

Hach astroTOC UV TURBO Process TOC Analyzer

Applications- for chemical/petrochemical and power generation condensate water

Chemical manufacturers, petrochemical plants, and electric utilities all require large volumes of clean steam to produce products and services. Feedwater polishing and steam generation are very expensive and fairly uniform processes, so many chemical/petrochemical plants have joined forces with electric utilities to share the steam generated by one boiler system. These cogeneration arrangements reduce operation costs for both facilities.

Several relationships between the generator and the partner facility may exist, but the key concern is producing clean steam for both. Specifically, the amount of TOC in the stream is most important because it can have a major negative impact on turbines, manufacturing equipment, and water polishing systems. Most chemical processes have the potential to increase TOC levels. A large increase may indicate a leak in the heat exchangers in the process stream.

To safeguard each cogeneration partner, on-line TOC analyzers are used to continuously monitor the steam after use in one facility and before it reaches turbines/equipment of the partner facility. If excess organics are present, the TOC analyzer makes the reuse/waste of the steam an automatic, objective decision.

When the TOC levels exceed the agreed limit, the partner responsible for a significant increase in TOC may face financial consequences from the other. It is in everyone's best interests to monitor outgoing and return steam to prevent costly equipment problems.

Applications- for semiconductor recycle/reclaim water, and pharmaceutical USP/EP water

The astroTOC UV TURBO is also recommended for semiconductor applications to measure TOC levels in recycle/reclaim water and pharmaceutical applications for USP/EP water for injection and purified water.

Fastest true TOC analyzer with accurate performance

The astroTOC UV TURBO is fast, yielding accurate results in five minutes. Other analyzers that measure TOC in low levels ($\mu\text{g/L}$) use differential conductivity calculating TOC by subtraction, where Total Inorganic Carbon (TIC) is subtracted from Total Carbon (TC) to give Total Organic Carbon ($\text{TC} - \text{TIC} = \text{TOC}$). This method can be inaccurate because two measurements must be made (TC and TIC). The astroTOC UV TURBO removes the TIC from the sample, so it only measures true TOC as described by ASTM, EPA, ISO, and Standard Methods.

Increased TOC concentrations do not require increased analysis time with the astroTOC UV TURBO. Unlike batch-type TOC analyzers, the astroTOC UV TURBO continuously monitors samples even when the TOC concentration is extremely high, which typically occurs during spill conditions in cogeneration applications. This prevents black-out periods of up to 60 minutes just when you need continuous TOC monitoring the most.

Sample composition and oxidation by-products do not interfere

TOC is a sum parameter that measures all organic species in the water. When using conductivity to measure TOC, it is assumed that a change in conductivity is only due to a change in TOC. Sometimes, inorganic species in the sample (NO_2^- , I_2 , HClO^-) can be converted to gases by the sample acidification and oxidation. These gases will cross the membranes used by TOC conductivity based analyzers, making the final TOC result a false positive or false negative.

Uses proven NDIR technology

Using NIST traceable gas standards, the NDIR detector is calibrated in the range of 0 to 1000 ppm. This assures the sensitivity needed for measuring TOC at low levels. The user can perform calibrations on-site and at any time, avoiding downtime and the inconvenience of sending the instrument back to the factory for calibration. The on-site calibration also avoids the risk of losing the calibration or damaging the instrument during shipment back to the customer site.

The NDIR detector used in the astroTOC UV TURBO provides an exceptionally stable platform. The zero or baseline is adjusted every time the instrument is calibrated, which increases measurement stability and avoids drift. Designed and manufactured at Hach, each NDIR detector must endure a stringent two-week stability test before it leaves the factory, ensuring that customers receive a robust, stable detector.



