SHIMADZU
Excellence in Science

On-Line TOC Analyzer for Ultrapure Water

TOC-1000e S

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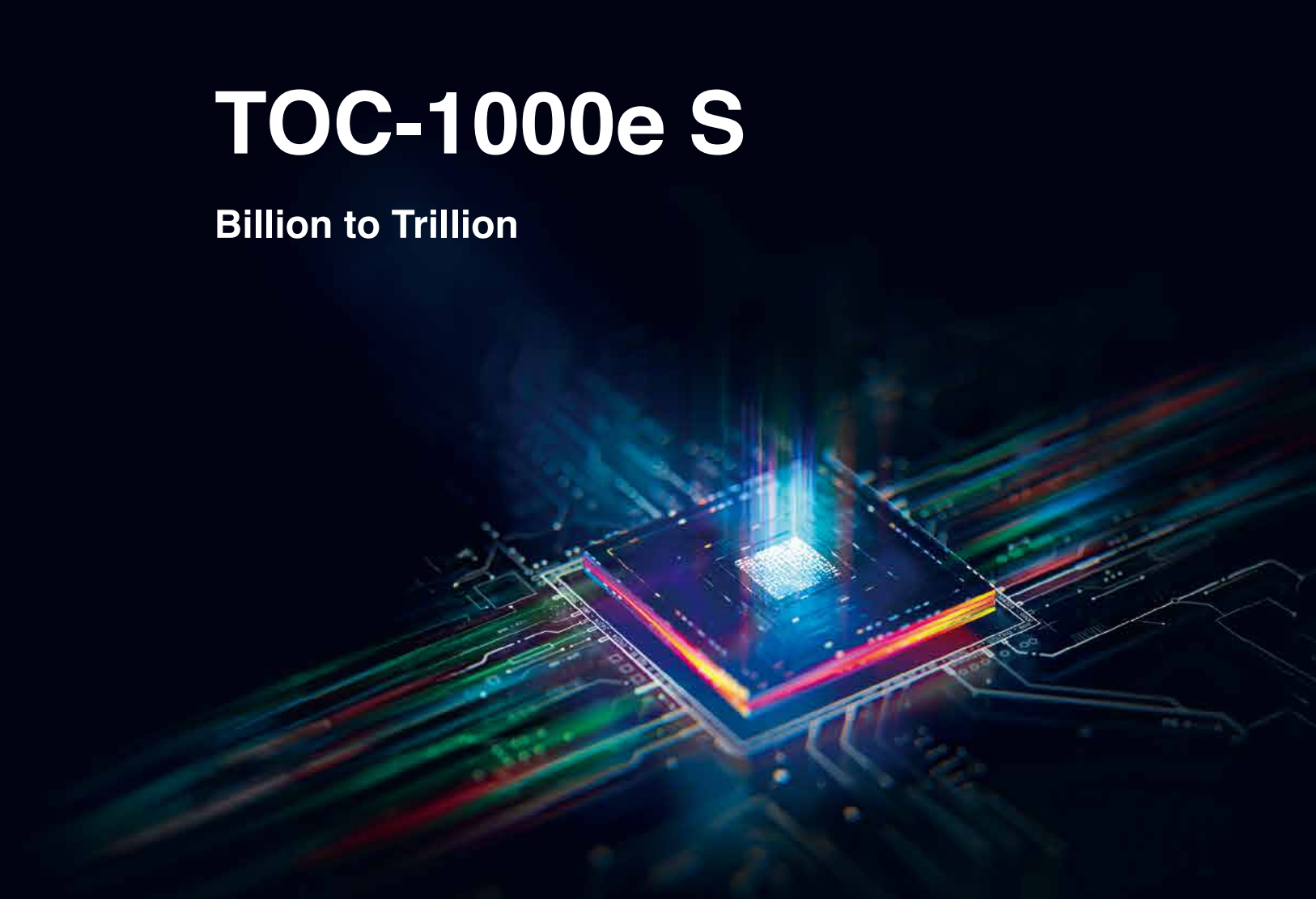
Billion to Trillion



On-Line TOC Analyzer for Ultrapure Water, for the Semiconductor Manufacturing Process

In semiconductor manufacturing, even the smallest trace of contamination can compromise product quality. As semiconductor miniaturization continues to advance, minimizing trace-level organic contamination has become increasingly critical to maintain high product yield rate. As a result, the quality standards for ultrapure water used in semiconductor manufacturing are becoming even stricter. Especially in the manufacturing process of cutting-edge semiconductors, the need to detect urea and other hard-to-oxidize compounds has increased. Detecting those compounds has been difficult using conventional techniques. The TOC-1000e S on-line TOC analyzer for ultrapure water, incorporating feedback from cutting-edge semiconductor manufacturers, has been developed to address these challenges.

