



QuickTOC_{trace}

TOC-ANALYSIS

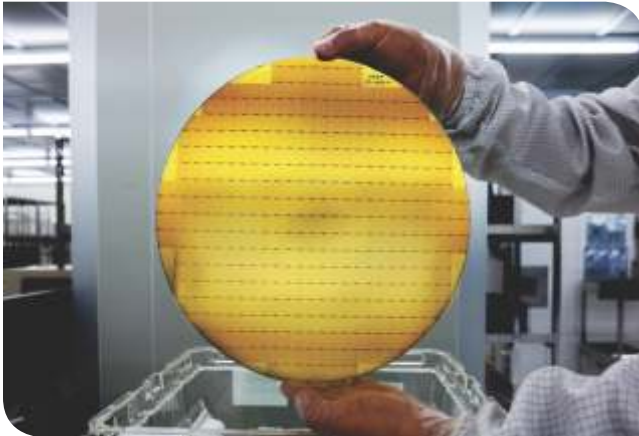
Continuous TOC monitoring.
For the lowest ranges.

Fast. Reliable. Compact.



A MEASURING SYSTEM FOR ULTRAPURE WATER.

The lowest organic impurities are detected fast and cost-effectively - for optimal process control in challenging industries.



The QuickTOCtrace is suitable for the determination of TOC in ultra pure and purified water - especially in the manufacture of semiconductors and pharmaceutical industries as well as in any process, where ultra pure water is essential.

Quick and reliable monitoring of ultrapure water helps to ensure high product quality and process security in the manufacture of pharmaceutical products and semiconductors.

Ultrapure water demands purity.

Ultrapure water is prepared under stringent conditions to ensure purity from contaminants such as organics, inorganics, dissolved solids, volatiles, non-volatiles, dissolved gases, reactive and inert substances.

Depending on the application, ultrapure water is defined in norms such as ASTM D5127, SEMI F63, as well as the pharmacopoeia.

Where ultrapure water is used.

UPW is used in the manufacture of

semiconductors, photovoltaics, integrated circuit boards and the pharmaceutical industry. It is used to rinse wafers, dilute chemicals and in optical systems in photolithography.

UPW in the pharmaceutical industry.

Water for injection (WFI) is a demanding application. In the manufacture of any type of active ingredient and medicine, the entire production process, including the cleaning process, is closely monitored.

QA & security through online analysis.

Monitoring TOC is important to quality assurance. In semiconductor manufacturing organic and inorganic contaminants have a negative effect on sensitive photo-lithographic processes. Increased TOC promotes

biological growth that contributes to unintended chemical processes. In the pharmaceutical industry, the assurance of product quality is paramount. WFI is used for injections, high purity water (HPW) for sterile preparations and purified water (PW) for non-sterile preparations such as pills, and cleaning processes.

Organic contaminants can originate from feed water, distribution systems and chemical feed systems. While cleaning, disinfection and filtration processes can minimize impurities, monitoring TOC is important to verify the effectiveness of these processes and the quality of the water.

Requirements for pure water in semiconductor and pharmaceutical industries

Parameter	Semiconductor UPW	Pharma WFI	Pharma HPW	Pharma PW
Conductivity	0.055 $\mu\text{S}/\text{cm}$	<1.1 $\mu\text{S}/\text{cm}$ (20 °C, Ph. Eur.) / <1.3 $\mu\text{S}/\text{cm}$ (25 °C, USP)	<1.1 $\mu\text{S}/\text{cm}$ (20 °C, Ph. Eur.)	<4.3 $\mu\text{S}/\text{cm}$ (20 °C, Ph. Eur.) / <1.3 $\mu\text{S}/\text{cm}$ (25 °C, USP)
TOC	<1 $\mu\text{g}/\text{l}$ (online <10 ppb)	<0.5 mg/l (Ph. Eur., USP)	<0.5 mg/l (Ph. Eur.)	<0.5 mg/l (Ph. Eur., USP)
Bacteria	<1 CFU/100 ml	<10 CFU/100 ml (Ph. Eur., USP)	<10 CFU/100 ml (Ph. Eur.)	<100 CFU/100 ml (Ph. Eur., USP)

Ph. Eur. = Europäische Pharmacopoeia USP = US Pharmacopoeia

Measuring TOC using UV oxidation.

