

Sievers InnovOx

Laboratory and On-Line TOC Analyzers



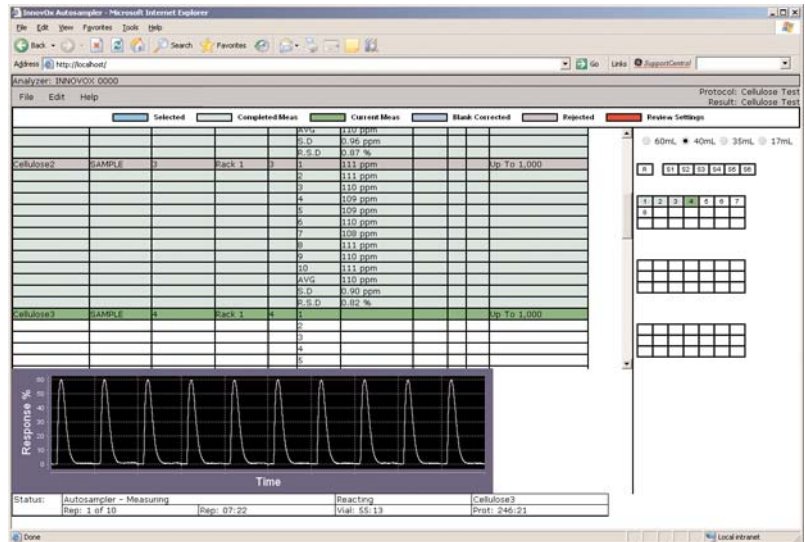
Overview

GE Analytical Instruments designed the Sievers* InnovOx Total Organic Carbon (TOC) Analyzers to provide industry-leading sample handling robustness and instrument uptime for process, environmental, and wastewater TOC Analysis. Available in both Laboratory and On-Line models, the InnovOx uses an innovative Supercritical Water Oxidation technique that offers enhanced reliability, greater ease of use, and lower maintenance than typical combustion or UV persulfate TOC analyzers.

Features and Benefits

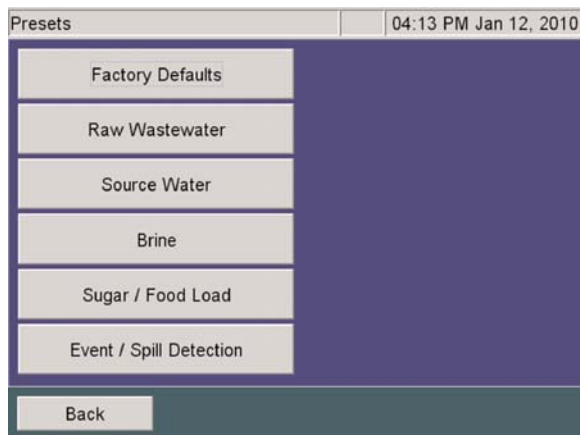
- **Wide Dynamic Operating Range** — Measures from 0.5 to 50,000 parts per million (ppm) TOC.
- **Versatile Measurement Modes** — Measures Total Inorganic Carbon (TIC), Non-Purgeable Organic Carbon (NPOC), Total Carbon (TC) and TOC by difference (TC-TIC).
- **Sample Handling Robustness** — Uses an innovative Supercritical Water Oxidation (SCWO) technique to achieve superior TOC recoveries regardless of organic compounds and particulate impurities in the sample. The InnovOx can handle a wide variety of traditionally difficult sample matrices, including brine, cellulose, and humic acid (see tables on pages 3 and 4), with unprecedented reliability.
- **Easy Operation** — The On-Line offers preset protocols for easy startup. Both On-Line and Laboratory models have intuitive color touch-screen interfaces, and operate immediately without any necessary heater warm-up or detector stabilization.

- **Low Maintenance and Cost of Ownership** — Robust by design, the InnovOx requires minimal operator intervention or preventive maintenance, offers up to six months' calibration stability, and features a solid state nondispersive infrared (NDIR) detector.
- **Ethernet Web browser interface (Lab model)** — Allows users to remotely monitor and control Analyzer operations and results using a Web-based interface and the instrument's Ethernet interface.
- **User-configurable alarms and outputs (On-Line model)** — Notifies user of water system events and enables remote monitoring of analysis results and performance.

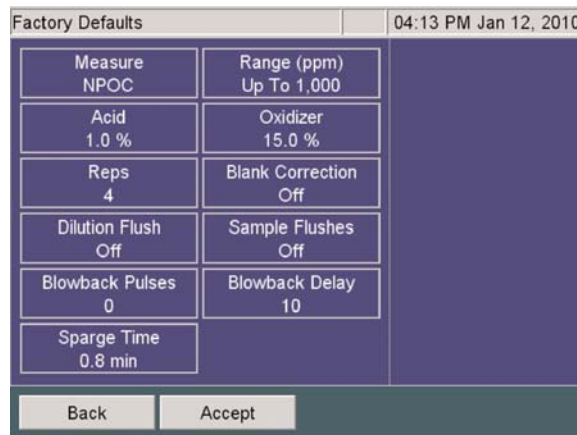


InnovOx Laboratory TOC Analyzer Web Interface





InnovOx On-Line TOC Analyzer Presets



InnovOx On-Line TOC Analyzer Defaults

Key Applications

- Petrochemical
- Manufacturing
- Environmental Labs
- Pharmaceutical
- Municipal Drinking Water
- Power
- Municipal Wastewater
- Pulp and Paper
- Chlor-alkali Chemistry
- Research
- Food and Beverage
- Brine and Seawater

dioxide, even in the presence of chloride and other inorganic species that negatively interfere with non-SCWO oxidation.

