

PRODUCT DATASHEET

# QuickTOCtrace™

For continuous TOC monitoring in ultra-pure water



**Fast**

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**Reliable**

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**Compact**

- Pure water
- Ultra pure water
- Process water
- Boiler feed water
- Condensate return

# The Measuring System For Ultra Pure Water

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

The QuickTOCtrace™ is suitable for the determination of TOC in ultra pure and purified water – especially in the manufacture of semi-conductors and pharmaceutical industries as well as in any process, where ultra pure water is essential. In order to ensure the high product quality and to guarantee process security, the fast and reliable monitoring of ultra pure water is of the utmost importance. This applies in particular to manufacture of pharmaceutical products and semiconductor technologies.

## UPW – Ultra Pure Water. Highest Requirements With Minimal Impurities

Ultra pure water is prepared under particularly stringent specifications. It is a matter of ensuring purity in respect of all types of contaminants: organic/inorganic compounds, dissolved/solid or volatile/non-volatile components, dissolved gases, reactive/inert substances etc.

Depending on the respective application, requirements regarding UPW purity are defined in norms such as ASTM D5127 and SEMI F63, as well as pharma regulations (pharmacopoeia).

## UPW In The Manufacturing Of Semiconductors

Alongside solar technology and photovoltaics, energy generation and the pharmaceutical industry, UPW is primarily used in the manufacture of semi-conductors. It is used inter alia in the rinsing of wafers, the dilution of chemicals and in optical systems in photolithography. The primary and critical application of UPW is front end cleaning in the manufacture of integrated circuit boards.

## UPW In The Pharmaceutical Industry

Water for injections (WFI) is a demanding application of UPW in the pharmaceutical industry. In the manufacture of any type of active ingredient and medicine, the entire production process, including the cleaning process, is seamlessly monitored.

### Requirements for pure water in semiconductor and pharmaceutical industries

Parameter	Semiconductor UPW	Pharma WFI	Pharma HPW	Pharma PW
Conductivity	0.055 µS/cm	<1.1 µS/cm (20 °C, Ph. Eur.) / <1.3 µS cm (25 °C, USP)	<1.1 µS/cm (20 °C, Ph. Eur.)	<4.3 µS/cm (20 °C, Ph. Eur.) / <1.3 µS/cm (25 °C, USP)
TOC	<1 µg/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.

## Quality Assurance And Process Security Through Continuous Monitoring

The monitoring of the above mentioned parameters is of great importance with regard to quality assurance. In the manufacture of semiconductors, particles and organic/inorganic components can have a significant effect on sensitive photo-lithographic processes. Biological growth, often promoted by an increased TOC content, can contribute to unintended chemical processes. In the pharmaceutical industry, the assurance of product quality is paramount. Depending on the areas of application, WFI is used for injections, highly purified water (HPW) for the processing of sterile preparations and purified water (PW) for non-sterile preparations such as pills, and for cleaning processes. Sources of impurities (particles, bacteria, organic (TOC) and inorganic components) are the feed water and additional water used in the preparation of ultra pure water on the one hand. On the other hand, distribution systems can in turn be a source of contamination, as can additives and cleaning processes. Regular chemical and/or steam-based cleaning processes (pharma), as well as ultra-filtration (semi-conductors), ozonization and general optimizing of duct systems can minimize impurities. The effectiveness of cleaning processes and the quality of the ultra pure water used are subject to monitoring through TOC analyses and conductivity measurements..

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### TOC Determination Using UV Oxidation

As a cumulative parameter, TOC is a measure of the organic impurity of water and is thus an important indicator of its quality. TOC is determined by means of oxidation of aqueous samples and the quantitative measurement of the resulting  $\text{CO}_2$ . In typical UPW application, organic contamination is  $<1\text{mg/l}$  TOC and the sample is enriched with oxygen, which ensures total oxidation through UV light. This is an affordable method that yields quick results..

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### Differential Conductivity Measurement

In ultra-pure water systems, electrolytic conductivity and resistance measurement are the most widely used indicators of contamination. In differential measurement, the conductivity of the sample prior to UV oxidation is measured in a first step, and a subsequent measurement is carried out after oxidation. Under UV light, organic components are oxidized into  $\text{CO}_2$ , which increases conductivity. This change is used to calculate TOC concentration..

