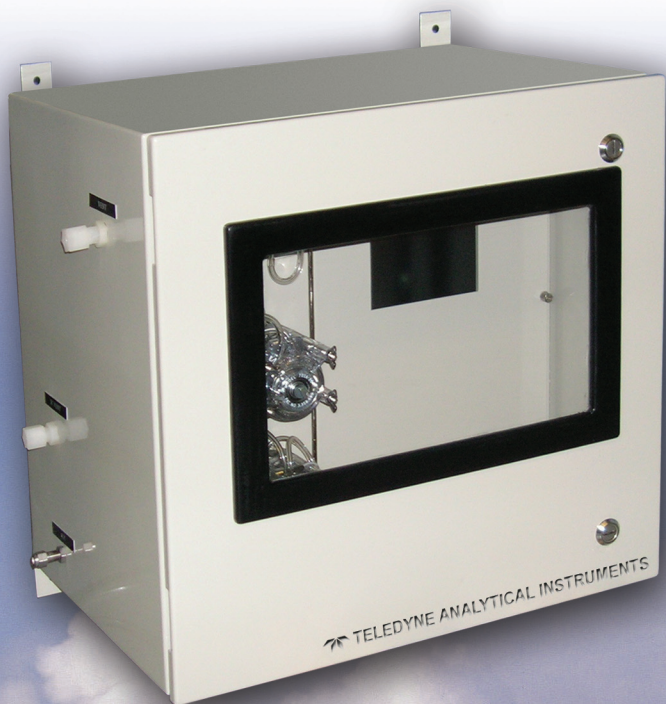


 **TELEDYNE
ANALYTICAL INSTRUMENTS**

SERIES 6700



TOC
TOTAL ORGANIC CARBON

**UV / Heated Persulfate Method
Ozone / Hydroxyl Radical Method
Combustion Method
Ultrapure Method**

The Series 6700 covers a complete range of Total Organic Carbon (TOC) Analyzers capable of addressing a variety of industrial applications for process and environmental compliance purposes. Depending on the application, TAI can recommend which technique is best suited to continuously detect TOC within your process.

The robust and reliable Infrared CO₂ analyzer is the heart of each design. It provides specific, interference-free CO₂ detection, has no moving parts, and is extremely easy to access and service, as required.

Each configuration is available with an optional Microsoft Windows™ based computer with touch screen control.

TOC Methods

UV / Heated Persulfate Method

Excellent TOC accuracy from low parts-per-million to moderate concentrations of salt-free samples. Minimum maintenance. Preferred method for most applications.

Ozone/Hydroxyl Radical Method

Excellent for low to high levels of TOC analysis for difficult to oxidize samples or in undiluted acids or industrial salts over 26%. Low maintenance. Preferred substitute for High Temperature Combustion in most applications.

Combustion Method

Good for difficult to oxidize or high TOC concentration samples with industrial salts less than 1%. Preferred for some higher range samples which have limited oxidation efficiency by other methods.

Ultrapure Method

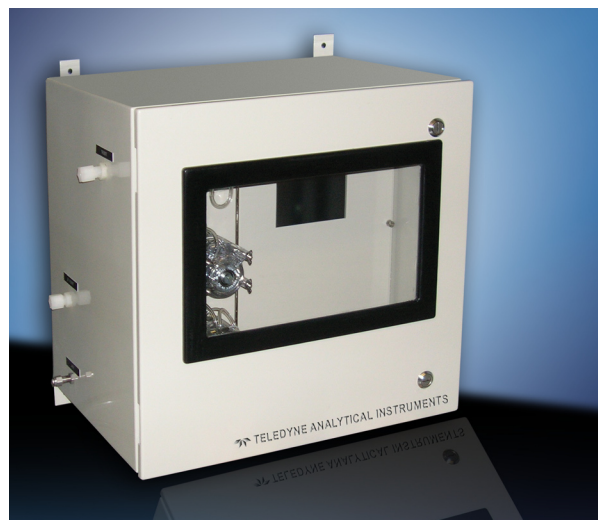
Unsurpassed NDIR detection for interference-free accuracy in the parts per billion range. Requires no pumps for minimum maintenance. Lowest MDL. Preferred for applications less than 1000 ppb TOC

Configurations

Teledyne offers custom turn-key system solutions suitable for general purpose or hazardous, outdoor environments, complete with sample systems, oxygen generators and NEMA enclosures.