NDIR Detection

The InnovOx uses a highly stable, nondispersive infrared (NDIR) detector. Unlike other NDIR detectors, the InnovOx NDIR has no moving parts, and features tight temperature control of the IR source and detector.

Visit the Library at www.geinstruments.com to see animations of these key components.

Technology and Operation

The InnovOx features three main steps, each with significant process innovations:

Sample Handling and Reagent Mixing

The InnovOx ensures superior sample representation and accuracy by processing a large sample volume and thoroughly agitating the sample in the Sample Mixing Chamber. The sample and reagents are added through a unique sample coil delivery system which prevents syringe contamination.

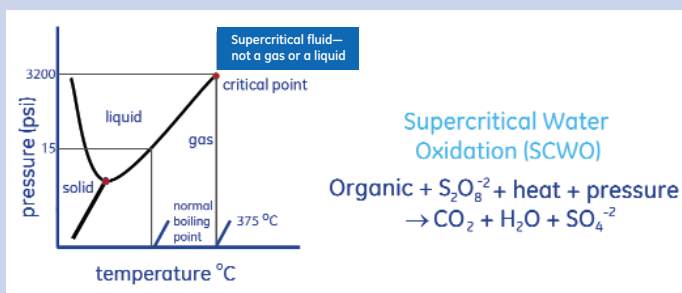
Supercritical Water Oxidation (SCWO)

Using a patent-pending SCWO technique (see sidebar at right), the Sievers InnovOx takes the water sample to a supercritical state by increasing the temperature, and subsequently the pressure, within the reactor. The properties of supercritical water enable an ultra-efficient, rapid oxidation of organic carbon to carbon

Supercritical Water Oxidation (SCWO)

Supercritical Water Oxidation (SCWO) was originally developed to treat large volumes of aqueous waste streams, sludges, and contaminated soils. SCWO destroys organic wastes using an oxidant in water and temperatures and pressures above the critical point of water, 375 °C, and 3,200 psi. These conditions enable rapid and complete oxidation.

Today, SCWO research and development is focused on treating a variety of toxic and hazardous organic wastes. GE Analytical Instruments is the first company to use this technique in a commercial laboratory TOC instrument.



InnovOx Laboratory Model Details

Accessories and Options

GE Autosampler

For high-volume laboratory applications, the InnovOx can be used with the GE Autosampler. It can handle up to 120 35-mL sample tubes or up to 63 40-mL or 60-mL vials in one protocol. An optional stirring station creates a homogeneous mixture for analysis during the sampling process.



Air Filter

The Air Filter can be used to purify ambient air and pressurize it sufficiently for use as sparge and carrier gas. It easily attaches to the back of the InnovOx Laboratory, and allows the Analyzer to be used in place of external carrier gas cylinders.



Sievers Certified Standards and TOC Vials

Sievers Certified Reference Materials are available for InnovOx calibration and verification needs, as well as reliable and economical 40-mL and 60-mL TOC vials.

Specifications

Operating Specifications¹

Analysis Modes	TIC, NPOC, TC, TOC (TC-TIC)
Dynamic TOC Range	0.5 to 50,000 ppm TOC
TOC LOD	0.05 ppm
TOC Accuracy	± 3% of reading at 50 ppm NPOC
TOC Precision	RSD ≤ 5% of reading at 50 ppm NPOC
TOC Linearity	R ² ≥ 0.995, measured as NPOC

(see Operation & Maintenance Manual for calibration recommendation)

Analysis Time	2.6 to 9.2 min, depending on mode
TOC Calibration Stability	Up to 6 months
Particle Diameters in Sample	≤ 800 µm diameter
Ambient Operating Temperature Range	10–40 °C (50–104 °F)
Maximum Relative Humidity	Up to 95%, non-condensing
Sample Temperature Range	10–60 °C (50–140 °F)
Sample Inlet Pressure	Ambient
Drain	Gravity drain

Analyzer Specifications

Outputs	Ethernet and 3 USB ports
Display	Color, touch-sensitive LCD
Power	100–240 ±10% VAC, 400 W, 50/60 Hz
Dimensions	Analyzer: H: 52.05 cm (20.49 in); W: 32.26 cm (12.7 in); D: 58.42 cm (23.0 in) GE Autosampler: H: 52.2 cm (20.5 in); W: 28.2 cm (11.1 in); D: 53.3 cm (21.0 in)
Weight	Analyzer: 22.4 kg (49.4 lb); GE Autosampler: 14.1 kg (31.1 lbs)
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1. Certified to CSA C22.2 No. 61010-1.

