TOC-V Series

Shimadzu
Total Organic Carbon Analyzer
Shimadzu's World-leading TOC Analyzers

**Total solutions for all aims and conditions**
Comprehensive 8-model line-up for both laboratory and on-line use

Comprehensive selection of options enables the analysis of a wide range of samples, including ultrapure water and polluted water, as well as solid and gas samples.

**Laboratory Models**

*Combustion catalytic oxidation/NDIR method*  

- TOC-VCSH  
  - Standalone high-sensitivity model
- TOC-VCSN  
  - Standalone standard model
- TOC-VCPH  
  - PC-controlled high-sensitivity model
- TOC-VCNP  
  - PC-controlled standard model
- TOC-VE  
  - Standalone

**Option**

- Auto sampler  
  - ASI-V
- 8-Port Sampler  
  - OCT-1

(Reference page : P12)  
(Reference page : P13)
Shimadzu’s World-leading TOC Analyzers

Total solutions for all aims and conditions

Comprehensive 8-model line-up for both laboratory and on-line use

- Laboratory Models
- On-line Models

Comprehensive selection of options enables the analysis of a wide range of samples, including ultrapure water and polluted water, as well as solid and gas samples.

TOC has been adopted in various fields as an accurate quick indicator of total organic content.

- Study and monitoring of organic contamination of rivers, lakes, dams, and other water in the natural water cycle.
- Water quality control of industrial effluent and sewage plant effluent and operation management for effluent processing.
- Process control of the organic content in water at all types of factory.

- Environmental and biotechnology research and R&D at test organizations.
- Control of purified or recycled water for the semiconductor, pharmaceutical, water-washing system, or nuclear power industries.
- *Compliance with FDA 21 CFR part 11 (CPH, CPN, and WP models).
- Study and monitoring of the degree of contamination of soil, sludge, and sediments.

Wet chemical oxidation/NDIR method

<table>
<thead>
<tr>
<th>On-line Models</th>
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<tbody>
<tr>
<td>Combustion catalytic oxidation/NDIR method</td>
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</tbody>
</table>

**Wet chemical oxidation/NDIR method**

- TOC-Vws
- TOC-VWP
- ON-LINE TOC-VCSH

Standalone model

**Auto sampler**

ASI-V 8-Port Sampler

**OCT-1 TN (Total Nitrogen Unit)**

TNM-1 Solid sample combustion unit

SSM-5000A Solid sample combustion unit

**Stand-alone model**

**PC-controlled model**

**Standalone**

**High-sensitivity model**

(Reference page: P12)

(Total Nitrogen Unit) TNM-1

(Reference page: P14)

Solid sample combustion unit SSM-5000A

(Reference page: P15)
Total Organic Carbon Measurement is

**Combustion catalytic oxidation/NDIR method**

The key point about a TOC analyzer is whether it can efficiently oxidize hard-to-decompose insoluble and macromolecular organic compounds, not just the easily decomposed, low molecular weight, organic compounds. The 680°C combustion catalytic oxidation method, that was developed by Shimadzu and subsequently spread round the world, can efficiently analyze all organic compounds.

**Example: TOC Oxidation Performance Evaluation Test**

Evaluation using the method prescribed in the European Standard, Determination of samples containing particles (EN1484 Annex C).

- Test solution: TOC 100 mgC/L suspension of 20 to 100μm cellulose (Ultrasonic treatment should not be used.)
- Measurement method: 3 repeated measurements during stir with a magnetic stirrer.
- Evaluation criteria: Mean measured value between 90 and 110 mgC/L. CV (coefficient of variation) should be < 10%.

**Test results**

Using TOC-VCPH
Mean measured value: 98.64 mgC/L CV: 2.43%

Using TOC-VCPH + ASI-V (incorporating magnetic stirrer)
Mean measured value: 99.41 mgC/L CV: 1.70%

**Extremely wide range from 4μg/L to 25,000 mg/L for applications from ultrapure water to highly contaminated water.**

- Combination of highly sensitive NDIR with a high-volume sample combustion system achieves sub-10 μg/L level TOC analysis.
- Specify the blank check program to automatically conduct the blank check by creating and analyzing ultrapure water inside the system.
- High concentration samples are analyzed by diluting to 25,000 mg/L by the built-in automatic dilution function.

**Simultaneous TOC and TN (Total Nitrogen) analysis (with TN unit).**

Note: In the case of simultaneous TOC and TN analysis, TOC high sensitivity analysis using high sensitivity catalyst is impossible.

**Use compressed air**
(with carrier gas purification kit).

**Analyze gas and solid samples as well as liquids**
(with gas sample injection kit or solid sample combustion unit).
Shimadzu's Forte

**Combustion catalytic oxidation/NDIR method**

- **TOC-VE**
  - Basic model, incorporating all essential functions.
  - TOC analyzer with priority on easy measurement through manual sample injection and simple operations.