General Features

- Complies with EPA, ASTM, and other standard approved methods for continuous TOC analysis
- NPOC (Non-purgeable organic carbon) analysis
- TOC-True Analysis (including volatile organics)
- Rapid response
- Onboard Microsoft Windows CE computer plus paperless chart recorder **OR** Menu driven LCD display
- Separate electronics and liquid compartments
- Low maintenance and easy access for service



SERIES 6700 Total Organic Carbon (TOC) Analyzers

Installation Requirements

- Electrical source (110 / 220 VAC 10 amp service with cutoff switch)
- Sample flow of a minimum of 10 mil / minute; a fast bypass loop is recommended
- Gravity fed drain with air break
- A source of CO₂-free air or oxygen with a maximum flow rate of 300 cc / minute at 15 psig

TOC Measurement Basics

Carbon definitions:

Total Carbon = Total Inorganic Carbon + Total Organic Carbon

Total Inorganic Carbon = (CO₂) + (H₂CO₃) + (HCO₃⁻) + (CO₃⁻²)

Total Organic Carbon = thousands of simple and complex biological and man-made compounds

Elevated TOC levels can result in biofilms, accelerated corrosion, process contamination, and toxicity exposure

Basic TOC measurement methods:

Difference method: Measure TIC → oxidize → measure TC → calculate TOC using TOC = TC - TIC (This method is prone to large errors, particularly for high TIC.)

Direct method NPOC: Remove TIC → oxidize → measure TOC directly

Operational Theory

Selecting the appropriate TOC method for an application requires a cost / performance trade-off analysis.

Does one measure...?

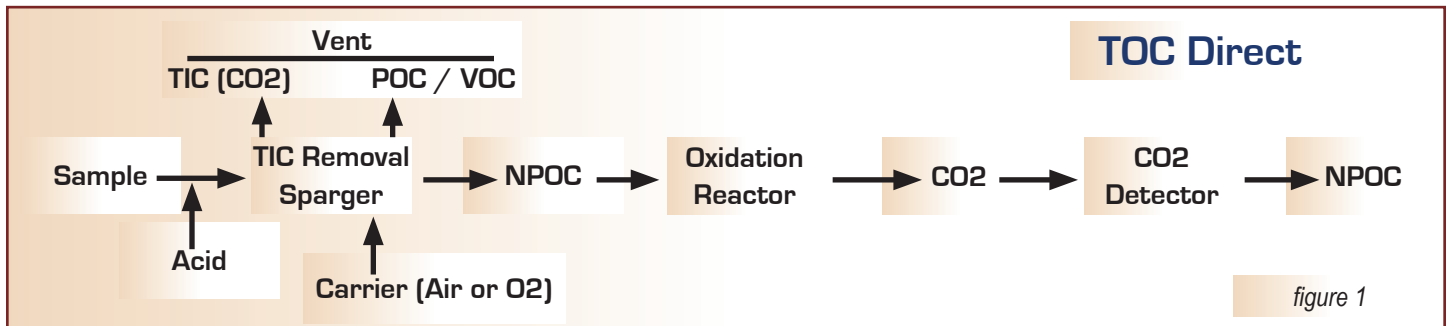
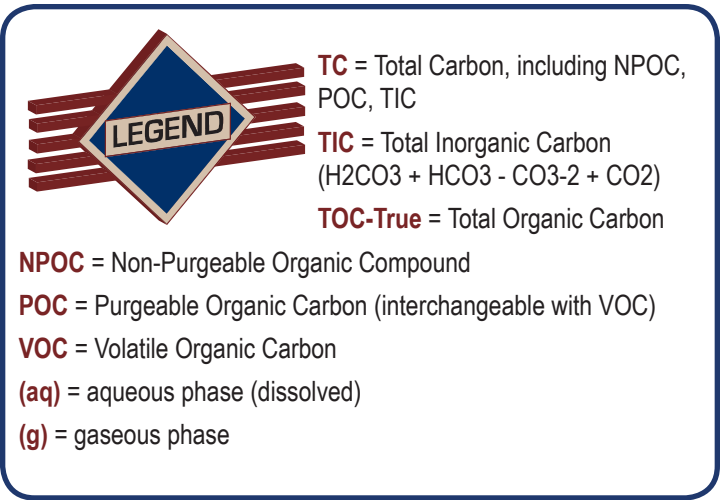
TC - which includes NPOC, POC, TIC (interference)