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### The QuickTOCtrace

Using UV oxidation and differential conductivity measurement, LAR's QuickTOCtrace reliably determines organic concentration in a range of 0.1 to 1,000 ppb TOC and yields results within 30 seconds.

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### At A Glance

- The quality of high-purity and ultra pure water must be assured
- Quality assurance and process security require reliable methods
- The TOC value is the measure of water sample's organic load
- Designed to be easy to maintain and user-friendly, yielding results in a few seconds

## The Analyzer

Especially for challenging applications that require reliable detection within seconds of lowest impurities in pure water.

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## Continuous TOC Measurement By Means Of UV Oxidation And Differential Conductivity Measurement

The QuickTOCtrace is an online system working on the basis of the traditional continuous flow process with conductivity detection. UV oxidation using the "direct surface" process guarantees highest precision thanks to highly sensitive conductivity sensors. With integrated temperature sensors, all data that is relevant of the measurement of TOC are monitored and processed. The QuickTOCtrace can thus reliably determine the parameter TOC in a measuring range of 0.1 – 1,000 ppb. The QuickTOCtrace is an easy to use, low maintenance online measuring device that enables quick and reliable monitoring of demanding applications. It is particularly suited for applications in the pharmaceutical industry (WFI, HPW, PW), as well as ultra pure water (UPW).

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## System Suitability Test – SST

The verification of the TOC result is carried out using periodical implementation of the system suitability test and complies with the standards prescribed by the US pharmacopoeia, as well as the European pharma regulation (European pharmacopoeia). QuickTOCtrace's software enables a quick and simple initiation of the SST at any time and offers automatic data evaluation as well as automatic implementation of the testing procedure.

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## Qualification And Calibration

Calibration can be carried out by the user at any time. By connecting the inlets for the calibration solution and the diluted water sample, as well as terminating the online measurement, the calibration can be carried out using the software. Statistical evaluation of measurements and the respective calibration parameters are displayed on the screen (plausibility test).

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## Software And Data Output

The QuickTOCtrace is controlled via an integrated processing unit and an 8" touch screen monitor. Based on the Windows 7 operating system, data can be embedded and documented as encrypted date-specific files, so that crude data is not manipulated as per pharma guidelines. All saved files can be accessed using the viewer function and/or exported for further processing.

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## The Principle

Safe and fast measurements

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### Chemical Reactions



With the UV-Oxidation  $\text{CO}_2$  is created which is a part of the carbonate-hydrogencarbonate equilibrium.