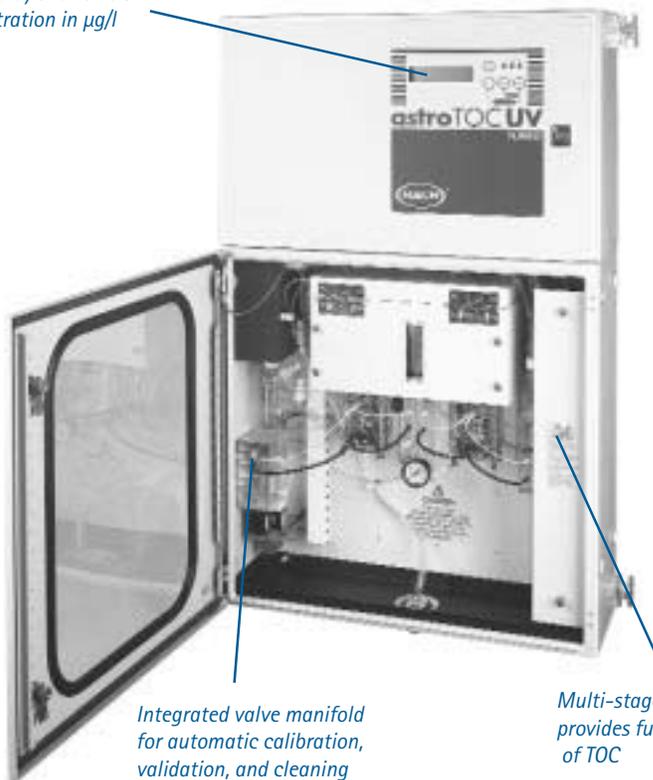
The Hach astroTOC UV TURBO Process TOC Analyzer

- Fastest true TOC analyzer with accurate performance
- Sample composition and oxidation by-products do not interfere
- Uses proven NDIR technology with supreme accuracy at low levels
- Multi-point calibration compensates for background TOC in make-up water
- Housed in spacious, robust, dual-compartment enclosure
- Advanced diagnostics and features designed for ease of use

Multi-point Calibration Compensates for Background TOC

An advanced calibration utility offers a multi-point (up to 10) calibration. The TOC-added calibration compensates for the TOC background usually found in make-up water. This type of calibration is necessary when calibrating at low levels when the unknown carbon species in the DI water is significant. The analyzer calculates the calibration curve slope and adjusts the slope so the line is forced through zero, allowing accurate low-level measurements.

LCD display shows TOC concentration in $\mu\text{g/l}$ or mg/l



Integrated valve manifold for automatic calibration, validation, and cleaning

Multi-stage UV-reactor provides full oxidation of TOC

Housed in a spacious, robust enclosure

The spacious two compartments that house the electronics and fluidics make maintenance a snap. An IP66/NEMA 4 rated enclosure enables the astroTOC UV TURBO Analyzer to withstand harsh industrial environments. The dual compartments ensure that any leaks in the fluidic system will not damage the electrical components.

Advanced diagnostics and features for ease of use

The advanced diagnostics monitor general system conditions. These include loss of sample flow, loss of carrier gas, and pump tube deterioration. Also included is a programmable process spill threshold, which protects the analyzer from fluid blockage and pollution due to over-range conditions. If the TOC exceeds a user-set level, the instrument will

go offline, perform a self-cleaning, then try to go back on-line. This prevents instrument damage while optimizing continuous monitoring as much as possible.

Many features that ease instrument use and maintenance are included with the analyzer. Mappable relays let you select from a variety of diagnostics or system functions. Auto-cleaning, auto-validation, and auto-calibration can be scheduled to occur anytime of the day or night during low-use periods. The validation is a simple single-point QA/QC check to assess system performance.

Principle of operation

The astroTOC UV TURBO Analyzer combines chemical and ultraviolet oxidation techniques in a low-temperature reactor to deliver direct TOC measurements. It uses a multi-staged UV oxidation reactor and a chemically impervious non-dispersive infrared (NDIR) CO_2 detector system, assuring full compliance with *Standard Methods* 5310 C and EPA method 415.1.

In the first analysis step, the sample is mixed with acid, converting the total inorganic carbon (TIC) into CO_2 . The TIC sparger removes all the CO_2 from the sample solution. Subsequently, the TIC-free sample is drawn at an accelerated rate, mixed with sodium persulfate and routed through the UV reactor. The residence time in the UV reactor is optimized to assure full oxidation of the TOC into CO_2 . The gas/liquid mixture is transported by the carrier gas into the gas-liquid separator (GLS), where the sample gas is separated and diverted into the NDIR detector for the direct, interference-free CO_2 measurement. The resulting CO_2 concentration measurement is directly proportional to the original TOC concentration found in the sample. The front panel displays the TOC concentration in mg/l or $\mu\text{g/l}$.