Shimadzu has been a trusted provider of TOC analyzers for more than 50 years, establishing a legacy as the leader in TOC instruments. Now leveraging these decades of expertise and advanced techniques, Shimadzu delivers the TOC-1000e S on-line TOC analyzer for ultrapure water, specifically designed to meet the rigorous requirements of the modern semiconductor manufacturing process.

POINT

POINT 01

Superior detection sensitivity for hard-to-oxidize compounds

POINT 02

Fast response to contamination events

POINT 03

Industry-leading compact design and lightweight build

POINT 04

User-friendly operation for efficient workflow

POINT 05

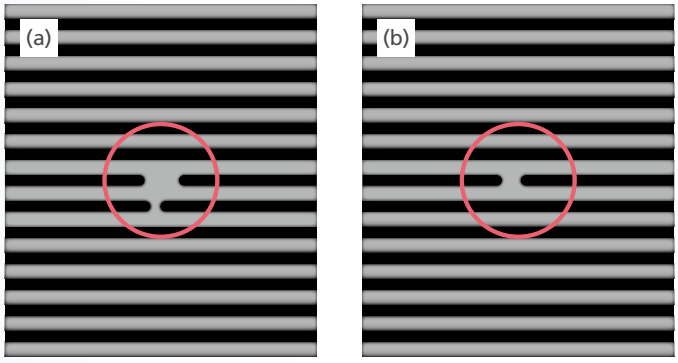
Supports a Variety of Data Output Formats and a Web Browser Function

POINT 01

Superior detection sensitivity for hard-to-oxidize compounds

High Oxidation Capacity with Accurate Detection of Urea and Other Hard-to-Oxidize Compounds

In semiconductor manufacturing, large volumes of ultrapure water are produced from various water sources. During this purification process, impurities must be removed to the greatest possible extent. Urea is particularly challenging to eliminate due to its hard-to-oxidize characteristics. Any residual urea in the ultrapure water can generate ammonia gas, which causes issues in the subsequent machining of semiconductor materials. Insufficient detection capability, even with conventional on-line TOC analyzers with similar operating principles, has been a problem. With the TOC-1000e S, samples are exposed to high-energy shortwave light from an excimer lamp using the Active-Path™ configuration, enabling the high-sensitivity detection of urea and other hard-to-oxidize organic compounds.



Defective part on the circuit

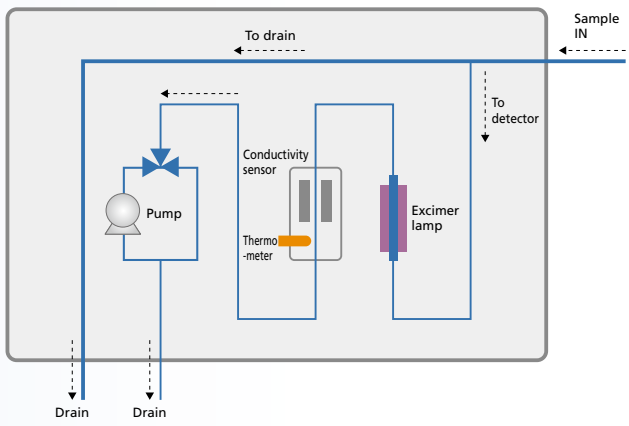
POINT 02

Fast response to contamination events

Ensures Rapid Detection of Impurities

Detecting the presence of impurities in ultrapure water at an early stage prevents defects in semiconductor materials. The TOC-1000e S features a simple measurement flow line, in which the excimer lamp and the electric conductivity meter are connected in series. Sample water continuously flows through the measurement line, allowing real-time detection of unexpected impurities.

