water applications
- Meets USP $\Omega 643\Omega$, $\Omega 645\Omega$, EP 2.2.44 and JP requirements for the Pharmaceutical Industry
- Sensor platform allows easy integration into water purification make-up and distribution system designs
- Ultra low TOC detection for ultrapure water applications to continuously monitor critical organic levels in Semiconductor make-up, distribution and process systems
- Two TOC measurement points with one 770MAX instrument to manage performance of various unit processes within water purification systems
- Compact NEMA 4X rated enclosure for demanding industrial environments
- Meets ASTM D5173 standard test method for on-line TOC monitoring
- Conductivity/temperature sensor and measurements traceable to NIST and ASTM D1125 and D5391

Applications

Pure and Ultrapure water production requires monitoring of organic contamination throughout the treatment process. The 5000TOC Sensor provides continuous, fast, and reliable monitoring of TOC levels from post RO waters to point-of-use. With continuous on-line measurements, the 5000TOC Sensor ensures TOC excursions will not be missed.

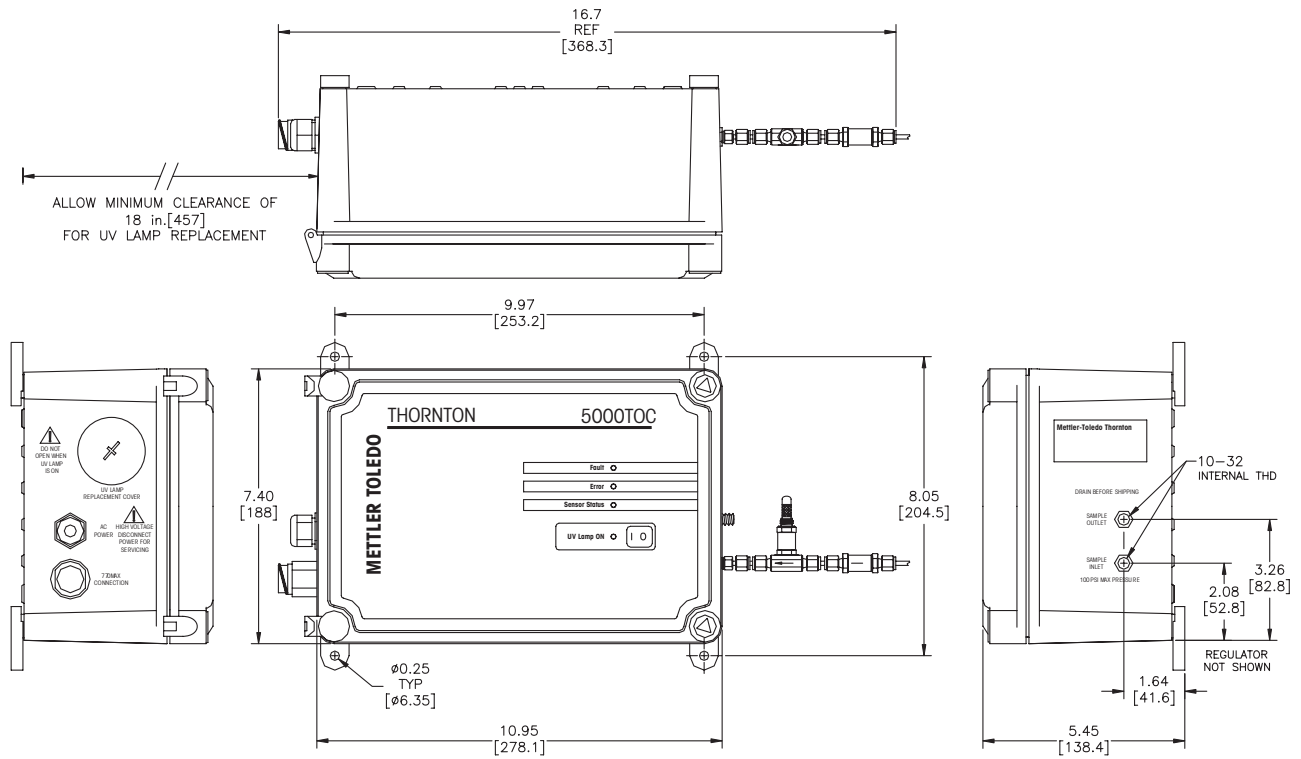
Pharmaceutical-grade waters must meet strict water quality requirements. This highly regulated industry mandates the monitoring of Total Organic Carbon levels for PW (Purified Water), WFI (Water for Injection) and HPW (Highly Purified Water). The instruments used in this application must also undergo periodic testing to verify the ability to completely oxidize and accurately measure TOC. Testing requirements are described in the USP Chapter $\Omega 643\Omega$ and EP 2.2.44. The 5000TOC Sensor provides the performance needed to meet these requirements, and USP $\Omega 645\Omega$ for conductivity, while offering added benefits such as continuous on-line measurement in a low-maintenance, industrial package. The 5000TOC Sensor can operate at elevated temperatures to 100°C, where steam and periodic hot water sanitizing is required.