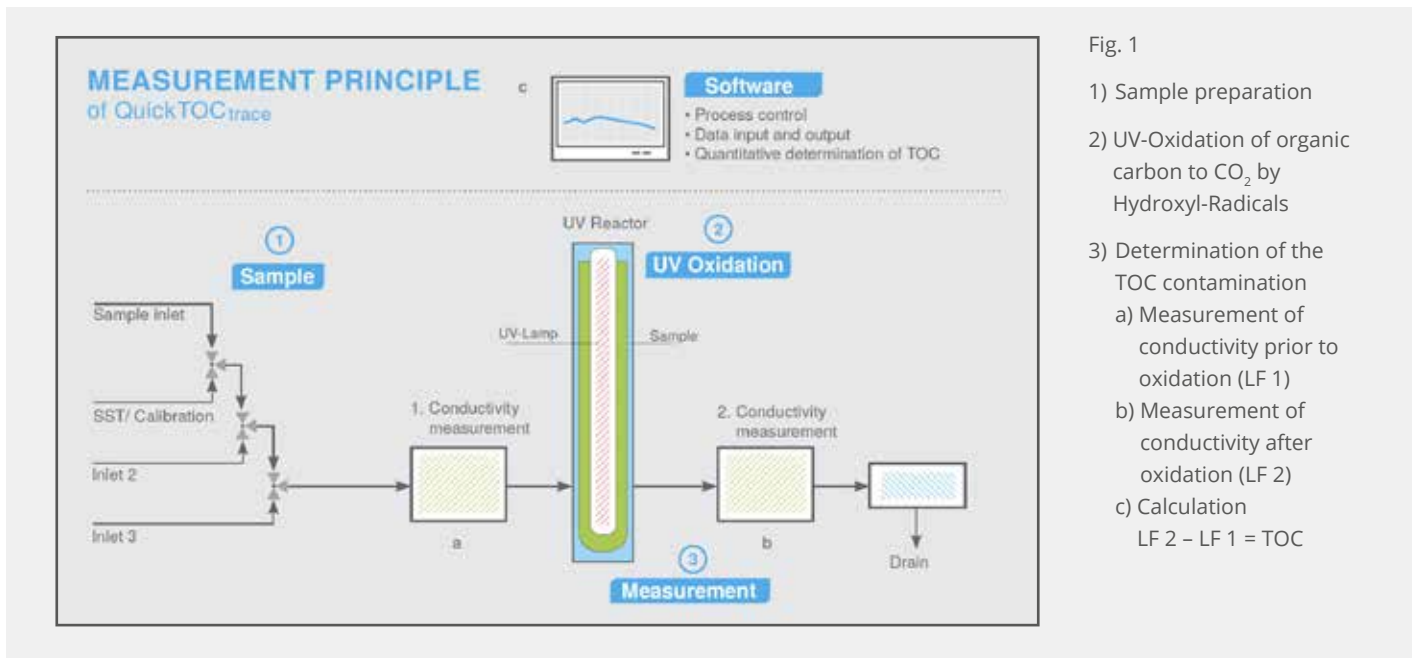


Fig. 1

- 1) Sample preparation
- 2) UV-Oxidation of organic carbon to CO<sub>2</sub> by Hydroxyl-Radicals
- 3) Determination of the TOC contamination
  - a) Measurement of conductivity prior to oxidation (LF 1)
  - b) Measurement of conductivity after oxidation (LF 2)
  - c) Calculation  
LF 2 - LF 1 = TOC

## UV Oxidation: Formation Of Free Radicals

Oxidation using the “direct surface” procedure – thus without the use of chemical oxidants – has proven very effective in the measurement of very small TOC concentration, commonly found in ultra-pure water. When water containing O<sub>2</sub> is exposed to UV radiation (185 nm, 254 nm), short-lived, highly reactive species with a high oxidation potential are formed. Amongst them is for example the OH radical, which can oxidize organic compounds to CO<sub>2</sub>. The conductivity of ultra pure water is strongly dependent on dissolved CO<sub>2</sub>. UV oxidation produces CO<sub>2</sub>, which increases the conductivity of the sample. This change is used in differential conductivity measurement to determine the corresponding TOC concentration.

## Differential Conductivity Measurement

Conductivity measurement is based on the measurement of ohmic resistance, or its reciprocal value, the electrolytic conductivity value. This conductivity is influenced by the value, volatility and particle density of ions in the aqueous solution. It is therefore an effective indicator of any impurities.

In differential conductivity measurement, the initial conductivity before oxidation, as well as the conductivity after the treatment of the sample, are measured. The TOC concentration results from the difference obtained from subtracting the first, lower conductivity measurement from the second, higher one.

## QuickTOCtrace An Overview

**Online TOC measurement – the fastest way to analyze ultra pure water**

The QuickTOCtrace is a measuring system for the continuous online determination of the total organic carbon (TOC) in ultra pure water applications such as ultra-pure process water in the semiconductor manufacture.

## Advantages & Features

- Recognized differential conductivity measurement with UV oxidation
- 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

## TECHNICAL DATA

Measurement Technique and Sample Preparation	
Measurement Method	UV oxidation (partial) with difference-conductivity measurement
Measurement Ranges	0.1 – 1,000 ppb TOC, 0.055 – 2.0 µS/cm conductivity
Response Time	<30 seconds (T90)
Parameter	TOC, conductivity
Calibration	Automatic and manually
Sample Streams	1 to 3 (optional)
Dimensions and Weight	
Housing	Stainless Steel IP 20, IP 54 (optional)
Dimensions	W 300 x H 500 x D 200 mm
Weight	ca. 7 kg
Electric Specifications	
Power Supply	230 / 115 VAC, 50 Hz
Analogue Output	4– 20 mA (0– 20 mA optional)
Interface	USB 2.0
Equipment Devices and Data Output	
8" touch screen graphic display, backlit	
Integrated computer for control	
Operating system Windows 7 embedded	
Self explanatory software incl. 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	

Water is our element. We do everything for its protection.