**Further evolution of the automatic sample injection system**

- Syringe with sparging function
  - Efficient, automatic acidification and sparging for NPOC measurements reduces measurement time by approximately 40% (compared with other Shimadzu products).
  - Automatic dilution reduces salinity, acidity, and alkalinity to considerably extend the maintenance period for the catalyst and combustion tube. (Maintenance period depends on the sample and measurement conditions.)
  - Dual flow line washing methods: rinsing with sample or rinsing with dilution water.
  - Sample intake tubes provided for individual TOC analyzer measurements during Autosampler use.

**Test solution:** TOC 100 mgC/L suspension of 20 to 100 + m cellulose (Ultrasonic treatment should not be used.)

**Measurement method:** 3 repeated measurements during stir with a magnetic stirrer.

**Evaluation criteria:** Mean measured value between 90 and 110 mgC/L. CV (coefficient of variation) should be < 10%.

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<td>Microsyringe MANU250</td>
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**Multi-function sample pretreatment / injection system**

The essential part of the system - the combination of 680°C combustion catalytic oxidation with newly designed high-sensitivity NDIR - is identical to TOC-VCS/CP.

**Simple analysis using an LCD and keyboard designed for ease of operation.**

**System can be upgraded with a TN unit (for simultaneous TOC and TN measurements).**

**System can be upgraded with a TN unit (for simultaneous TOC and TN measurements).**

**Special Accessories**

Select a microliter syringe to suit the application.
**Principle of the Combustion Catalytic Oxidation/NDIR TOC Analyzer**

Combustion catalytic oxidation/NDIR method

**TC (Total Carbon) Measurement**
Carrier gas (purified air) is passed at a controlled flow rate of 150 mL/min through an oxidation catalyst-filled TC combustion tube, heated to 680°C. When the sample pretreatment/injection system injects the sample into the combustion tube, the TC in the sample is oxidized or decomposes to create carbon dioxide. The carrier gas carrying the combustion products from the combustion tube is cooled and dehumidified in the dehumidifier before passing via the halogen scrubber into the sample cell of the non-dispersive infrared detector (NDIR), where the carbon dioxide is detected. The NDIR analog signal forms a peak, and the data processor calculates the peak area. To measure the TC concentration of the sample, the relationship between the TC concentration and peak area (calibration curve) is predetermined using a TC standard solution, to express the peak area as a ratio of the TC concentration.

**IC (Inorganic Carbon) Measurement**
The acidified sample is sparged with the carrier gas (purified air) to convert only the IC in the sample to carbon dioxide. This carbon dioxide is detected by the NDIR and the sample IC concentration is measured in the same way as TC. The IC is a combination of carbonate and bicarbonate.

**TOC (TC-IC) Measurement**
Subtracting the IC concentration from the TC concentration determines the TOC concentration.
Oxidation/NDIR TOC Analyzer

NPOC Measurement (TOC by acidification/sparging method)
A small amount of hydrochloric acid is added to acidify the sample and the sample is sparged with sparge gas. This converts all IC in the sample to carbon dioxide and drives the CO₂ out of the sample solution. The TOC concentration is determined by measuring the TC of the sample after the IC is eliminated. NPOC measurement is equivalent to TOC measurement using acidification and sparging (IC elimination) defined for official test methods (EPA, ASTM, EN, etc.). As any purgeable organic compounds may be lost from the sample during sparging, the TOC measured by this method can be called NPOC (Non-Purgeable Organic Carbon).

POC (Purgeable Organic Carbon) Measurement
POC measurement is the measurement of the TOC of the organic carbon driven from the sample by the sparge gas in the sparging process during NPOC measurement. The CO₂ component in the sparge gas is eliminated when the sparge gas passes through the CO₂ absorber. The POC is then oxidized in the POC combustion tube to create carbon dioxide, which is detected by the NDIR. This data is processed in the same way as in TC measurement.

TOC (NPOC + POC) Measurement
The TOC concentration is obtained by adding the POC concentration to the NPOC concentration.

TN (Total Nitrogen) Measurement
Carrier gas (purified air) is passed at a controlled flow rate of 150 mL/min through a combustion tube that is filled with thermal decomposition catalyst and heated to 720°C. When the sample pretreatment/injection system injects the sample into the combustion tube, the TN in the sample thermally decomposes to create nitrogen monoxide. The carrier gas carrying the nitrogen monoxide from the combustion tube is cooled and dehumidified in the dehumidifier before passing into a chemiluminescence detector, where the nitrogen monoxide is detected. The chemiluminescence detector utilizes the gas-phase chemiluminescence of ozone and nitrogen oxide, such that the detected nitrogen monoxide analog signal forms a peak. To measure the TN concentration of the sample, the relationship between the TN concentration and peak area (calibration curve) is predetermined using a TN standard solution, to express the peak area as a ratio of the TN concentration.