Internal structure and measurement principle



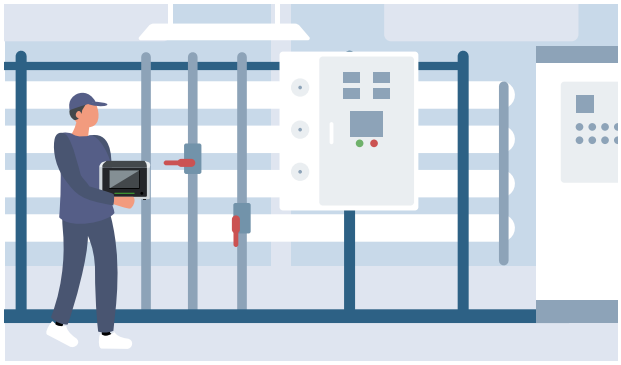
POINT 03

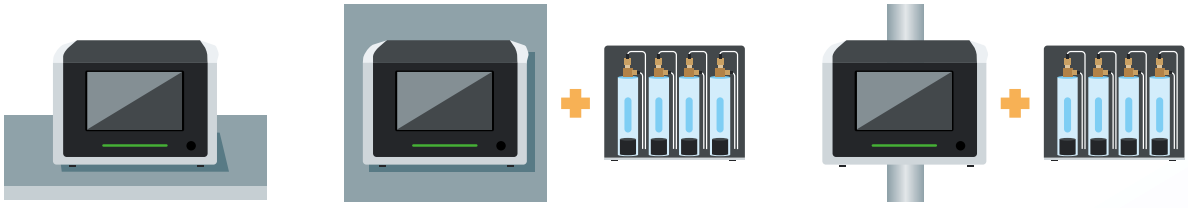
Industry-leading compact design and lightweight build

Compact, Lightweight, and Easy to Install Seamless Transfer to Measurement Points

The TOC-1000e S is small and only weighs approximately 3 kg. In addition to desktop use, it can be easily installed on walls or pipes with the optional bracket kit. For any setup, a vial sampler can be attached to one side of the instrument, enabling on-site calibration.

It can also be easily moved between measurement points and serve as a backup instrument during maintenance of active instruments.





Desktop　　Wall Mount　　Pole Mount

High-Visibility Display and Indicators

With its large display and clear UI, the software delivers outstanding visibility and ease of operation, enhancing efficiency for routine checks, data output, and maintenance. The indicators show various aspects of the instrument status in different colors.

Monitor Display

Measurement (blue)

Warning (orange)

Error (red)

Indicators

POINT 04

User-friendly operation for an efficient workflow

Maintenance-Free for One Year, and Tool-Free Maintenance

The configuration of the instrument is very straightforward and parts replacement is only required once a year. The only parts requiring periodic replacement in the main unit are the excimer lamp and the pump head. Both can be accessed from the front of the instrument, removed, and installed easily without any tools.

Excimer lamp replacement

Pump head replacement

On-Site Calibration Using a Vial Sampler and Certified Standard Solutions

Calibration and validation can be easily performed on-site using an optional vial sampler and certified standard solutions. The procedures are straightforward and easy to follow.
In addition, on-line calibration against a reference instrument optimizes the quality control of ultrapure water when multiple instruments are in use.

Certified Standard Solutions

Stability Check Function

ANALYTICAL INTELLIGENCE

A stability check function is available to verify the stability of the instrument when on-line measurements resume after relocation or maintenance.

ANALYTICAL INTELLIGENCE

- Automated support functions utilizing digital technologies, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.

POINT 05

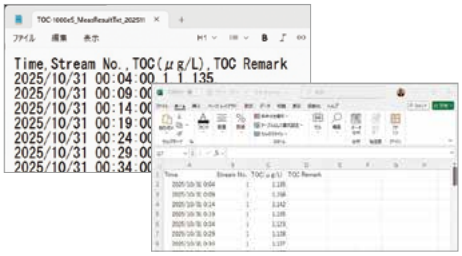
Supports a Variety of Data Output Formats and a Web Browser Function

Output Data in an Easy-to-View, User-Friendly Format

Data can be output from the eTOC to a USB flash drive in text format (CSV format) or PDF format.

Text files

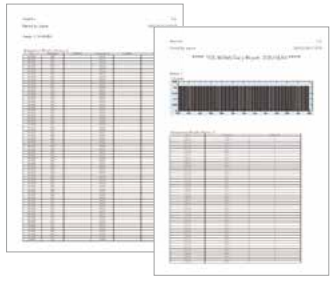
Comma-delimited (CSV) or tab-delimited. The data can be read into spreadsheet software.