We are the leading manufacturer of water analyzers for industrial and municipal waste water treatment, process monitoring, as well as for pure water analysis. Further products in the areas of environmental technology and industrial processing complete our product portfolio.

### Unique & State Of The Art - Ultra High Temperature Method

We are the only company worldwide that, using a high temperature method at 1,200°C, can completely oxidize a sample to accurately determine sum parameters - particularly when measuring the TRUE TOC with differing concentrations.

We offer application specific analyzers developed by our research and development team. In addition, we maintain close contact with our clients and continually analysis the exact problem areas of every application. Since the availability of our devices is a deciding criteria, they are constructed in a very user-friendly way. All important areas require little effort to be accessed and the protective housing offers additional safety.

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## After Sale Support

Servicing is carried out by our qualified partners worldwide. Technical support, via telephone or email is available at all times. Additionally, we offer practically orientated seminars and trainings, operator meetings and workshops, that leave no questions unanswered. protective housing offers additional safety..

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## We Always Take A Closer Look

Setting ourselves the highest quality standards, we closely cooperate with our partners to fulfill the customers expectations throughout the world. Thus, we regularly evaluate our distributors and when necessary, introduce measures to improve our collaboration with them. Not only do we fulfill the requirements of the ISO 9001, but we also work continually on improving our standards of quality. To enable this, we collect information about all applications in our database that are subsequently analyzed and evaluated. Regular meetings are held to address every issue guaranteeing highest quality standards.

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**TOC-ANALYSIS** – From complex industry waster water to pharmaceutical pure water, our TOC analyzers determine parameters quickly and precisely.

**COD-ANALYSIS** – With our analyzers 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.

**TNb/TP-ANALYSIS** – TNb and TP are important parameters for waste water treatment. We are the only ones who offer them in combination with TOC and COD in one system.

**FURTHER PRODUCTS** – We offer a specific solution for nearly all applications. With our protective housings, you are always on the safer side. Find out more: [www.process-insights.com](http://www.process-insights.com)

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## Areas of application

Environment / Municipal Facilities / Industry

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## Industries

Environmental Monitoring / Waste Water Treatment / Waste Processing / **Pharmaceutical** / Laboratory / Petrochemical / Refineries / Chemical / Coal And Steel / **Power** / Airports / Automobile / Paper Manufacture / Breweries / Food Manufacture / Drink Manufacture / Milk Processing / **Semiconductor Manufacture**

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## Types of water

Groundwater / Surface Water / Drinking Water / Water Influent / Water Effluent / Discharge Control / Industrial Waste Water / De-Icing Water / **Process Water** / High Salt Concentration / Oil-In-Water / Cooling Water / **Pure Water** / Boiler Feed Water / Condensate Return / **Pharma Hpw** / **Pharma WFI** / **Semiconductor UPW**

## GAIN REAL-TIME INSIGHT INTO YOUR PROCESS

Process Insights manufactures and delivers premium sensors, monitors, detectors, analyzers, instrumentation, and software that are mission-critical to keep your operations, personnel, and the environment safe – every day across the globe.

Get the most reliable, precision analytical technologies available on the market today. We will work to match your needs and budget, and provide the optimal, and most stable process analysis solution for your application.

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## CENTERS OF EXCELLENCE | PROVIDING PROVEN SOLUTIONS

Process Insights is committed to solving our customers' most complex analytical, process, and measurement challenges everyday.

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For a complete range of products, applications, systems, and service options, please contact us at: [info@process-insights.com](mailto:info@process-insights.com)

For a complete list of sales & manufacturing sites, please visit: <https://www.process-insights.com/about-us/locations/>

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REVOLUTIONIZING MEASUREMENT

**EVERYWHERE**