



The A10[®]

Total Oxidizable Carbon Monitor

A10 TOC Monitor Provides a Complete Picture of Water Purity

While resistivity is a sensitive and accurate way to measure and display the level of ionic concentration in ultrapure water, it gives no indication of the level of dissolved organic compounds that may be present. Ultrapure water with a resistivity of $18.2 \text{ M}\Omega\cdot\text{cm}$ @25 °C has a low inorganic salt* level, but concentrations of organic substances still may remain high. Many laboratory experiments will be affected by even relatively low levels (50 ppb TOC) of organic contaminants. As a result, it is necessary to monitor these contaminants in order to give scientists a complete and accurate picture of the quality of high purity water used in the laboratory.

*The theoretical resistivity of ultrapure water containing no other ions aside from the protons and hydroxyl resulting from the water molecule dissociation is equal to $18.2 \text{ M}\Omega\cdot\text{cm}$ @25 °C. The addition of only $1 \text{ }\mu\text{g/l}$ of NaCl makes the resistivity value drop to $17.5 \text{ M}\Omega\cdot\text{cm}$ @ 25 °C.

TOC Reduction Improves Laboratory Results

For instance, a moderate TOC level in high purity water used for chromatography applications will degrade the baseline quality and reduce the sensitivity of an analysis. Additionally, the presence of TOC will shorten the lifetime of chromatography columns by fouling the chromatography column beads and subsequently preventing a good mass transfer between the beads and the mobile phase.

The variable presence of undetermined organic substances in ultrapure water used for the preparation of culture media or buffers will also affect experiments including cell culture or electrophoresis separations.

For all these reasons, it is important for laboratories to be able to regularly measure the TOC level of high purity water.

MILLIPORE

www.millipore.com/bioscience

Millipore TOC Monitors

To meet this need, Millipore's Milli-Q® water purification systems are designed with a built-in TOC monitor to ensure regular, on-line measurement of the level of organic substances in ultrapure product water at the time of delivery.

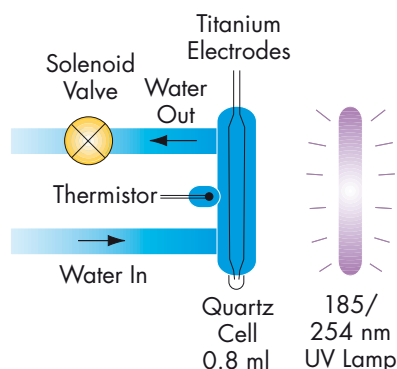
Millipore also offers an alternative solution to scientists who wish to measure the TOC level in high purity water delivered by systems without a built-in TOC monitor. The independent Millipore A10 TOC monitor can be connected to any high purity water laboratory system in order to provide a rapid measurement of the TOC level in the water produced.

TOC Monitor Operation Principles

Both the independent Millipore TOC monitor and the built-in equipment operate according to the same principle.

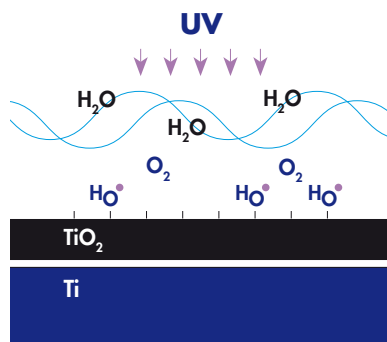
How the Patented A10 Monitor Works

Figure 1: Instrument Design



Water flows for 3 minutes through the 0.8 ml quartz TOC analysis cell that contains 2 titanium electrodes. Then the solenoid valve closes and the conductivity of the high purity water is measured, compensated at 25 °C (baseline conductivity). The UV lamp is then powered "on", emitting light at 254 and 185 nm.

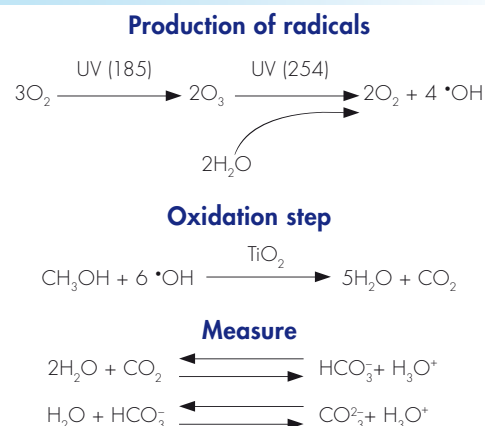
Figure 2: From UV to hydroxyl radicals



The energy of the 185 nm light generates ozone that produces hydroxyl ($^\bullet OH$) radicals from the oxygen dissolved in water. This process is catalyzed by the titanium dioxide coating formed on the electrodes. The $^\bullet OH$ radicals are powerful oxidizing agents that will react with the organic substances dissolved in water.

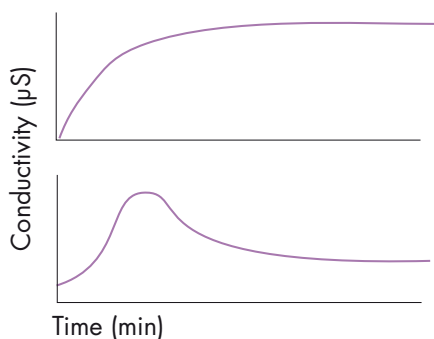


Figure 3: Oxidation and Measure



The end product of organic molecule oxidation is carbon dioxide, which dissolves and reacts with water to produce charged ions that increase the conductivity. The A10 monitor will measure conductivity compensated at 25 °C and perform the oxidation until all organic molecules are oxidized and the conductivity value becomes stable. The test can therefore last 3 or 6 minutes depending on the nature and concentration of organic molecules in water. A complex set of algorithms confirms complete oxidation, calculates TOC value from the difference between baseline and final conductivity, and displays result.