NPOC - which includes NPOC only and no TIC interference or detection of POC

TOC - which includes NPOC and POC, but no TIC interference

To perform correct TOC analysis, the operator must measure all constituents of organic carbon present in the sample: NPOC and POC. It must also exclude the TIC interference.

Figure 1 is a basic, commonly used technique to measure the NPOC, sometimes referred to as "TOC-Direct".

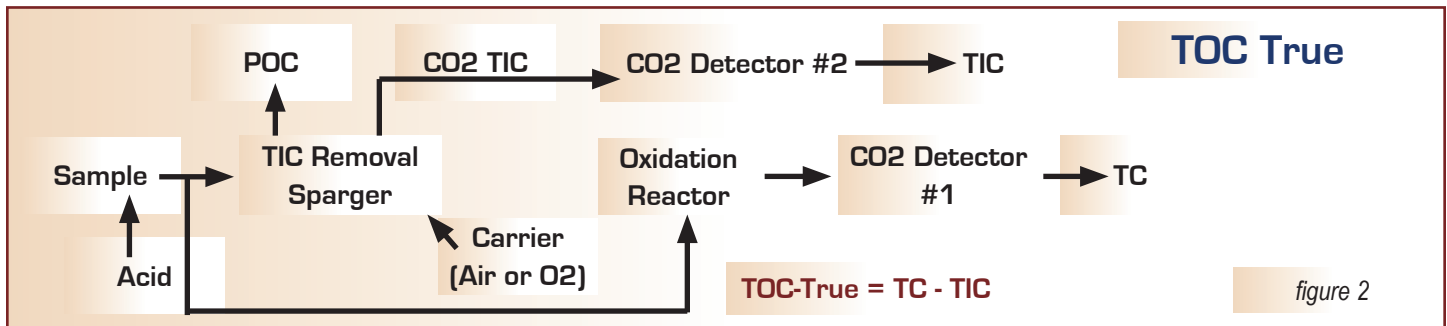


Acid is added to the sample, lowering its pH to approximately 2.0, at which point the carbonates present in the sample are converted to dissolved CO₂.

In the sparger, the carrier gas strips (sparges) the CO₂ converted from the TIC and vents it, along with any purgeable (volatile) organics, leaving only NPOC in the sample.

The resultant NPOC is then oxidized to CO₂ in the reactor and measured by the CO₂ detector as NPOC in the sample, often referred to and reported erroneously as TOC.

Figure 2 is a preferred method of performing a "TOC-True" analysis.