TOC/TN Measurement
After acidification and sparging to eliminate IC, the sample is injected into the combustion tube, where the TN decomposes and the TOC (NPOC) of the sample simultaneously is oxidized to form CO₂. This carbon dioxide is detected by an NDIR connected in series with the chemiluminescence detector. The series connection between the NDIR and the chemiluminescence detector allows the nitrogen monoxide and carbon dioxide generated from a single sample injection to be simultaneously detected.
Shimadzu Wet Oxidation TOC Analyzers Aim for High Sensitivity with Great Oxidation Performance

### Wet oxidation/NDIR method

**TOC-Vws**

**TOC-Vwp**

Newly designed high-sensitivity NDIR achieves ultrahigh sensitivity measurements.

Sensitivity and accuracy enhanced by minimizing the reagent blanks that hinder accurate analysis.

**Measurement Principle**

**TC Measurement**
Phosphoric acid and the oxidant (persulfate) are added to the sample, which is heated under UV illumination to convert the TC in the sample to carbon dioxide. This carbon dioxide flows with the carrier gas via the dehumidifier into the NDIR sample cell. The area of the carbon dioxide peak signal is measured and this peak area is converted to TC concentration using a pre-prepared calibration curve.

**IC Measurement**
The sample is acidified with phosphoric acid and sparged to convert the IC in the sample to carbon dioxide. This carbon dioxide is detected by the NDIR and the sample IC concentration is measured in the same way as TC.

**NPOC Measurement**
The sample is acidified with phosphoric acid and sparged to eliminate the IC. The NPOC concentration is determined by measuring the TC (=NPOC) of the sample after the IC is eliminated, using the same method as for TC measurement.

**Powerful oxidation through a combination of peroxosulfuric acid, UV illumination, and heating.**

**No need of purging of reagent bottle reduces consumption of carrier gas.**
Sensitivity with Great Oxidation Performance

Trace level TOC measurement in Ultra-pure water.

<table>
<thead>
<tr>
<th>Conditions</th>
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<tbody>
<tr>
<td>Analyzer</td>
<td>TOC-Vws</td>
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<tr>
<td>Principle</td>
<td>TOC measurement by IC removal (acidifying and sparging)</td>
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<tr>
<td>Injection volume</td>
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<td>Number of measurements</td>
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Results

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<td>mean</td>
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<tr>
<td>SD</td>
<td>0.114μg/L</td>
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<tr>
<td>CV</td>
<td>4.73%</td>
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</table>

High accuracy measurement of TOC as low as 2μg/L(ppb)

Measurement flow line diagram

TOC-Vws

Carrier gas inlet
Gas flow rate controller
Carrier gas
Acid
Oxidant
Autosampler ASi-V
Sample
IC sparger
Drain
Dilution water
Oxidation reactor (UV illumination, heating)
Non-dispersive infrared detector (NDIR)
Dehumidifier/gas pretreatment unit
Data processor
Printer
Keyboard
LCD

TC Measurement

The sample is acidified with phosphoric acid and sparged to convert the TC in the sample to carbon dioxide. This carbon dioxide is detected by the NDIR and the sample TC concentration is measured in the same way as TC.

IC Measurement

Subtracting the IC concentration from the TC concentration determines the TOC concentration.

NPOC Measurement

Measurement principle

TOC-VWS

Trace level TOC measurement in Ultra-pure water.

High accuracy measurement of TOC as low as 2μg/L(ppb)
S Model with Screen and Keyboard or P Model Under PC

S Models

TOC-Vcs

The combination of simple, easily operated keyboard and large LCD makes these models easy to use.

TOC-Vws

A separate window for each measurement condition setting item enhances clarity and ease of input.

Helpful operation guides are displayed.

Frequently used functions such as calibration, measurement, and ASI measurement are assigned dedicated keys to reduce operations.

The method function registers measurement conditions.

Features (Common to S and P Models)

Automatic setting of optimal measurement conditions
When creating the calibration curve, the optimal measurement conditions are displayed when the standard solution concentration is set. Detailed calibration curve information can easily be referenced when setting the measurement conditions.

Automatic condition changing and re-analysis of out-of-range samples
If the sample peak goes over the calibration curve range, measurement conditions such as dilution rate and injection volume are automatically changed and the analysis is repeated.

Automatic selection of the best calibration curve
Up to three calibration curves can be set for sample measurement. The optimal calibration curve is selected for the sample and the sample measurements are conducted using these measurement conditions.
Control
Select the Model that Suits your Application

P Models

TOC-VCP

TOC-VWP

All TOC analyzer operations, control, and data collection can be conducted by a personal computer.
Enhanced software security functions support FDA 21 CFR Part 11.

