



## QuickTOC<sub>trace</sub>

TOC-ANALYSIS

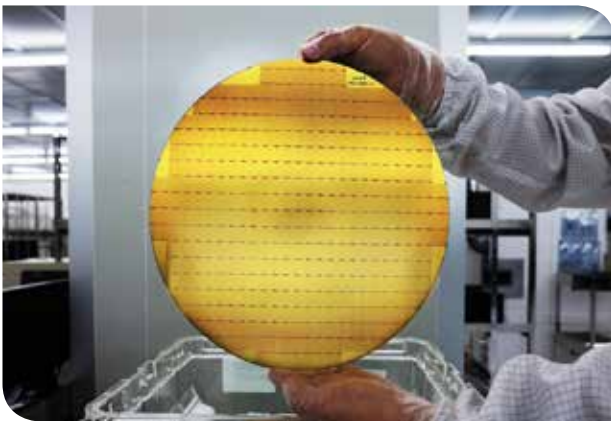
The continuous TOC monitoring.  
For lowest ranges.

Fast. Reliable. Compact.



# A MEASURING SYSTEM FOR ULTRA PURE WATER.

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



The QuickTOC<sub>trace</sub> 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.

**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 manufacture of semiconductors.**

Alongside solar technology and photovoltaics, energy generation and the pharmaceutical industry, UPW is primarily used in the manufacture of semiconductors. 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 anorganic 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 ultrafiltration (semiconductors), ozonisation and general optimising of duct systems can minimise 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.

#### 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 CO<sub>2</sub>. In typical UPW application, organic contamination is <1mg/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.

#### 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 oxidised into CO<sub>2</sub>, which increases conductivity. This change is used to calculate TOC concentration.

#### The QuickTOC<sub>trace</sub>.

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

#### 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.
- The QuickTOC<sub>trace</sub> is designed to be easy to maintain and user-friendly, yielding results in a few seconds.

# THE ANALYSER.

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

## Continuous TOC measurement by means of UV oxidation and differential conductivity measurement.

The QuickTOC<sub>trace</sub> 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 QuickTOC<sub>trace</sub> can thus reliably determine the parameter TOC in a measuring range of 0.1 - 1,000 ppb.

The QuickTOC<sub>trace</sub> is an easy to use, low-maintenance online measuring device that enables quick and reliable monitoring of demanding applications.

The QuickTOC<sub>trace</sub> is very easy to operate and requires extremely low maintenance.



It is particularly suited for applications in the pharmaceutical industry (WFI, HPW, PW), as well as ultra pure water (UPW).

## 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).

QuickTOC<sub>trace</sub>'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.

## 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).

## Software and data output.

The QuickTOC<sub>trace</sub> 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.