Text files

Daily reports (PDF files)

Daily measurement results can be summarized in easy-to-view reports with tables of numerical values and trend graphs.



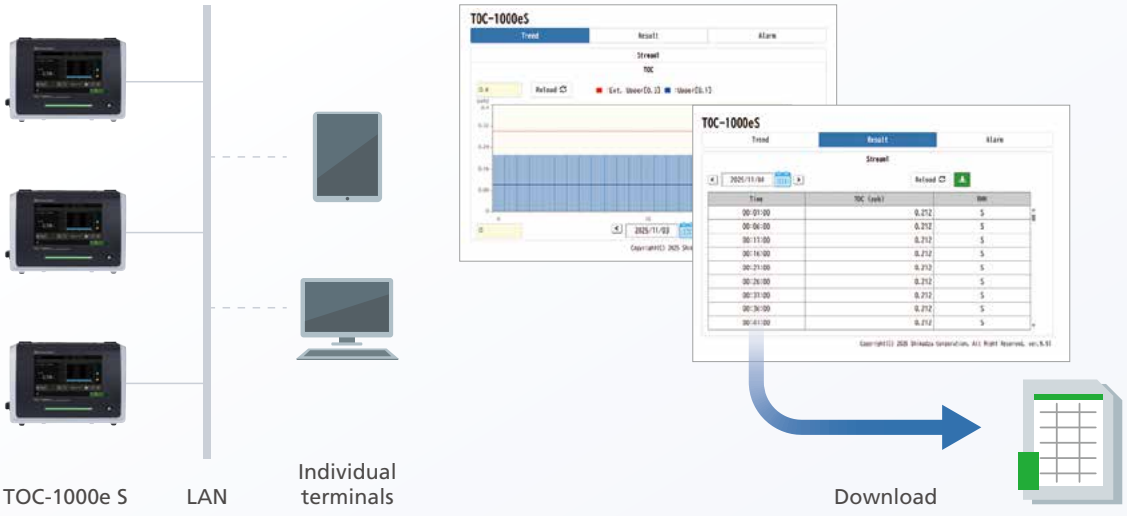
Daily reports

External input/output

Using the external input/output kit included as standard, measurement values can be output as analog output (4 to 20 mA), or can be output as warnings or events with contact outputs.

Monitor Data Online from Any Location

Connect the TOC-1000e S to a network to check the measurement values from a remote location, using a PC or tablet. The data can be accessed using a Web browser, so special software is not required. The data can also be downloaded as a file.
An on-site visit is not required, even for remote or multiple instruments.

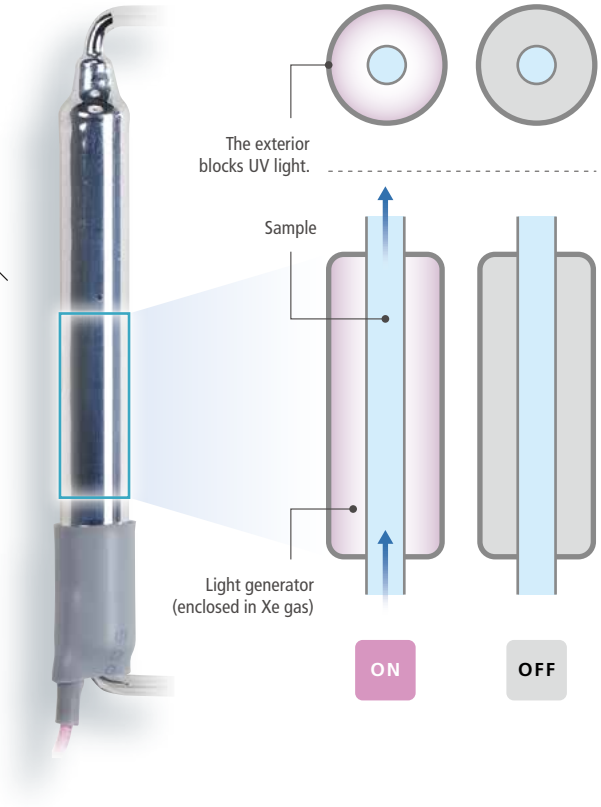


Mercury-Free Excimer Lamp

TOC-1000e S is the on-line TOC analyzer to adopt an excimer lamp for oxidation. The excimer lamp delivers high-energy 172 nm light that can be switched instantly ON or OFF, minimizing lamp deterioration by activating only during oxidation. In addition, with Shimadzu's unique Active-Path configuration, samples are efficiently exposed to the high-energy light from the excimer lamp, ensuring complete oxidation of organic substances and exceptional measurement accuracy.