PC Specifications for PC Control (P Model)

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<tbody>
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<td>CPU</td>
<td>Pentium 400 MHz, or above.</td>
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<tr>
<td></td>
<td>(800 MHz recommended for Part 11 compatibility.)</td>
</tr>
<tr>
<td>Video functions</td>
<td>SVGA (800 x 600 dots min.)</td>
</tr>
<tr>
<td></td>
<td>(1024 x 768 dots min. recommended)</td>
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<tr>
<td>OS</td>
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<tr>
<td>Main memory</td>
<td>Capacity required by OS + 64 MB min.</td>
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<tr>
<td>Hard disk</td>
<td>20 MB min. for installation</td>
</tr>
<tr>
<td>External storage medium</td>
<td>CD drive (CD-R drive for Part 11 compatibility.)</td>
</tr>
</tbody>
</table>

* Adobe Acrobat for Windows is also required for Part 11 compatibility.

User authentication, user authority level restriction, and operation history functions ensure data reliability. Combination with the Shimadzu CLASS Agent data-management software provides customer support for Part 11 compatibility.

Wizards allow simple input of measurement and calibration settings.

All information is stored as files in the personal computer for reference and re-use.

The measurement conditions and results can be output to EXCEL or other application software or input from other application software.

Automatic exclusion of anomalous values and re-calculation of repeated analyses

The mean value, standard deviation, and coefficient of variation are displayed and printed during repeated analyses. Anomalous values can be automatically eliminated and re-calculated.

Convenient automatic power off function

Automatic power off after electric furnace cools down ensures power is not left on and saves energy.

Comprehensive calibration system handles many uses

- Output is linearized for all range.
- Calibration curve can be created to compensate for TC in water used for standard solution adjustment.
- A maximum of 25 (model S.) (model P has no limit) calibration curves can be stored and recalled. All calibration curve data can be displayed and recorded.
Accessories Evolved in Parallel with

**Autosampler**

**ASI-V**

Enhanced features and convenience with easier operation

Combining the ASI-V automatic sample injector with a TOC-V Series analyzer (except TOC-V E) creates a fully automatic analysis system.

**Features**

- Three sample vial capacities are available. Select the sample vial and sample rack to suit the analyzed sample.
  - 9 mL vials x 93
  - 24 mL vials x 93
  - 40 mL vials x 68
  - 125 mL vials x 24

- All three vial types have a well sealed septum that can be easily replaced with the screw cap.

- The sampling needle is optimized for sample extraction from highly-sealed vials and for sparging.

- Changing analysis conditions or adding sample vials during analysis is simple. System operation and carrier gas flow can be automatically stopped on completion of measurements.

- Creating multiple calibration curves and selecting the optimal curve for samples with significantly differing concentrations allows these samples to be analyzed in a single run.

- Rinsing both external and internal surfaces of the sampling needle prevents carryover between samples.

- Optional magnetic stirrers agitate the sample in the vials to prevent settling of suspended solids. (Applicable to 24 mL and 40 mL vials.)

- Magnetic stirrers are installed for the samples at the measurement position and previous position to provide powerful agitation prior to measurement.

Note: Magnetic stirrers works for only from #1 to #85 vials among all 93 of them, in the case of using 24 mL vials.
Accessories Evolved in Parallel with the TOC Analyzers

Enhanced features and convenience with easier operation

Autosampler 8-Port Sampler OCT-1

ASI-V

The bridge to ultra-simplified auto analysis

Bringing you an innovative but inexpensive autosampler that automates your analyzer system.

Setup is extremely easy, because special vials are not needed.

Combining the ASI-V automatic sample injector with a TOC-V Series analyzer (except TOC-V E) creates a fully automatic analysis system.

Three sample vial capacities are available. Select the sample vial and sample rack to suit the analyzed sample.

All three vial types have a well sealed septum that can be easily replaced with the screw cap.

The sampling needle is optimized for sample extraction from highly-sealed vials and for sparging.

Changing analysis conditions or adding sample vials during analysis is simple. System operation and carrier gas flow can be automatically stopped on completion of measurements.

Creating multiple calibration curves and selecting the optimal curve for samples with significantly differing concentrations allows these samples to be analyzed in a single run.

Rinsing both external and internal surfaces of the sampling needle prevents carryover between samples.

Optional magnetic stirrers agitate the sample in the vials to prevent settling of suspended solids.

(Suitable for 24 mL and 40 mL vials.)

Sparging for NPOC measurement, the most frequently conducted analysis, can be selected from the following three types (if the external sparging kit is used).

Features

Compact, straightforward configuration using an 8-port valve.