Detection method

ASTM, EN, EPA, ISO and *Standard Methods* recommend TOC analysis methods using NDIR detection. This technique provides stable, accurate measurement by detecting CO_2 gas. The detector performs CO_2 measurement and compares it against a reference measurement. The difference between the two measurements is equal to the concentration of CO_2 present in the cell. The NDIR measurement rays in the astroTOC UV TURBO Analyzer follow a direct path to a concave mirror and a bundled path back to the receiver. This avoids the inherent drawbacks of the wall-bounce path, including loss of sensitivity and inaccurate measurement due to the interference of dust particles or water droplets on the NDIR cell wall.

Hach astroTOC UV TURBO TOC Analyzer Specifications*

Range

0–2000 µg/l (0–2.000 mg/l), 0–5000 µg/l (0–5.000 mg/l),
0–10,000 µg/l (0–10.000 mg/l), 0–25,000 µg/l
(0–25.000 mg/l), 0–50,000 µg/l (0–50.000 mg/l)

Accuracy/Repeatability/Linearity

≤ ± 4 % of reading or 8 µg/l (whichever is greater)
at 25° C (77° F)**

**Performance specifications established with range
configuration 0–5000 µg/l (0–5 mg/l)

Minimum Detection Limit

≤ 5 µg/l for range 0–5000 µg/l at 25° C (77° F)***

***MDL established per EPA Appendix B to part 136

Response Time

T90 ≤ 5 minutes

T20 ≤ 3 minutes

(includes TIC sparging)

Inlet Pressure

0.15–6 bar (2–87 psig)

Flow Rate

25–200 ml/minute

Sample Temperature Range

2° C to 70° C (36° F to 158° F)

Extended Inlet temperature

2–100° C (212° F) with a 3000 mm (120 in) long, 6 mm
(1/4 in) O.D. stainless steel sample inlet tube at a flow
rate of 25–60 ml/minute.

Operating Temperature Range

5° C to 40° C (41° F to 104° F)

Recorder Outputs

Two 4–20 mA analog outputs selectable for sample
concentration, analyzer system warning or auto range
indication

Alarms

Five relays selectable for sample concentration alarm,
analyzer system warning or analyzer system shutdown
alarm. Each is equipped with an SPDT relay with contacts
rated for 3A resistive load at 250 VAC or 0.5A at 30V.

Optional Serial Communication

One multi-function RS232 or RS485 serial port
(ModBUS, CSV)

Power

115/230 VAC 50/60 Hz (switch selectable)

300 VA maximum

Sample Inlet/Outlet Connection

1/4-inch OD tube, compression fitting

Samples

Single stream, fast loop inlet (optional: Dual-stream)

Drain Connection

1 1/2-inch OD standard drain pipe

Drain pressure

ambient

Carrier Gas

1/8-inch OD tube, compression fitting
Clean, CO₂-free air or Nitrogen at 2.8–6.2 bar
(40–90 psig)

Compliance/Certification

CE certified, listed to UL and CSA safety standards by ETL
Standard Methods 5310 C, EPA 415.1

Enclosure

Cold Rolled Steel epoxy powder coated, IP66/NEMA 4
Optional Stainless Steel, IP66/NEMA 4

Dimensions

Approximately 981 mm (38.6 inches) tall,
675 mm (26.6 inches) wide, 220 mm (8.7 inches) deep