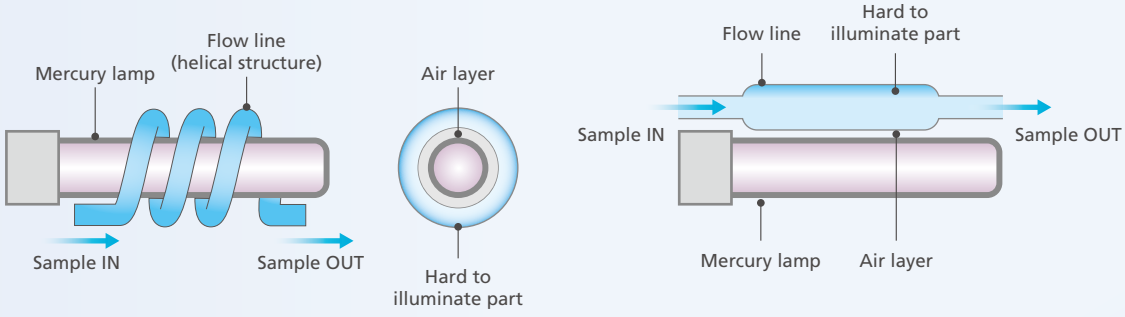
Active-Path Configuration

- Integrated light source and sample flow line
- The light source encloses the flow line rather than being separated from it, so the sample is efficiently exposed to UV light.
- The flow line has a simple shape, minimizing contamination and carryover.
- UV-blocking materials are used for the lamp casing. This prevents accidental eye exposure and ozone generation inside the instrument.



General Instrument Issues

- UV light does not efficiently reach the sample due to absorption by air.
- UV light has limited effectiveness in reaching areas far from the lamp.
- The oxygen in the air reacts with the UV light and ozone is inadvertently generated within the instrument.



Optional Products

Description	P/N	Remarks
Vial Sampler	S638-57230-41	40 mL vials × 4 pc
Bracket Kit	S638-23033-41	Compatible with wall mounts and pole mounts
Power Terminal Board Kit	S638-68186-41	
Sample Piping Set	S040-22311-01	Integrated flow line cut-off valve, flow rate adjustment valve, and in-line filter

Periodic Replacement Parts

Description	P/N	Remarks
Excimer Lamp	S638-69201-41	
Pump Head	S638-59384-41	
Filter Element	S040-22311-21	

Prepared Standard Solutions

Application	P/N	Remarks
Blank Water	S638-60252-91	For cleaning: Blank water × 4 pc
147 μS/cm Potassium Chloride Electric Conductivity Standard Solution Set	S638-60254-91	For electric conductivity calibration: 147 μS/cm KCl × 2 pc, blank water × 1 pc
0-250-500 μg/L Sucrose TOC Standard Solution Set	S638-60255-91	For TOC calibration and validation: Blank water × 1 pc, 250/500 μg/L sucrose × 1 pc each

Product specification

Item	Specifications
Measurement items	TOC
TOC measurement principle	UV oxidation-conductivity measurement method
Measurement range*1	0 to 500 μg/L
Detection limit*1	0.02 μg/L
Repeatability*1	±0.05 μg/L (when concentration is no greater than 1 μg/L)
Accuracy*1	±5% (500 μg/L sucrose)
Linearity*1	R2 = 0.98 or greater (when measuring 250 mg/L in the 0-500 mg/L range)
Startup time	5 minutes
Measurement cycle	5 minutes, 10 minutes, 15 minutes, 30 minutes
External dimensions	270 (W) × 180 (H) × 140 (D) mm
Required power supply	100 to 240 V AC, 50/60 Hz 100 VA
Weight	3.0 kg
Protection from dust and water spray	IP33
Wiring length	10 m or less (when using LAN, analog, and contact)

*1 The specifications apply when the oxidation time is set to 70 seconds.