As a sum parameter, TOC is a measure of water quality. One quick, affordable way to measure TOC is to oxidize a sample and measure the resulting CO₂. In UPW applications organic contamination is <1mg/l TOC and the sample is enriched with oxygen, ensuring total oxidation through UV light.

Measuring differential conductivity.

In ultrapure water, electrolytic conductivity and resistance are the most widely used indicators of contamination. In differential measurement, a sample's conductivity is measured before and after UV oxidation. Oxidized organics increase the sample's conductivity, which correlates to TOC.

The QuickTOC^{trace}.

By combining UV oxidation and differential conductivity, LAR's QuickTOC^{trace} measures TOC in a range of 0.1 to 1,000 ppb, with results in only 30 seconds.

AT A GLANCE

- The quality of high-purity and ultra pure water must be assured.
- Quality assurance & process security require reliability.
- TOC is the measure of water's organic load.
- The QuickTOC^{trace} is designed to be easy to maintain and user-friendly, with quick results in a few seconds.

THE ANALYZER.

Accurate TOC in seconds for pure water applications.

Continuous TOC through UV oxidation & differential conductivity.

The QuickTOC^{trace} combines conductivity and UV oxidation to provide continuous TOC measurement in the 0.1 - 1,000 ppb range. This easy-to-use, low-maintenance online analyzer quickly, reliably monitors low-level TOC and is particularly well-suited for applications in the pharmaceutical industry (WFI, HPW, PW), and wherever ultrapure water (UPW) is used.

System Suitability Test - SST.

TOC results are verified using a System Suitability Test that complies with both US and European pharmacopoeia standards. The software interface enables quick, simple initiation of the SST with automatic data evaluation.

Qualification and calibration.

Software-guided calibration can be carried out by the user at any time. Statistical evaluation of measurements and the respective calibration parameters are displayed on the screen (plausibility test).

Software and data output.

The Windows 7-based interface features an 8-inch touch-screen. Per pharma guidelines, data is encrypted in date-specific files so raw data cannot be manipulated. Saved files are accessed using the viewer function or exported.

THE PRINCIPLE.

Safe and fast measurements.

UV oxidation produces free radicals.

Oxidation without the use of chemicals has proven very effective in the measurement of very low TOC values. Exposing water containing O₂ to UV (185 nm, 254 nm) forms short-lived species with a high oxidation potential. One example is the OH[•] radical, which can oxidize organic compounds to CO₂.

The conductivity of ultrapure water is strongly dependent on dissolved CO₂. UV oxidation produces CO₂ which increases the conductivity of the sample. This change is used in differential conductivity measurement to determine the corresponding TOC concentration.

Differential conductivity.

Conductivity measurement is based on the measurement of ohmic resistance or its reciprocal, electrolytic conductivity. Since pure water is highly resistive, increased conductivity is an effective indicator of impurities.

Differential conductivity compares measurements before and after oxidation. The TOC concentration results from the difference obtained from subtracting the first, lower conductivity measurement from the second, higher one.

With UV-Oxydation CO₂ is created which is part of the carbonate-hydrogencarbonate equilibrium.

CHEMICAL REACTIONS

$$H_2O + hv (185\text{ nm} / 254\text{ nm}) \rightarrow OH^{\bullet} + H^{\bullet} \text{ and } 2 H^{\bullet} \rightarrow H_2$$