InnovOx Measurements for Brine, Cellulose, and Humic Acid Samples			
Replicate	28% Brine Solution (Process Sample)	90 µm Cellulose Solution (100 ppm C)	Humic Acid Solution (10 ppm C)
1	5.80	95.1	10.2
2	5.69	98.0	10.1
3	5.59	90.9	10.4
4	5.68	104	10.4
5	5.69	93.2	10.2
6	5.53	98.0	10.2
7	5.49	93.3	10.4
8	5.70	101	9.91
9	5.57	103	9.86
Mean	5.66	97.3	10.19
Stand. Dev.	0.12	4.50	0.20
RSD	2.13%	4.63%	2.0%

Consumables

	<u>Maintenance Frequency</u>	<u>Estimated Maintenance Time</u>
Acid Reagent	As needed, typically for 6 months (285 mL)	5 minutes
Oxidizer Reagent	As needed, typically 30-day stability	5 minutes
Reagent Grade Water	As needed	5 minutes
Air Filter Cartridge	3 months of operation	5 minutes
Pumps	24 months	15 minutes
Sample Flow Path Tubing	12 months	15 minutes
Valve Seals (2)	Up to 3 months of operation, depending on sample matrix	15 minutes

InnovOx On-Line Model Details

Accessories and Options

Air Purifier

The Air Purifier removes CO₂ from the air so the Analyzer can use house air as the compressed gas source.

Filter Panel

This accessory filters one sample stream, and it is automatically cleaned by back flushing with compressed air. The Filter Panel is adjustable for various particulate levels.

Fail-Safe Accessory

Sensors detect when the flow rate of each sample stream stops or consumables need replenishing.

IP56

The IP56 configuration protects the Analyzer from water jets and dust that would interfere with its operation.

Other Accessories

Other accessories include a mounting stand, a sample peristaltic pump, and multi-stream (2, 5) configurations.

Specifications

Operating Specifications¹

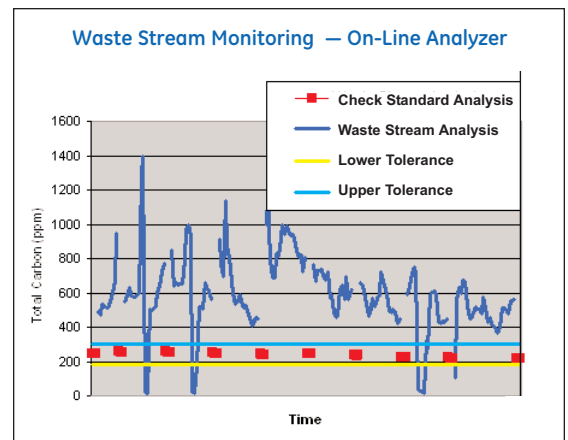
Analysis Modes	TIC, NPOC, TC, TOC (TC-TIC)
Dynamic TOC Range	0.5 to 50,000 ppm TOC
TOC LOD	0.05 ppm
TOC Accuracy	± 3% of reading at 50 ppm NPOC
TOC Precision	RSD ≤ 5% of reading at 50 ppm NPOC
TOC Linearity	R ² ≥ 0.995, measured as NPOC <i>(see Operation & Maintenance Manual for calibration recommendation)</i>
Analysis Time	2.6 to 8.3 min in on-line mode
TOC Calibration Stability	Up to 6 months
Particle Diameters in Sample	≤ 200 µm diameter without filtration, > 200 µm with optional filter panel
Ambient Operating Temperature Range	10–40 °C (50–104 °F)
Maximum Relative Humidity	Up to 95%, non-condensing
Sample Temperature Range	10–60 °C (50–140 °F)
Sample Inlet Pressure	Up to 125 psig
Drain	Gravity drain

Analyzer Specifications

Outputs	Ethernet (Modbus and TCP/IP), Binary, 4–20 mA, and USB
Display	Color, touch-sensitive LCD
Power	100–240 ±10% VAC, 280 W, 50/60 Hz
Dimensions	Analyzer: H: 92.7 cm (36.5 in); W: 64.6 cm (25.4 in); D: 38.7 cm (15.3 in)
Weight	Analyzer: 36.3 kg (80 lb)
Safety Certifications	CE, ETL listed. Conforms to UL Std. 61010-1. Certified to CSA C22.2 No. 61010-1.
IP Rating	IP56 (optional)

Consumables

	<u>Maintenance Frequency</u>	<u>Estimated Maintenance Time</u>
Acid Reagent	As needed	5 minutes
Oxidizer Reagent	As needed	5 minutes
Reagent Grade Water	As needed	5 minutes
Pumps	24 months	15 minutes
Sample Flow Path Tubing	12 months	15 minutes
Valve Seals (2)	Up to 3 months, depending on sample matrix	15 minutes
Sample Pump Tubing (optional)	3 months	15 minutes



* Trademark of General Electric Company; may be registered in one or more countries.

¹ Stated analytical performance is achievable under controlled laboratory conditions that minimize operator and standards errors. Patents pending.



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