Semiconductor manufacturing processes have some of the most stringent specifications for organic contamination in pure and ultrapure water systems. Use the 5000TOC Sensor throughout the plant to monitor the integrity of reverse osmosis membranes, the effectiveness of TOC destruct UV lamps, resin bed performance, organics shedding, and the quality of the final rinse water.

Recycle and reclaim applications take advantage of the fast analysis time. The 5000TOC Sensor provides continuous monitoring, not lengthy batch cycles. This provides the system operator with time to respond to TOC excursions due to process variability.

Power generation makeup water treatment – from reverse osmosis to demineralizers, the 5000TOC Sensor provides fast reliable monitoring of TOC contamination in the water system. Organic contamination, can be detected before it enters the steam cycle where its breakdown to organic acids can accelerate corrosion.

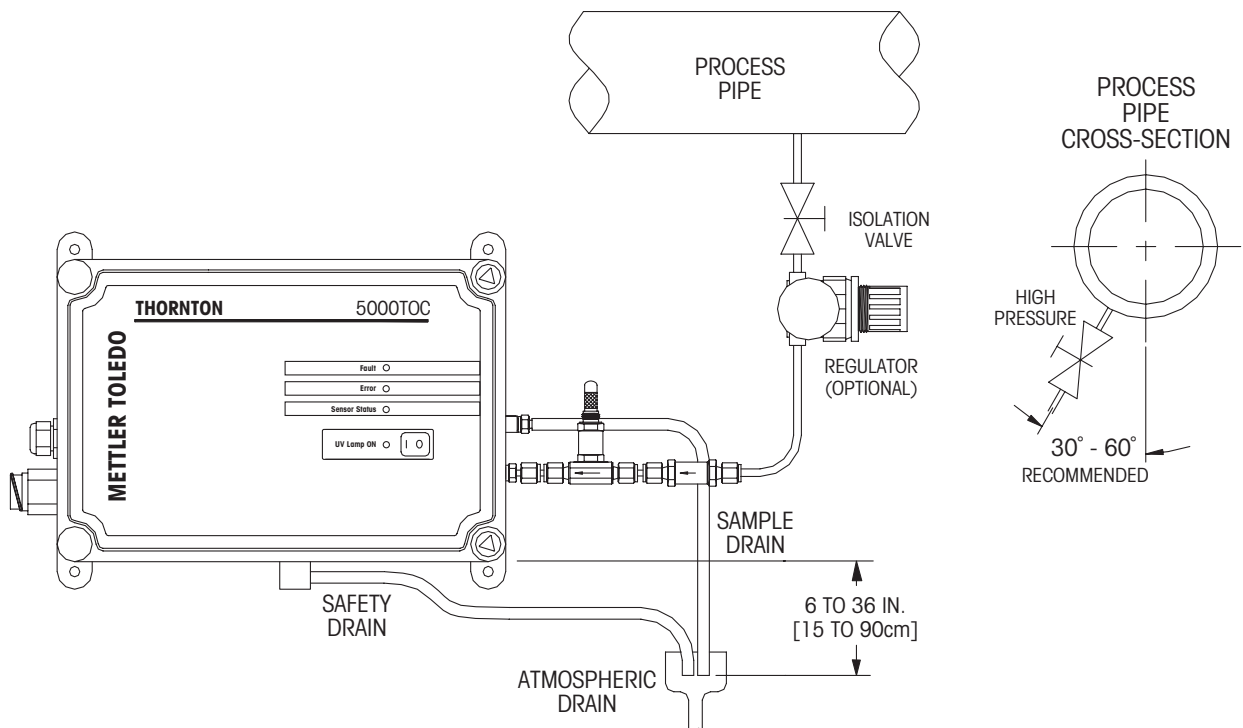
Dimensional Data



5000TOC SENSOR DIMENSION DIAGRAM
DIMENSIONS IN INCHES [mm]

5000TOC Sensor Installation

The Thornton 5000TOC Sensor minimizes installation and setup time. Two tubing connections are required, one for the sample inlet, and one for the oxidized sample outlet. An isolation valve is recommended at the sample point for shutoff, as needed (valve not supplied by Thornton).



TOC Performance Specifications

TOC Sensor	
Measurement Range	0.05 - 1000 ppbC ($\mu\text{gC/L}$)