Subsystems

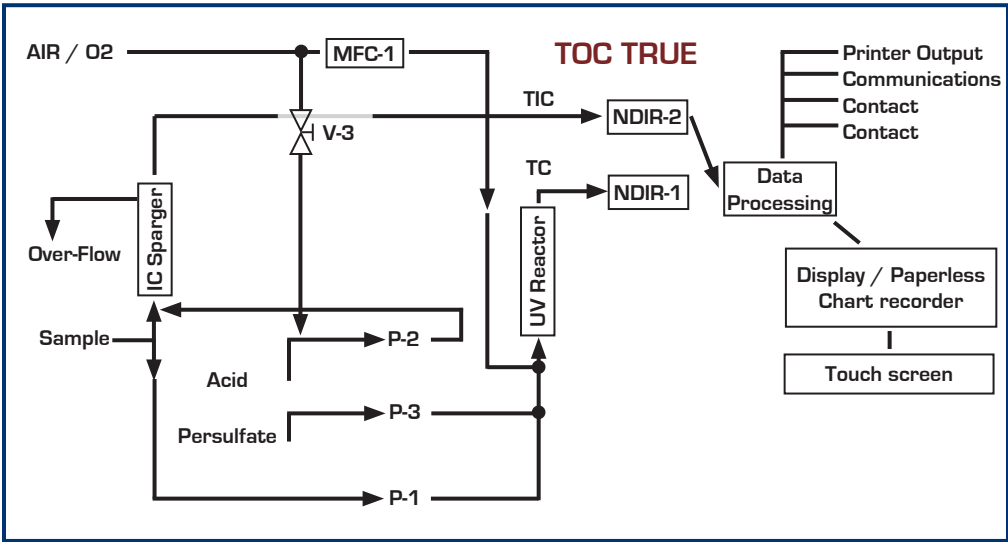
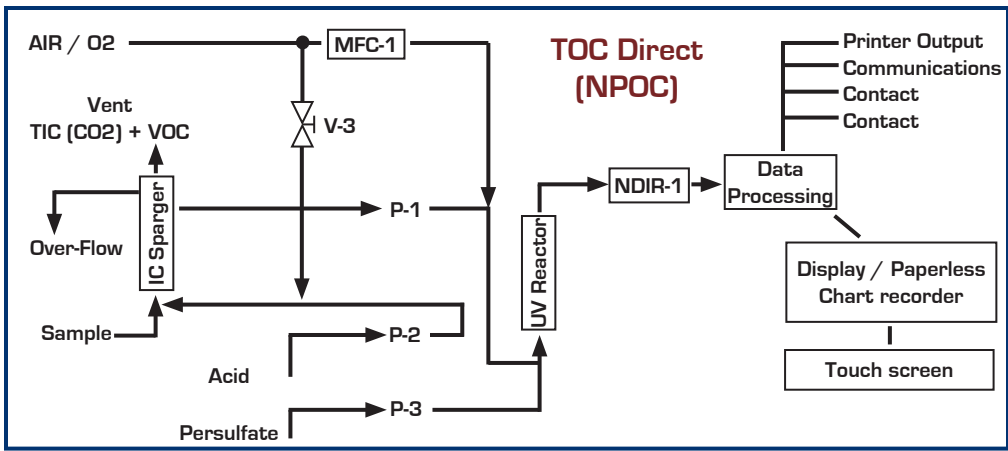
A Series 6700 TOC Analyzer is comprised of 5 subsystems:

- 1) Sample handling
- 2) Inorganic Carbon removal OR Inorganic Carbon analysis / TOC-True method
- 3) Oxidation
- 4) NDIR CO₂ gas detection
- 5) Electronic signal processing, display, and control

The sample system is designed to accept the liquid sample and any required reagents, transporting them through the analyzer to the appropriate components.

For TOC (actually, NPOC) analysis, the sample is pumped initially to the sparger, where it is mixed with acid to lower the pH between 2.0 and 3.0. At that pH, all inorganic carbon / carbonates are converted to dissolved CO₂ gas, which is sparged out of the liquid solution by the air/O₂ carrier gas.