Mounting

Wall mount

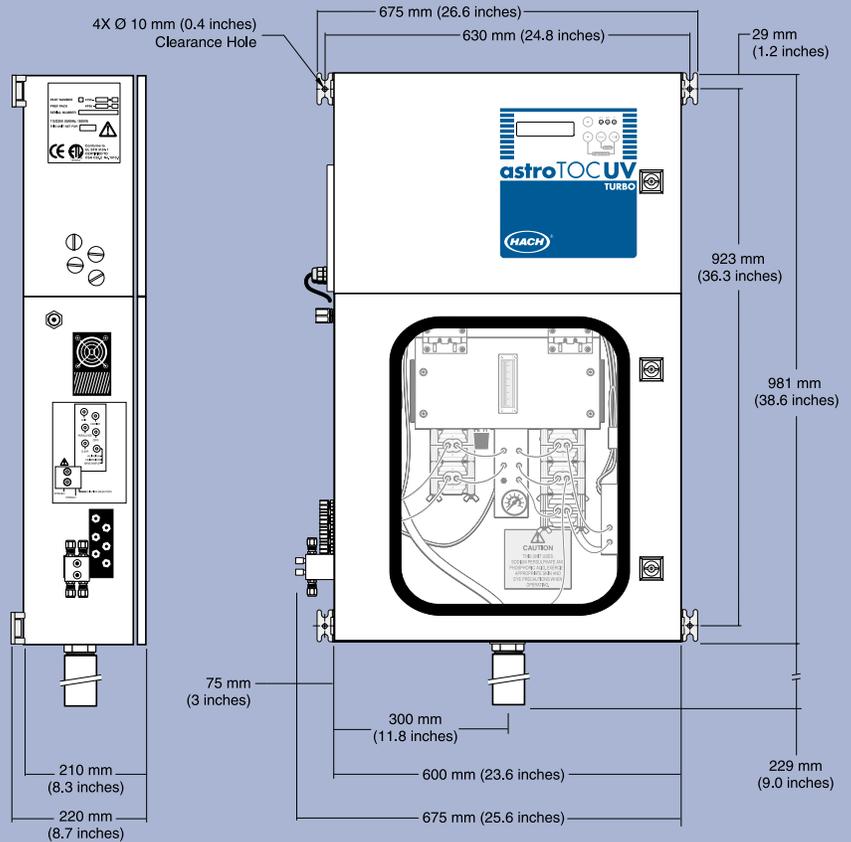
Shipping Weight

120 lbs. (54 kg)

*Subject to change without notice.

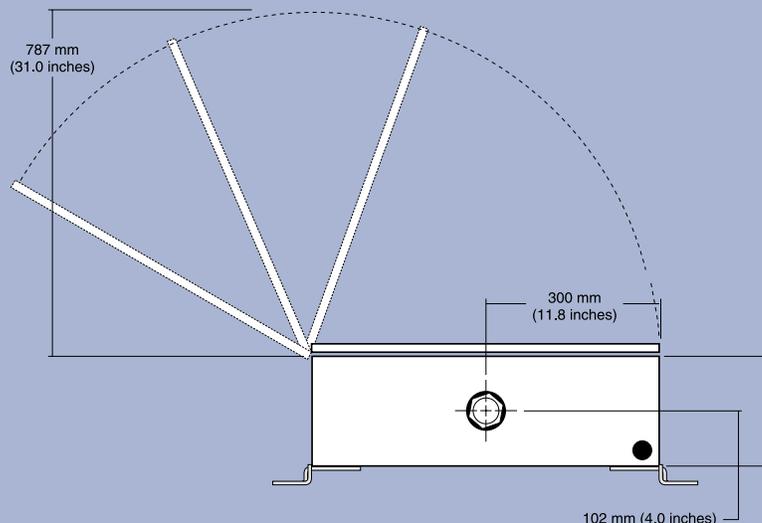
Installation

The Hach astroTOC UV TURBO Analyzer is designed to be wall-mounted easily with four 10 mm (3/8-inch) screws. Adequate clearance must be left at the sides and bottom of the enclosure for plumbing and electrical connections. The sample inlet connection is 6 mm (1/4-inch) OD tube compression fitting and the drain connection is 1 1/2-inch OD standard drain pipe. Electrical connections are inside the instrument. Four thru-holes for 1/2-inch utility conduit fittings or four PG13.5 strain relief fittings are provided.



SIDE VIEW

FRONT VIEW



BOTTOM VIEW

How to Order

Hach astroTOC UV TURBO Analyzers are shipped with a start-up kit and a manual. An analyzer and a preference package part number must be selected.