Up to 2 OCT-1 units can be connected to a single TOC-V. As 8 sample containers can be loaded on a single OCT-1 unit, as many as 16 samples can be handled if 2 OCT-1 units are connected.

Commercially available stirrers can be used with the OCT-1.

Other Features of the OCT-1

- Compact, straightforward configuration using an 8-port valve.
- Commercially available stirrers can be used with the OCT-1.
- Up to 2 OCT-1 units can be connected to a single TOC-V. As 8 sample containers can be loaded on a single OCT-1 unit, as many as 16 samples can be handled if 2 OCT-1 units are connected.
- TOC-V series products currently in use (except for TOC-Ve) can be automated by being combined with the OCT-1.
Accessories Evolved in Parallel with the TOC Analyzers

**TN unit**

**TNM-1**

Combining the TNM-1 with a TOC-V CS/CP analyzer creates a TOC/TN simultaneous analysis system.

**Features**

- Combustion tube and oxidation catalyst are shared with TOC analysis, such that maintenance is virtually identical to dedicated TOC use. Maintenance is simple as no oxidant or other reagent is required.

- NO (nitrogen monoxide) is measured by Shimadzu’s tried and tested chemiluminescence method.

- Measurements over a wide range up to 4000 mg/L.

Note: In the case of simultaneous TOC and TN analysis, TOC high sensitivity analysis using high sensitivity catalyst is impossible.

**Simultaneous measurement of TOC and TN**

**TC measurement**

**TN measurement**

- Combining the SSM-5000A with a TOC-V CS/CP or a TOC-V WS/WP analyzer permits analysis of many solid samples in addition to aqueous samples, including soil, sludge, and sediments.

- Carbon measurement in attached residues using the swab method can be conducted for cleaning validation.

The above photo shows a combination of the SSM-5000A with the TOC-VCSH.

Swab sampling

Swab method for cleaning validation

Residue evaluation procedure using swab sampling with quartz microfiber filter paper and direct combustion carbon analysis

Please contact Shimadzu or its agents in your area for further information.

**Transfer to sample boat. TC measurement**
the TOC Analyzers

Solid sample combustion unit

SSM-5000A

Combining the SSM-5000A with a TOC-VCS/CP or a TOC-VWS/WP analyzer permits analysis of many solid samples in addition to aqueous samples, including soil, sludge, and sediments. Carbon measurement in attached residues using the swab method can be conducted for cleaning validation.

The above photo shows a combination of the SSM-5000A with the TOC-VCS/CP.

Features

- Analysis of 1 g samples with up to 30 mg carbon content reduces weighing errors or errors due to the uneven distribution of the sample carbon content.
- The use of unique tandem measurement cells, combining a long cell to measure aqueous samples and a short cell for solid samples, permits a single TOC analyzer unit to handle a range from several 10 ppb TOC in ultrapure water to several 10% TOC in solid samples.
- Measurement of inorganic carbon (carbonate) in solid samples is also easy.
- Aqueous samples containing large amounts of suspended matter can be analyzed by inputting the sample in a sample boat.
- Switching between TOC-VCS/CP or TOC-VWS/WP analysis of aqueous samples and SSM-5000A measurements of solid samples is achieved by simple screen settings.
- The SSM-5000A can be attached to a TOC-VCS/CP or TOC-VWS/WP unit with Autosampler installed. (Automatic measurement of solid samples is not possible.)

Swab method for cleaning validation

Swab sampling → Transfer to sample boat → TC measurement

Residue evaluation procedure using swab sampling with quartz microfiber filter paper and direct combustion carbon analysis

Please contact Shimadzu or its agents in your area for further information.
**Options**

**Special Accessories**

**Carrier Gas Purification Kit** Part number 638-41447-01
Compressed air supplied as instrument air or compressor air, for example, can be used as the carrier gas after elimination of the carbon-containing impurities, such as carbon dioxide and hydrocarbons. This kit is suitable for samples with TOC of 0.5 mg/L (0.5 ppm), or higher.
This kit is available for TOC-VCPH/CPN.
Compressed air supply pressure: 300 to 700 kPa
Air consumption: approx. 300 mL/min
Dust, mist, drain liquid to be removed in advance.

**Nitrogen Carrier Gas Kit** Part number 638-42054
Using this kit, which consists of an oxygen-permeating tube and a CO₂ absorber, nitrogen gas can be used as a carrier gas instead of high-purity air. This kit is available for TOC-VCPH/CPN/CPH/CPN, TOC-V, and on-line TOC-VCS/CPN. Purity of nitrogen gas should be 99.999% or higher.
When the kit is used, the measurement range of both TOC and IC is limited to 0 to 100 mg/L.
This kit cannot be combined with the TNM-1.
This kit cannot be used with the Carrier Gas Purification Kit (638-41447-01).