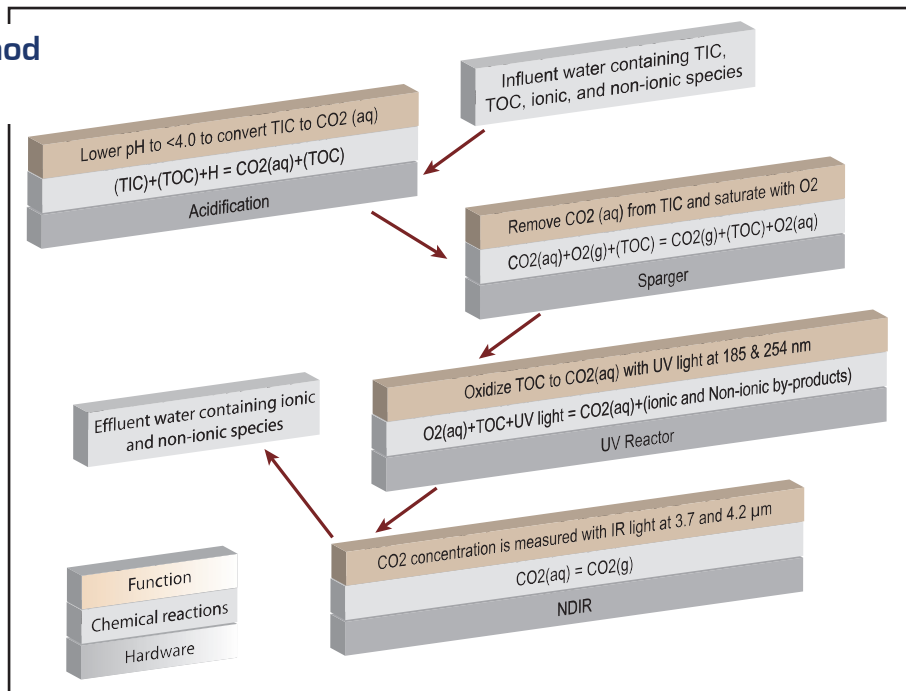
At this point, any volatile organic carbon is also sparged out and lost for inclusion in the TOC analysis, unless a TOC-True analysis is performed.



TOC Measurement Method (UV / Persulfate)

Applications

- Standard Method 5310 C/D
- EPA 415.1
- EPA 9060
- ASTM D 4839-88
- ASTM D 4779-88
- Boiler feedwater
- Cooling water
- Wastewater
- River water
- Process control



On Line Microprocessor Based Units

Standard features:

TOC Analyzer including:

- NPOC analysis
- Single stream analyzer
- Peristaltic pump sampling
- 2 TOC alarm levels
- Master fault alarm
- 4-20 mA output, TOC level (2 each)
- Single NDIR
- RS-232C
- Powder coated steel enclosure

TC analyzer including:

- NPOC analysis
- Single stream analyzer
- Peristaltic pump sampling
- 2 TOC alarm levels
- Master fault alarm
- 4-20 mA output, TOC level (2 each)
- Single NDIR
- RS-232C
- Powder coated steel enclosure

Options

Dual NDIRs

Portable Cal Gas kit including regulator

Start-up Kit: includes tubing, fittings and carboys to aid in installation and start-up

Sodium Persulfate Ultra-Pure: case of 4 (5 lbs container) sufficient for 2 months of operation

“Zero Air” Generator

“Oxygen” Generator

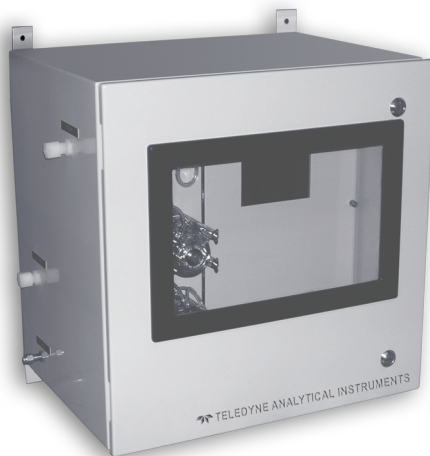
Single Line Sample Cooler

Blow-Back Sample Conditioning System

X or Z-Purge System

Mounting Rack on rollers

NEMA 4 painted steel enclosures



On Line Windows CE Based Units

Standard features:

TOC Analyzer including:

- NPOC analyzer
- Single stream analyzer
- Microsoft Windows™ CE Computer with Touch Screen VGA color display
- Solid state data storage
- Historical records digitally stored up to 1 year
- Paperless chart recorder
- PCMCIA slot
- Single NDIR
- Peristaltic pump sampling
- 2 TOC alarm levels
- Master fault alarm
- 4-20 mA output, TOC level
- RS-232C
- RS-485 outputs (2 each)
- Powder coated steel enclosure

TC analyzer including:

- NPOC analyzer
- Single stream analyzer
- Microsoft Windows™ CE Computer with Touch Screen VGA color display
- Solid state data storage
- Historical records digitally stored up to 1 year
- Paperless chart recorder
- PCMCIA slot
- Single NDIR
- Peristaltic pump sampling
- 2 TOC alarm levels
- Master fault alarm
- 4-20 mA output, TOC level
- RS-232C
- RS-485 outputs (2 each)
- Powder coated steel enclosure