Accuracy	± 0.1 ppb C for TOC < 2.0 ppb (for water quality > 15 $\text{M}\Omega\text{-cm}$ [$.067 \mu\text{S/cm}$]) ± 0.2 ppb C for TOC > 2.0 ppb and < 10.0 ppb (for water quality > 15 $\text{M}\Omega\text{-cm}$) $\pm 5\%$ of measurement for TOC > 10.0 ppb (for water quality 0.5 to 18.2 $\text{M}\Omega\text{-cm}$)
Repeatability	± 0.05 ppb C < 5 ppb, $\pm 1.0\%$ > 5 ppb
Resolution	0.001 ppbC ($\mu\text{gC/L}$)
Analysis Time	Continuous
Initial response time	< 60 seconds
Limit of Detection	0.025 ppbC

Conductivity Sensor	
Cell Constant Accuracy	$\pm 2\%$
Temperature Sensor	Pt1000 RTD, Class A
Temperature Accuracy	$\pm 0.25^\circ\text{C}$

Sample Water Requirements	
Temperature	0 to 100 $^\circ\text{C}$ *
Particle Size	<100 micron
Minimum Water Quality	$\geq 0.5 \text{ M}\Omega\text{-cm}$ ($\leq 2 \mu\text{S/cm}$), pH < 7.5 **
Flow Rate	≥ 20 mL/min
Pressure	4 to 200 psig (0.3 bar to 13.6 bar) at sample inlet connection ***

General Specifications	
Case Dimensions	11" [280mm] W x 7.4" [188mm] H x 5.25" [133mm] D
Weight	5.0 lb. (2.3 kg)
Enclosure material	Polycarbonate plastic, flame retardant, UV and chemical resistant UL # E75645, Vol. 1, Set 2, CSA #LR 49336
Enclosure rating	NEMA 4X, IP65 Industrial environment
Ambient Temperature/ Humidity rating	5 to 50 $^\circ\text{C}$ / 5 to 80% Humidity, non-condensing
Power requirements	100 - 130VAC or 200 - 240VAC, 50/60 Hz, 25W Maximum
Local Indicators	Four LED lights for Fault, Error, Sensor Status and UV Lamp ON
Ratings/Approvals	CE Compliant, UL and cUL (CSA Standards) listed, NEMA 4X, IP65 Conductivity and temperature sensors traceable to NIST, ASTM D1125 and D5391. Meets ASTM D5173 Standard Test Method for On-Line Monitoring of Carbon Compounds in Water by UV Light Oxidation