**Gas Purifier, adsorption type** Part number 638-52824-02
This purifier eliminates impurities from cylinder gas not guaranteed to meet CO, CO₂, and hydrocarbon content: each 1 ppm max.
This kit is available for TOC-VCSN/CPN.

**Gas Sample Injection Kit** Part number 638-93149-03
Incorporating this kit with TOC-V allows manual sample injection from a microliter syringe. Gas or aqueous samples can be injected. The TC, carbon dioxide, and TOC of a gas sample can be measured. (TOC is determined as (TC - CO₂). CO is included in TOC.)

**POC Kit** Part number 638-91066
This kit allows measurement of the purgeable organic carbon (POC) that is driven from the sample during the sparging process at room temperature.

**ASI-V Magnetic Stirrer** Part number 638-67075 for 24 mL vials
Part number 638-67076 for 40 mL vials
When attached to the ASI-V Autosampler, the magnetic stirrer agitates the vial contents to prevent precipitation of insoluble organic carbon out of the sample.
* If 24 mL vials are used, of the total 93 vials, vials No. 1 to No. 85 are stirred.

**ASI-V Stir bars** Part number 046-00617-02 for 24 mL vials
Part number 046-00617-03 for 40 mL vials

**Suspended Sample Kit** Part number for main frame 638-41460 for autosampler 638-93151
The TOC-VC** sample flowpath is 0.5 mm. This kit expands the flowpath to 0.8 mm to allow intake of larger suspended matter. Homogenization of the sample to pulverize the suspended matter into as fine and uniform a state as possible is important for the accurate measurement of samples containing suspended matter.

**External Sparging Kit** Part number 638-77152
This kit sparges the sample in the Autosampler vials for efficient NPOC measurement.

**Air Supply Pipe Set** Part number 638-41204
Includes a 20 m air supply pipe.

**Small Vial Rack Set for ASI-V** Part number 638-53068
This set consists of a vial rack and 9mL vials, and enables measurements of small sample volume. Applicable models are: TOC-VCPH/CPN/CPH/CPN.
ASI-V Magnetic Stirrer or External Sparging Kit cannot be used when this set is used.

### External Dimensions Diagram

**TOC-V Series**

**TOC-V series**

**TOC-Vcsws + ASI-V + SSM-5000A**

**TOC-Vc + OCT-1 (2units)**

**TOC-VWP + ASI-V + PC**

**TOC-Vcswc/CP + TNM-1**
## Specifications

### Total Organic Carbon Analyzer TOC-V Series

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<td><strong>Model</strong></td>
<td>TOC-VC-SH</td>
<td>TOC-VC-SN</td>
<td>TOC-VC-PH</td>
<td>TOC-VC-PN</td>
<td>TOC-VE</td>
<td>TOC-VWS</td>
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</tr>
<tr>
<td><strong>Measured items</strong></td>
<td>TC, IC, TOC, NPOC (optional POC, TN)</td>
<td>TC, IC, TOC, NPOC (optional POC, TN)</td>
<td>TC, IC, TOC, NPOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Applicable samples</strong></td>
<td>aqueous sample (optional solid/gas samples)</td>
<td>aqueous sample</td>
<td>aqueous sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measurement range (mg/L)</strong></td>
<td>TC: 0 to 25000</td>
<td>IC: 0 to 30000</td>
<td>IC: 0 to 30000</td>
<td>IC: 0 to 30000</td>
<td>IC: 0 to 20000</td>
<td>IC: 0 to 20000</td>
<td>IC: 0 to 30000</td>
</tr>
<tr>
<td><strong>Detection limit</strong></td>
<td>4 μg/L</td>
<td>50 μg/L</td>
<td>4 μg/L</td>
<td>50 μg/L</td>
<td>—</td>
<td>0.5 μg/L</td>
<td></td>
</tr>
<tr>
<td><strong>Measurement accuracy (reproducibility)</strong></td>
<td>CV 1.5% max.</td>
<td>CV 2% max. (CV1% max. at 8000 mg/L or higher)</td>
<td>CV 1.5% max. (CV2% max. at 10000 mg/L or higher)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Measuring time</strong></td>
<td>TC: approx. 3 mins</td>
<td>IC: approx. 4 mins</td>
<td>IC: approx. 4 mins</td>
<td>IC: approx. 4 mins</td>
<td>IC: approx. 3 mins</td>
<td>IC: approx. 3 mins</td>
<td></td>
</tr>
<tr>
<td><strong>Sample injection</strong></td>
<td>automatic injection</td>
<td>manual injection</td>
<td>automatic injection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sample injection volume</strong></td>
<td>10 to 2000 μL variable</td>
<td>10 to 1500 μL variable</td>
<td>10 to 2000 μL variable</td>
<td>10 to 1500 μL variable</td>
<td>10 to 2000 μL variable</td>
<td>10 to 2000 μL variable</td>
<td></td>
</tr>
<tr>
<td><strong>IC pre-treatment</strong></td>
<td>Automatic internal acidification and sparging</td>
<td>Sparge gas supply</td>
<td>Automatic internal acidification and sparging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Automatic dilution</strong></td>
<td>dilution factor 2 to 50</td>
<td>none</td>
<td>dilution factor 2 to 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carrier gas</strong></td>
<td>High purity air</td>
<td>High purity nitrogen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gas pressure</strong></td>
<td>300 kPa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gas consumption</strong></td>
<td>approx. 1440 L/month</td>
<td>approx. 2210 L/month</td>
<td>approx. 1440 L/month</td>
<td>approx. 2210 L/month</td>
<td>approx. 2210 L/month</td>
<td>approx. 2210 L/month</td>
<td>approx. 3000 L/month (NPOC)</td>
</tr>
<tr>
<td><strong>Operating keys</strong></td>
<td>built-in</td>
<td>use PC</td>
<td>built-in</td>
<td>use PC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>built-in LCD</td>
<td>use PC</td>
<td>built-in LCD</td>
<td>use PC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Printer</strong></td>
<td>built-in</td>
<td>PC printer</td>
<td>Optional (CENTRONICS, ESC/P)</td>
<td>PC printer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature range</strong></td>
<td>5 to 35 degC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>AC100~127V +10%, MAX600VA</td>
<td>AC122~240V +10%, MAX1200VA</td>
<td>AC100~127V +10%, MAX350VA</td>
<td>AC220~240V +10%, MAX350VA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>approx. (W)440 x (D)360 x (H)450 (excluding protrusions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>approx. 40 kg</td>
<td>approx. 38 kg</td>
<td>approx. 40 kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Autosampler ASI-V