$$CO_2 + H_2O \rightarrow H_2CO_3 \rightleftharpoons HCO_3^- + H^+$$

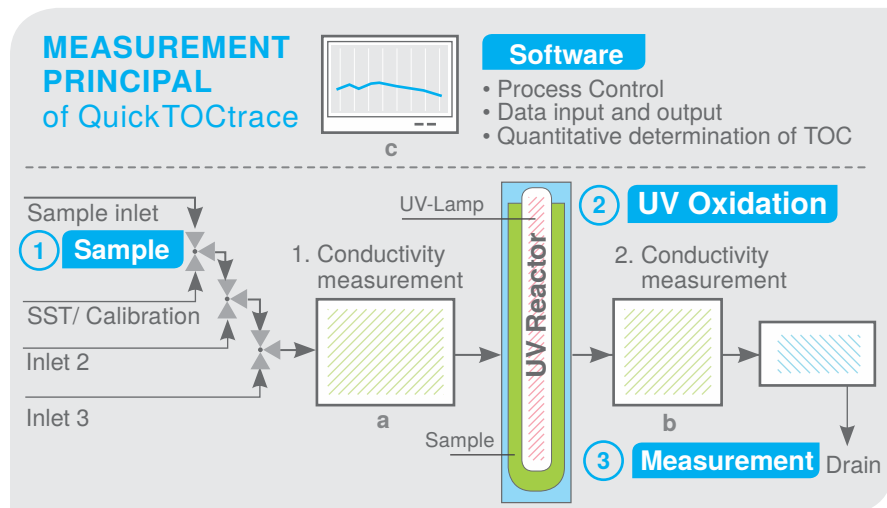
$$HCO_3^- + H^+ \rightleftharpoons CO_3^{2-} + H^+$$


Fig. 1

- 1) Sample preparation
- 2) UV-Oxidation of organic carbon to CO₂ by Hydroxyl-Radicals
- 3) Determination of the TOC contamination
 - a) Measurement of conductivity prior to oxidation (LF1)
 - b) Measurement of conductivity after oxidation (LF2)
 - c) Calculation: LF2-LF1=TOC

QuickTOC^{trace}

Online TOC measurement - the fastest way to analyze ultrapure water.

The LAR QuickTOC^{trace} is a measuring system for the continuous determination of the Total Organic Carbon (TOC) in ultrapure water applications such as ultrapure process water in the manufacture of semiconductors.



Fast and safe - you can rely on the QuickTOC^{trace}!

TECHNICAL DATA

Measurement Technique and Sample Preparation

Method UV oxidation (partial) with differential conductivity measurement

Ranges 0.1 - 1,000 ppb TOC,
0.055 - 2.0 μ S/cm conductivity

Response Time <30 seconds (T90)

Parameter(s) TOC, conductivity

Calibration Automatic and manual

Sample streams 1 to 3 (optional)

Dimensions and Weight

Housing Steel IP 20, IP 54 (optional)

Dimensions (WxHxD) 300 x 500 x 200mm (~11.8 x 19.7 x 7.9 in.)

Weight ca 7 kg (~15.4 lb)

Electrical Specifications

Power Supply 230 / 115 VAC, 50 Hz

Analog Output 4– 20 mA (0-20 mA optional)

Interface USB 2.0

Equipment Devices and Data Output

8-inch touch-screen graphic display, backlight

Integrated computer for control

Operating system Windows 7 embedded

Self explanatory software including viewer

Automatic System Suitability Test (SST)

Accessories and Options

Calibration solutions, SST-Kit, IQ/OQ documentation (conform to NIST, USP, etc.)

Heat-exchanger for samples with > 50°C

FEATURES & BENEFITS

- ✓ Recognized differential conductivity measurement with UV oxidation method
- ✓ Reaction time of <30 seconds
- ✓ Continuous measurement (every 2 seconds)
- ✓ Highly efficient oxidation
- ✓ UV lamp with a long life span
- ✓ Easy to use
- ✓ Easy calibration (1 time per year)
- ✓ Easy system validation with fully automatic SST (optional)
- ✓ Comprehensive data storage
- ✓ Very low maintenance

TOC-ANALYSIS

From complex industry wastewater to pharmaceutical pure water, our TOC analysers determine parameters quickly and precisely.

COD-ANALYSIS

With our analysers the chemical oxygen demand is cleanly and safely determined online, without using chemicals.

BOD/TOXICITY

We detect the BOD with the plant's own biomass and determine the toxicity with highly sensitive bacteria. Fast and reliably.

TN_b/TP-ANALYSIS

TN_b and TP are important parameters for wastewater treatment. Only LAR offers a combination of TOC and COD in one system.

OTHER PRODUCTS

LAR offers a specific solution for nearly all applications. With our protective housings, you are always on the safer side. To find out more: www.lar.com

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