Analyzers

H -4195-1002	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 2000 µg/l Range, 2 UV Lamps
H -4195-1002-USP	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 2 mg/l Range, 2 UV Lamps
H -4195-1005	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 5000 µg/l Range, 2 UV Lamps
H -4195-1005-USP	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 5 mg/l Range, 2 UV Lamps
H -4195-1006	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 10000 µg/l Range, 2 UV Lamps
H -4195-1007	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 25000 µg/l Range, 2 UV Lamps
H -4195-1008	HACH astroTOC UV TURBO, Cold Rolled Steel, 0 - 50000 µg/l Range, 2 UV Lamps
H -4195-3002	HACH astroTOC UV TURBO, Stainless Steel, 0 - 2000 µg/l Range, 2 UV Lamps
H -4195-3002-USP	HACH astroTOC UV TURBO, Stainless Steel, 0 - 2 mg/l Range, 2 UV Lamps
H -4195-3005	HACH astroTOC UV TURBO, Stainless Steel, 0 - 5000 µg/l Range, 2 UV Lamps
H -4195-3005-USP	HACH astroTOC UV TURBO, Stainless Steel, 0 - 5 mg/l Range, 2 UV Lamps
H -4195-3006	HACH astroTOC UV TURBO, Stainless Steel, 0 - 10000 µg/l Range, 2 UV Lamps
H -4195-3007	HACH astroTOC UV TURBO, Stainless Steel, 0 - 25000 µg/l Range, 2 UV Lamps
H -4195-3008	HACH astroTOC UV TURBO, Stainless Steel, 0 - 50000 µg/l Range, 2 UV Lamps

Preference Packages

115V	230V	
4P95-1000-00	4P95-2000-00	Cold Rolled Steel (no charge)
4P95-1001-00	4P95-2001-00	Cold Rolled Steel, Level Detection Kit
4P95-1010-00	4P95-2010-00	Cold Rolled Steel, Additional UV Lamp
4P95-1011-00	4P95-2011-00	Cold Rolled Steel, Additional UV Lamp/Level Detection Kit
4P95-1100-00	4P95-2100-00	Cold Rolled Steel, View Window
4P95-1101-00	4P95-2101-00	Cold Rolled Steel, View Window/Level Detection Kit
4P95-1110-00	4P95-2110-00	Cold Rolled Steel, View Window/Additional UV Lamp
4P95-1111-00	4P95-2111-00	Cold Rolled Steel, View Window/Additional UV Lamp/Level Detection Kit
4P95-1300-00	4P95-2300-00	Stainless Steel, View Window (no charge)
4P95-1301-00	4P95-2301-00	Stainless Steel, View Window/Level Detection Kit
4P95-1310-00	4P95-2310-00	Stainless Steel, View Window/Additional UV Lamp
4P95-1311-00	4P95-2311-00	Stainless Steel, View Window/Additional UV Lamp/Level Detection Kit

Accessories

120161	Free-standing Rack Assembly
200123	astroTOC UV, 1 Yr. Spare Parts Kit
200124	astroTOC UV, Yr. Spare Parts Kit
4300-0001	AAS 300 CO ₂ , Air Purifier with Electronic Timer for use with Compressed Air, 115V
4300-0002	AAS 300 CO ₂ , Air Purifier with Electronic Timer for use with Compressed Air, 230V
4300-0003	AAS 300 CO ₂ , Air Purifier with Pneumatic Timer for use with Compressed Air
200144	Sample Cooler Kit, TOC analyzers (for temperatures up to 100° C)

Typical Proposal Specification

The TOC analyzer shall employ UV/Persulfate oxidation utilizing a multi-staged UV-Reactor coupled with a NDIR CO₂ detection system to measure TOC in ≤ 5 minutes (T90).

In addition, the analyzer shall consist of the following:

- Dual enclosures with analytical/electrical separation
- Two UV Lamps in the Multi-staged UV reactor
- Pass/fail USP compliance suitability test routine
- Epoxy powder-coated cold rolled steel enclosure rated IP66/NEMA 4
- Compliance with Standard Methods 5310 C and EPA Method 415.1
- Grab sample and validation utilities for unknown sample or reference standard measurement
- User programmable auto calibration, auto validation, and auto cleaning
- Loss of sample flow and reactor feed detection
- Hinged pump assembly module
- Two 4-20 mA parameter mapped analog outputs
- User programmable auto ranging over four ranges
- Five-volt, free function mapped relay outputs
- One optional RS232 or RS485 serial communication output (ModBUS, CSV)
- CE certified, listed to UL & CSA Safety Standards by ETL

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

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