<table>
<thead>
<tr>
<th>Specification</th>
<th>8-Port Sampler OCT-1</th>
<th>TN (Total Nitrogen)</th>
<th>Solid sample combustion unit SSM-5000A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vial types</strong></td>
<td>Select from three types: 24 mL, 40 mL, 125 mL</td>
<td>TC, IC, TOC</td>
<td>TC, IC, TOC</td>
</tr>
<tr>
<td><strong>Number of vials</strong></td>
<td>9 mL, 33 mL, 66 mL, 125 mL</td>
<td>Measured range 0 to 200 mg carbon</td>
<td>Measured range 0 to 200 mg carbon</td>
</tr>
<tr>
<td><strong>Sample sparging</strong></td>
<td>Yes</td>
<td>0.1 ppm carbon</td>
<td>0.1 ppm carbon</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>370 x 540 x 490 (excluding protrusions)</td>
<td>Analysis Time* 5 to 6 minutes at a gas rate</td>
<td>Analysis Time* 5 to 6 minutes at a gas rate</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>approx. 14 kg</td>
<td>Carrier Gas</td>
<td>Carrier Gas</td>
</tr>
</tbody>
</table>

## Autosampler ASI-V

### 8-Port Sampler OCT-1

<table>
<thead>
<tr>
<th>Specification</th>
<th>8-Port Sampler OCT-1</th>
<th>TN (Total Nitrogen)</th>
<th>Solid sample combustion unit SSM-5000A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vial types</strong></td>
<td>Select from three types: 24 mL, 40 mL, 125 mL</td>
<td>TC, IC, TOC</td>
<td>TC, IC, TOC</td>
</tr>
<tr>
<td><strong>Number of OCT-1 Connection</strong></td>
<td>Up to 2 OCT-1 units</td>
<td>Measured range 0 to 200 mg carbon</td>
<td>Measured range 0 to 200 mg carbon</td>
</tr>
<tr>
<td><strong>Sample sparging</strong></td>
<td>No sparging with OCT-1 (Sparging is done in the syringe of TOC-V)</td>
<td>Analysis Time* 5 to 6 minutes at a gas rate</td>
<td>Analysis Time* 5 to 6 minutes at a gas rate</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>Approx. 245 x 245 x 440 (excluding protrusions)</td>
<td>approx. 160 x 235 x 400 (excluding protrusions)</td>
<td>approx. 450 x 655 x 290</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>approx. 3.5 kg</td>
<td>approx. 8 kg</td>
<td>approx. 30 kg</td>
</tr>
</tbody>
</table>

**Note:** Sample vial rack is also available.
Ideal for high-sensitivity continuous monitoring of TOC

**On-line Models**

| ON-LINE TOC-VCSH |

The functionality for continuous automatic measurement has been added to the ability of the combustion catalytic oxidation/NDIR TOC-V Series to perform high-performance, high-sensitivity measurement of organic substances. The On-line TOC-VCSH can be used for continuous automatic high-sensitivity monitoring of water samples such as pure water and tap water.