Sample Connections	
Inlet connection	0.125" [3mm] O.D. (6' [2m] FDA compliant PTFE tubing supplied)
Outlet connection	0.25" [6mm] O.D. Barb connection (5' [1.5m] flexible tubing provided)
Inlet Filter	316SS, inline 60 micron
Wetted parts	316SS/Quartz/PEEK/Titanium/PTFE/Polyurethane (outlet tubing only)/EPDM
Wall Mount	Standard, mounting tabs provided
Pipe Mount	Optional, with pipe-mount bracket accessory (for nominal pipe sizes 1" [2.4 cm] to 4" [10 cm])
Maximum Sensor Distance	300ft [91m]

* Temperature above 70 $^\circ\text{C}$ requires Heat Exchanger p/n 58 091 511.

** For power plant cycle chemistry samples, pH may be adjusted by measurement after cation exchange.

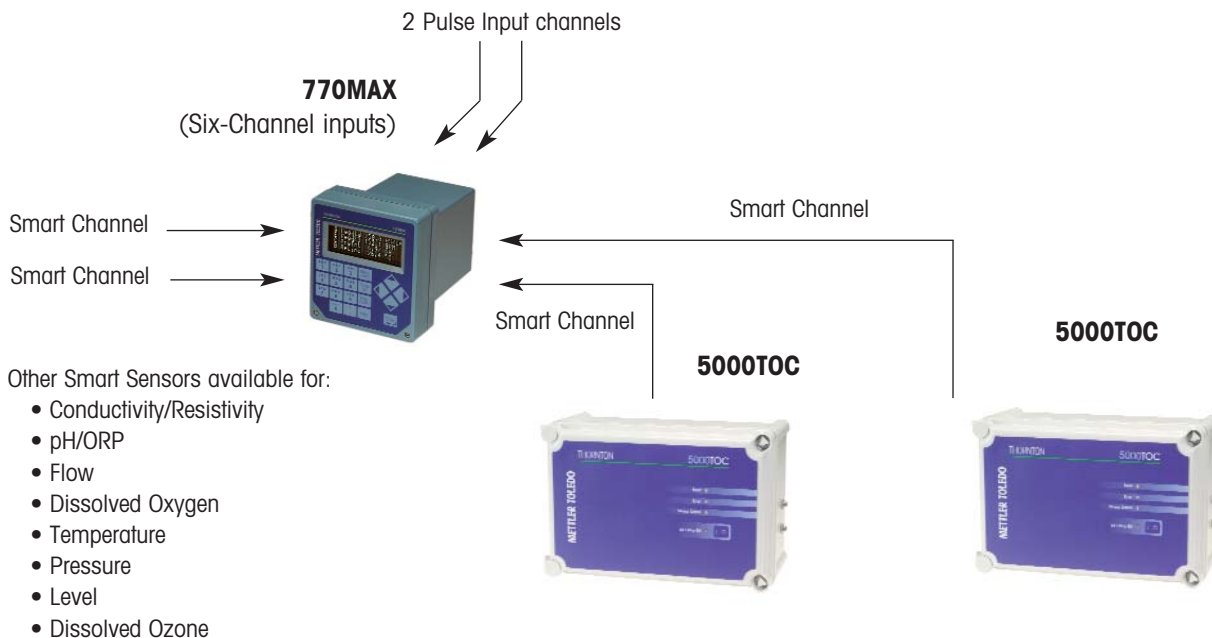
*** Process pressure above 85 psig (5.9 bar) requires optional High Pressure Regulator p/n 58 091 552.

Specifications subject to change without notice.

770MAX Capability

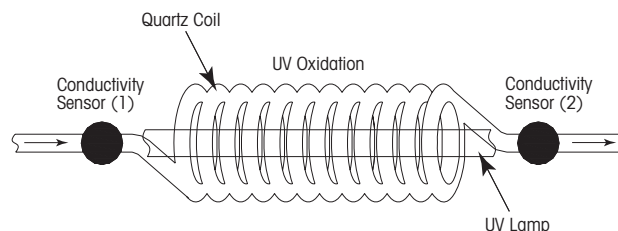
The 5000TOC Sensor uses Smart Sensor technology interfacing with the 770MAX Multiparameter Analyzer/Transmitter. The 770MAX instrument will allow up to two 5000TOC Sensors to be connected to any of the four Smart input channels, leaving the two remaining channels for use with all other 770MAX Smart Sensors. The 770MAX also provides two pulse input channels for additional flow measurements. The Sensor connects directly to the 770MAX instrument using standard patch cables.