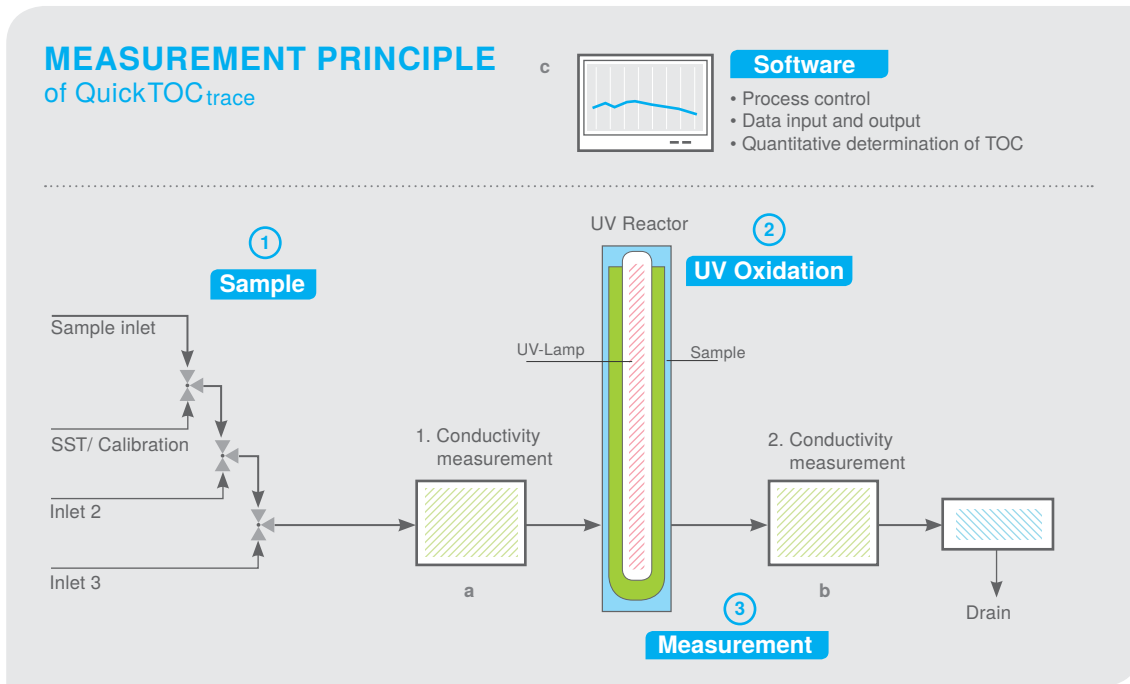


Fig. 1

- 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

## THE PRINCIPLE.

Safe and fast measurements.

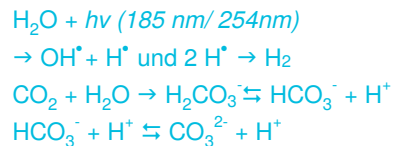
### UV oxidation. Formation of free radicals.

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<sup>•</sup> radical, which can oxidise 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.

## CHEMICAL REACTIONS



### 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.

With the UV-Oxidation CO<sub>2</sub> is created which is a part of the carbonate-hydrogencarbonate equilibrium.

# QuickTOC<sub>trace</sub> AN OVERVIEW

## Online TOC measurement – the fastest way to analyse ultra pure water.

The LAR QuickTOC<sub>trace</sub> 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.



Fast and safe –  
you can rely on the QuickTOC<sub>trace</sub>!

## ADVANTAGES & FEATURES

- ✓ Recognised 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	300 x 500 x 200 mm (W x H x D)
Weight	ca. 7 kg

### Electric 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" 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

# ALL cLeAR?

LAR Process Analysers AG: Water is our Element.  
We do everything for its protection.

We are the leading manufacturer of water analysers 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 and state of the art.

##### LAR's Ultra High Temperature Method at 1,200°C!

LAR formed in 1986, gained prominence through their TOC and COD analysers. LAR is the only company worldwide that, using a high temperature method at 1,200°C, can completely oxidise a sample to accurately determine sum parameters. Particularly when measuring the TRUE TOC with differing concentrations.

#### LAR is only satisfied once the customer is.

We offer application specific analysers 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.

#### After Sales. A familiar word to us.

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

#### 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.

LAR has established its own system for guaranteeing its standards of quality. 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 analysed and evaluated. Regular meetings are held to address every issue guaranteeing highest quality standards.

#### TOC-ANALYSIS



From complex industry waster water to pharmaceutical pure water, our TOC analysers determine the parameter quickly and precisely.

#### COD-ANALYSIS



With our analysers, the chemical oxygen demand is cleanly and safely determined online, without using hazardous 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<sub>b</sub>/TP-ANALYSIS



TN<sub>b</sub> and TP are important parameters for waste water treatment. We are the only ones who offer a combination of these with TOC and COD in one system.

#### FURTHER PRODUCTS



LAR offers a specific solution for nearly all applications. With our protective housings, you are always on the safer side. Learn more about our product range at [www.lar.com](http://www.lar.com).

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TÜV certified company

## TOC-ANALYSIS

# QuickTOC<sub>trace</sub>

### AREAS OF APPLICATION

ENVIRONMENT / MUNICIPAL FACILITIES / **INDUSTRY**

### INDUSTRIES

ENVIRONMENTAL MONITORING / WASTE WATER TREATMENT /  
**POWER** / WASTE PROCESSING / AIRPORTS / AUTOMOBILE /  
**PHARMACEUTICAL** / LABORATORY / CHEMICAL / PETROCHEMICAL /  
REFINERIES / COAL AND STEEL / PAPER MANUFACTURE /  
BREWERIES / FOOD MANUFACTURE / DRINK MANUFACTURE /  
MILK PROCESSING / **SEMICONDUCTOR MANUFACTURE**

### TYPES OF WATER

GROUNDWATER / SURFACE WATER / DRINKING WATER /  
WATER INFLUENT / WATER EFFLUENT / DISCHARGE CONTROL /  
INDUSTRIAL WASTE WATER / DE-ICING WATER / **PROCESS**  
**WATER** / OIL-IN-WATER / COOLING WATER / **PURE WATER** /  
BOILER FEED WATER / CONDENSATE RETURN /  
HIGH SALT CONCENTRATION / **PHARMA HPW** / **PHARMA WFI** /  
**SEMICONDUCTOR UPW**

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