**Combines Combustion Catalytic Oxidation at 680°C and NDIR Method**
Combustion catalytic oxidation at 680°C oxidizes even persistent or insoluble organic compounds. This method accurately measures any type of organic substance not affected by interfering substances or the sample properties such as pH or conductivity.

**Easy Maintenance**
Combustion catalytic oxidation at 680°C eliminates the need for oxidizing reagents, saving the tasks of procuring and preparing reagents. No special draining operations are needed.

**Off-line Measurement Functions**
A dedicated on-line measuring port is provided for easily conducting interrupting analyses. The optional OCT-1a allow the automatic measurement of up to 15 samples.

**Support Software for Pharmaceutical Water Management Applications**
The On-line TOC-Vcsh incorporates software for automatically performing tests specified by Japanese Pharmacopeia (resolution test) and USP (system suitability test). Combining the On-line TOC-Vcsh with an OCT-1 (optional) enables fully automatic testing; setting the reagent is all that is required.

**Wide Variety of TOC Measurement Methods**
NPOC, IC, TC and TOC (TC-IC) measurements are possible with the On-line TOC-Vcsh. TN measurement is also possible by adding an optional product. TOC and TN can be measured simultaneously.
monitoring of TOC

**Main Applications**

Management of pharmaceutical water  
Management of ultrapure and recycled water for the semiconductor industry  
Management of mains water  
Impurity contamination management for all types of water used at plants (cooling water, recycled water, and boiler water)

**Specifications**

<table>
<thead>
<tr>
<th>Measured items</th>
<th>NPOC (TOC by IC subtraction using acid sparging), TC, IC, TOC (TC-IC), TN (optional TNM-1 required)</th>
</tr>
</thead>
</table>
| Measurement method | 680°C combustion catalytic oxidation/NDIR method  
720°C combustion catalytic oxidation/chemiluminescence method (when TNM-1 is connected) |
| Measurement range | TC: 0-500 µg/L to 0-25,000 mg/L variable  
IC: 0-500 µg/L to 0-30,000 mg/L variable |
| Measurement cycle | Approx. 5 to 999 minutes (for NPOC measurement) |
| Number of measurement channels | 1 channel |
| Reproducibility | CV 1.5% max. |
| Linearity | ±2% F.S. max. |
| Zero stability | ±2% F.S. max. per day |
| Span stability | ±2% F.S. max. per day (ambient temperature fluctuations within 5°C) |
| Calibration cycle | Variable in the range 1 to 999 hours |
| Sample injection method | Automatic injection using syringe pump/slider |
| Sample injection volume | Variable in the range 10 to 2,000 µL |
| Sample dilution function | Diluted in syringe; dilution factor: 2 to 50 |
| IC pretreatment function | Automatic acidification and sparging |
| Carrier gas | High-purity air or oxygen (1 ppm max. of CO, CO₂, or HC)  
High-purity nitrogen (1 ppm max. of CO, CO₂, or HC) (when using optional nitrogen gas carrier kit)  
Supply pressure: Approx. 600 kPa  
Flowrate: 150 mL/min (230 mL/min with sparging) |
| Measurement value output | Analog output: Select from 4 to 20mA, 0 to 16mA (insulation, load resistance: 750Ω max.), and 0 to 1VDC  
RS-232C: Baud rate; 9,600 bps, Data length; 8 bits, Parity: none, Stop bits; 1 |
| Alarm output | Measurement value upper limit and upper upper limit alarms, system error alarm: No-voltage contact output (maximum: 5VA, 0.1A, 50V) |
| Control input | Remote stopping and starting of sample measurement and calibration |
| Sample conditions | Flowrate: Approx. 0.1 to 1 L/min  
Sample volume: 5 to 7 mL per measurement  
Temperature: 0 to 90°C |
| Ambient temperature | 5 to 35°C |
| Power supply | AC 100 - 127V ±10% MAX 800VA 50/60 Hz  
AC 200 - 240V ±10% MAX 1200VA 50/60 Hz |
| Dimensions | Approx. 440 (W) x 560 (D) x 460 (H) mm (excluding protrusions) |
| Weight | Approx. 40 kg |

**Special Accessories**

| Nitrogen carrier gas kit | P/N 638-42054 | High-purity N₂ gas (1 ppm max. of CO, CO₂, or HC) can be used as the carrier gas.  
*Simultaneous use of TNM-1 and this option is not possible.  
*The measuring range with this option becomes 0-500µg/L to 0-100mg/L for TC and IC both. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample adjustment tank</td>
<td>P/N 638-42053</td>
<td>Used when bubbles are contained within the sample.</td>
</tr>
</tbody>
</table>
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