Figure 4: Conductivity Patterns



Different profiles of conductivity curves are possible depending on type and concentration of organics present. During oxidation, some organic molecules can produce intermediate products that generate a higher conductivity than CO_2 . Therefore, accurate results can only be obtained in unknown samples when the difference between baseline and final conductivity is determined after complete oxidation.

Quality Assurance

Millipore A10 TOC monitors are calibrated in accordance with Millipore's Quality Assurance System standard procedures and specifications. Traceability of measurement equipment is performed according to the Millipore Calibration System.

Millipore A10 TOC monitors are delivered with a Certificate of Calibration. They can be recalibrated at user request and have been designed to take into account the suitability test requirements as specified in USP <643>.

Specifications

Parameter	Value
Performance	
Operating range	1 - 999 ppb TOC
Display resolution	single ppb increment
Repeatability	+/- 5 %
Accuracy	+/- 15 % or +/- 1 ppb (whichever is greater)
Water Sample	
Inlet pressure	4.8 bar (70 psi) max
Temperature	5 to 35 °C (41 to 95 °F)
Resistivity	> 15 MΩ·cm @25 °C**
**The Millipore A10 TOC monitor also may be used with a water sample whose resistivity is between 5 and 15 MΩ·cm @ 25 °C, but repeatability and accuracy levels will be lower.	
Physical Characteristics	
Operating temperature	15 to 30 °C
Operating weight	1.9 kg (4.2 lb)
Size, mm (in) (H x W x D)	237 x 155 x 150 mm (9.3 x 6.1 x 5.9 in)
Power supply	100 - 230 V +/- 10 % / 50 - 60 Hz

Ordering Information

Description	Catalogue No.
Millipore A10 TOC Monitor	ZFA100001
Millipore A10 UV Lamp replacement	ZFA10UVM1
Set of Inlet/Outlet tubing replacement	
2 x 5' tubes (4.7 mm O.D./3.17 mm I.D.) with Luer fittings	FTPF04945
Tubing – 25' roll	FTPF04949
Luer fittings (5/pk)	FTPF04950

To place an order or for technical assistance

On the Internet go to: www.millipore.com
or e-mail: tech_service@millipore.com

AUSTRALIA Tel. 1 800 222 111 (02) 9888 8999 Fax (02) 9878 0788	IRELAND Tel. 1 890 924 645 Fax 1 890 924 644
AUSTRIA Tel. 0820 874 464 Fax 0820 874 444	ITALY Tel. 848 8 45 645 Fax 848 8 45 644
BALTIC COUNTRIES Tel. +358 2 030 5645 Fax +358 2 030 5644	JAPAN Tel. (03) 5442-9714 Fax (03) 5442-9734
BELGIUM AND LUXEMBOURG Tel. 070 225 645 Fax 070 225 644	KOREA Tel. (822) 3011-9600 Fax (822) 564-2077
BRAZIL Tel. (011) 5548-7011 Fax (011) 5548-7923	MALAYSIA Tel. 03-7957-1322 Fax 03-7957-1711
CANADA Tel. (800) 645-5476 Fax (800) 645-5476	MEXICO Tel. (55) 5576 9688 Fax (55) 5576 8706
CHINA, PEOPLE'S REPUBLIC OF Beijing: Tel. (8610) 8519 1250 Fax (8610) 8519 1255 Guangzhou: Tel. (8620) 8755 4049 Fax (8620) 8752 0172 Hong Kong: Tel. (852) 2803 9111 Fax (852) 2513 0313 Shanghai: Tel. (8621) 5306 9100 Fax (8621) 5306 0838	NORWAY Tel. 810 62 645 Fax 810 62 644
CZECH REPUBLIC Tel. 22051 3841 Fax 22051 4298	POLAND Tel. 22-669 12 25 Fax 22-663 70 33
DENMARK Tel. 7010 5645 Fax 7010 5644	PUERTO RICO Tel. (787) 273-8495 Fax (787) 747-6553
EASTERN EUROPE, C.I.S., AFRICA, MIDDLE EAST AND GULF Tel. +33 1 30 127000 Fax +33 1 30 1271 80	SINGAPORE Tel. 6842 1822 Fax 6842 4988
FINLAND Tel. 0203 05 645 Fax 0203 05 644	SPAIN AND PORTUGAL Tel. 901 516 645 Fax 902 011 644
FRANCE Tel. 0825 045 645 Fax 0825 045 644	SWEDEN Tel. 0771 200 645 Fax 0771 200 644
GERMANY Tel. 01805 045 645 Fax 01805 045 644	SWITZERLAND Tel. 0848 645 645 Fax 0848 645 644
HUNGARY Tel. 01-381-0433 Fax 01-209-0295	TAIWAN Tel. 886-22792-9333 Fax 886-22792-6555
INDIA Tel. (91)80283 946 57 Fax (91)80283 963 45	THE NETHERLANDS Tel. 0900 7 645645 Fax 0900 7 645644
	U.K. Tel. 0870 900 46 45 Fax 0870 900 46 44
	U.S.A. Tel. (800) 645-5476 (8610) 6518 1058 01-381-0434 01-209-3232 22-663 70 31 Fax (800) 645-5439
	IN ALL OTHER COUNTRIES Millipore Intertech (U.S.A.) Tel. +1 (781) 533-8622 Fax +1 (781) 533-8630

MILLIPORE

www.millipore.com/bioscience

Lit. No. PB1005EN00 Printed in France 03/06.
© Copyright 2006, Millipore Corporation, Billerica, MA, U.S.A. Millipore, Milli-Q and A10 are registered trademarks of Millipore Corporation. All rights reserved. Photographs: Henry Thurel – BHL Production. Design: Sysaxe.