Options

TOC-True Analysis configuration with dual NDIRs

BENCHMARK / AUTOCAL / AUTOCLEAN

Correlated BOD/COD

Auto Dual Range

External Range Change

Portable Cal Gas kit including regulator

Start-up Kit: includes tubing, fittings and carboys

Sodium Persulfate Ultra-Pure

“Zero Air” Generator

“Oxygen” Generator

Single Line Sample Cooler

Blow-Back Sample Conditioning System

X and Z purge systems

Dual / Three / Four / Six Stream Sequencer

Mounting Rack on rollers

NEMA 4 enclosures

SERIES 6700 TOC Analyzers

Specifications*

Range: UV / Heated Persulfate: 0-10 ppm / 0-100 ppm / 0-1000 ppm / 0-10,000 ppm
Ozone / Hydroxyl Radical: 0-10 ppm through 0-25,000 ppm without dilution
Combustion: 0-100 through 0-10,000 ppm
Ultra Pure: 0-1000 ppb through 0-10 ppm

Sensitivity: Governed by repeatability specification ($\pm 2\%$ of full scale)

Repeatability: UV / Heated Persulfate: $\pm 2\%$ of full scale or ± 10 ppb whichever is greater
Ozone / Hydroxyl Radical: $\pm 3\%$ of full scale
Combustion: $\pm 3\%$ of full scale
Ultra Pure: $\pm 3\%$ of full scale

Drift: Compensated, self-calibrated NDIR ($\pm 2\%$ non-accumulative)

Response time: UV / Heated Persulfate: From 7 minutes, application dependent
Ozone / Hydroxyl Radical: From 10 minutes, application dependent
Combustion: From 5 minutes, application dependent
Ultra Pure: From 7 minutes, application dependent

Analog output: 4-20 mA

Relay outputs: 2 TOC adjustable level alarms; 1 master fault alarm

Display / Computer: LCD, operator menu prompting (standard) OR optional Windows CE

Ambient temperature: 0-40°C

Power supply: 110 / 220 VAC 10 amp service recommended

Enclosure: Powder coated steel, IP66 / NEMA-4X

Dimensions: 20" x 20" x 15" / 50.8 x 50.8 x 38.1 cm (HxWxD)

Weight: 27.2 kg. / 60 lbs.

Options Explained

- Pumpless, reagent saver package
Eliminates monthly peristaltic pump retubing and recalibration, conserves reagents by precisely dispensing the amount required.
- Microsoft Windows™ touch screen computer
Touch screen control; VGA color display; network ready; paperless chart recorder, PCMCIA slot; solid state data storage.
- Benchmark / Auto validation
Benchmark is a European NAMUR specified validation technique whereby on command a chemical calibration standard is automatically introduced to the analyzer and the response is compared to a previous calibration. If the response falls outside specified performance limits, a Maintenance Request or Fault alarm is activate.
In cases of process spills, when the analyzer performance is questioned, benchmark can rapidly and automatically validate analyzer performance. it eliminates time consuming and unnecessary recalibration cycles, which take the analyzer out of service when it is most critically needed. Benchmark is on-demand, or operator programmed for designated day and time activation on a repetitive basis.
- Auto-calibration
On command (manual or automatic by selection of day and time), the combination of valves alternately introduce water for "zero" calibration and the "span" solution. The computer then resets the analyzer to the new calibration values.
- Auto-clean
On command (manual or automatic by selection of day and time), the combination of valves operate to introduce a "cleaning" solution, depending on the chemical constituents of the sample. Acid or Persulfate is generally used.

* specifications at 25°C $\pm 5^\circ\text{C}$

TELEDYNE ANALYTICAL INSTRUMENTS

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Warranty

Instrument is warranted for 1 year against defects in material or workmanship

NOTE: Specifications and features will vary with application. The above are established and validated during design, but are not to be construed as test criteria for every product. All specifications and features are subject to change without notice.