The 5000TOC Sensor is designed to meet the requirements of today's industrial facilities with its UL rating and NEMA 4X enclosure. Combined with the 770MAX instrument it provides the most versatile and flexible TOC measurement platform available.



Measurement technology - UV Oxidation / Differential Conductivity

The 5000TOC Sensor uses proven ultraviolet oxidation with differential conductivity (see schematic below) as the method to effectively determine TOC concentrations. High performance Thornton conductivity sensors provide continuous conductivity measurement before and after sample oxidation. This is accomplished using a continuous flow-through spiral quartz tube design that allows the sample to flow continuously through the sensor. This design maximizes exposure to the 185 nanometer UV light, while minimizing measurement response time and providing complete oxidation. This simple and effective design requires no reagents or chemicals and includes no moving mechanical components.



5000TOC Sensor Ordering information

Description	
5000TOC Sensor, 110 VAC, 50/60 Hz	58 036 001
5000TOC Sensor, 220 VAC, 50/60 Hz	58 036 002

Accessories	
Printer, Serial Thermal, 110V *	58 079 010
Printer, Serial Thermal, 220V *	58 079 011
Kit, Tool, 5000TOC Sensor	58 091 520
Kit, Pipe mounting, for 1-1/2" nominal pipe size	58 091 521
Kit, Pipe mounting, for 2" nominal pipe size	58 091 522
Kit, Pipe mounting, for 3" nominal pipe size	58 091 523
Kit, Pipe mounting, for 4" nominal pipe size	58 091 524
Adapter, 0.25" tube to 0.125" tube, compression type	58 091 540
Adapter, 0.125" tube to 0.25" NPT-male connection	58 091 541
Adapter, 0.125" tube to 0.25" NPT-female connection	58 091 542
Adapter, 0.125" tube to 0.5" 316 Stainless Steel pipe (0.75" Tri-Clamp Connection)	58 091 543
Connector, Heat Exchanger	58 079 511
High Pressure Inlet Regulator, 1/4" NPT-female	58 091 552
Outlet Drain Tube	58 091 553

System Suitability and Calibration	
Kit, Combination System Suitability, TOC and Conductivity Calibration Test	58 091 534
Kit, System Suitability Test and TOC Calibration (Standards Sold Separately)	58 091 525
System Suitability Standards (for use with SST Kit #58 091 525, and 58 091 534, includes 500 ppb as Sucrose, 500 ppb as p-Benzoquinone and reagent water for one test)	58 091 526
Validation Support Package	58 091 527
Kit, Calibration Test (upgrades 58 091 526 to 58 091 534)	58 091 528
Calibration Solutions (for use with Calibration Combination Test Kit #58 091 534) (includes 500 ppb as Sucrose, 250 ppb as Sucrose verification, and reagent water)	58 091 529

Replacement Parts	
Kit, Filter, 40 micron, 316 SST (Pkg. 2)	58 091 502
Replacement Inlet Filter Element, 60 micron (Pkg. 2)	58 091 551
Replacement UV lamp (recommended every 4500 hours of operation)	58 079 510
Kit, Fuse, Sensor PCB (for use on both 110 and 220 VAC models)	58 091 519
Replacement thermal paper (for printer)	58 079 012

* Printer connects to 770MAX RS-232 Serial output.

Product Support

The following 5000TOC products and services are also available:

- Factory Instrument Calibration
 Customized Hands-On-Training
 Service and Calibration Contracts
 System Suitability Testing
 On-Site Calibration

Please contact Thornton Technical Service for more information.

www.mt.com/thornton

Visit for more information

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CE Compliant



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