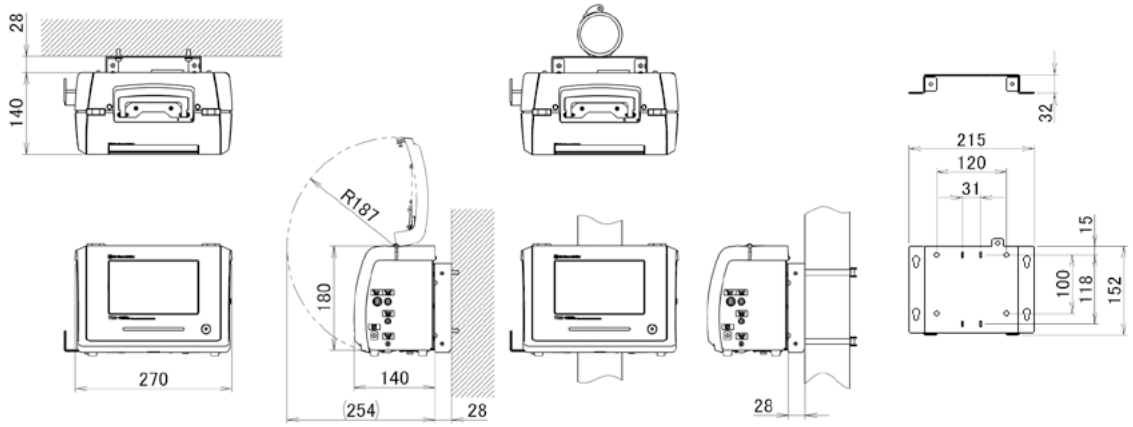
Sample conditions and Installation environment

Item	Sample conditions/Installation environment*2
Sample temperature*3	25±5 °C (Guaranteed operation: 10 to 50 °C)
Sample conductivity	0.1 μS/cm or less (Guaranteed operation: 1 μS/cm or less) (both at 25 °C sample temperature)
Sample flow rate	30 to 200 mL/min (Recommended: 100 mL/min, guaranteed operation: 30 to 500 mL/min)
Ambient temperature*3/humidity	25±5 °C (Guaranteed operation: 10 to 40 °C) 0 to 80 % (No condensation)

*2 The samples and environmental conditions must be within the specifications and the changes should be small.
*3 The difference between the ambient temperature and the sample temperature should be small.

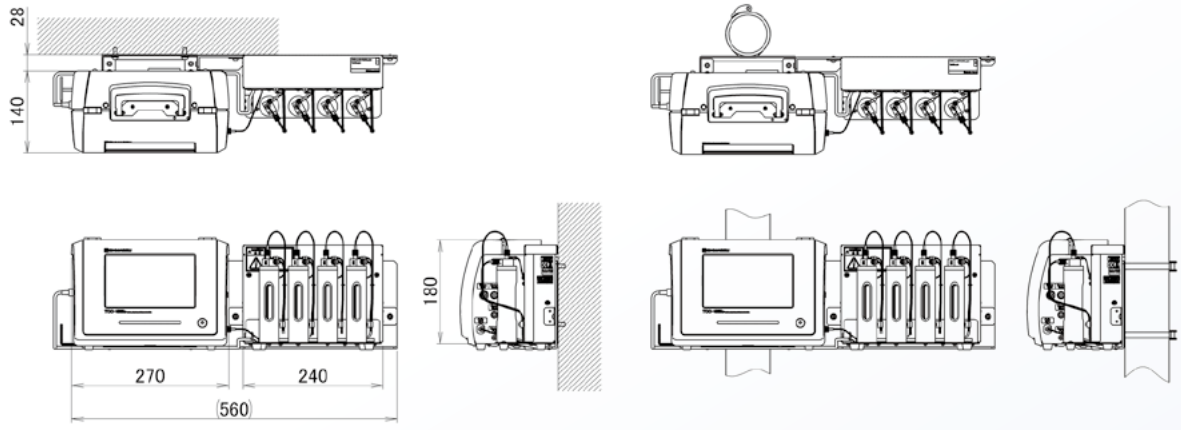
Installation Space

TOC-1000e S



Wall-mounted　　Pole-mounted　　Bracket

TOC-1000e S with Vial Sampler (Optional)



Wall-mounted　　Pole-mounted

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