

A close-up, high-angle photograph of a waterfall. The water is cascading down dark, wet rocks, creating a dynamic scene with splashing and bubbles. The lighting is bright, highlighting the texture of the water and the wet surfaces of the rocks.

TRL-onlineTOC MONITOR

Suspended solids is not a problem even without filtration:

Filtration of the sample process line is not required. This is achieved by using peristaltic pumps in the liquid flow pattern. Peristaltic pump is capable of handling even sludges and fluids carrying concentrated suspended solids, composing of even large particles up to 1200um in diameter.

Unique furnace design for repeatability, accuracy and extended catalyst service life:

Furnace is based on patented two zone design. First zone is operating at relatively higher temperatures between 600-1000°C, nominally at 900°C. This assures all carbon including particulate carbon to burn completely with no touch yet with the catalyst which is in the second zone operating at relatively lower temperatures, like 400-600°C assuring full functionality of the catalyst and achieving extended service life.

Low-cost yet high-performance catalyst:

The catalyst is developed in our own research facilities, lasts minimum 1500-2000 runs; because of relatively lower operating temperature and no direct contact with the sample but rather vapors and gas coming from the high temperature zone.

Unique sample dosing apparatus:

Dosing of the sample volume is achieved by the unique, very sensitive levelling apparatus in the system. This assures repeatable sampling all times during continuous monitoring.

Flexible configurations according to user needs:

TC and TOC measurements are standard in all configurations. The user makes a choice to monitor either TC or TOC, in this case.

TC, TOC, IC configuration allows the user to choose to monitor either TC only or simultaneous TOC and IC in the same run.

TN function is an adder on top of both configuration, that allow simultaneous measurement of TC+TN or TOC+TN or TOC+IC+TN in the same run.



No dilution up to 5.000ppm carbon:

Dilution of the sample is not required for the configurations up to 5.000ppm TC/TOC. Direct injection of the sample from the



process streamline to the TRL-onlineTOC monitor is achieved by the built-in sampling pump.

For higher ranges above 5.000ppm carbon, dilution function is achieved via built-in peristaltic pumps and additionally with a very unique dosing system within the monitor enclosure.

Validation of monitoring at user-set run-intervals:

Allocation for a validation sample is provided within the equipment enclosure. The user may set a frequency of validation of the unit, for example, once every 50 sample runs or other. Then TRL-onlineTOC runs the validation sample and observes if the defined/given concentration is measured or not; if validated then continue otherwise log the result, send a warning message through digital output.



Digital output is standard:

A digital output through RS232 port is readily available that carries measurement results, error and warning messages as well as messages for the measurements and over -and under-alarm settings.

Analog outputs:

4-20mA analog signals for measurement results as well as range identification are available.

Alarm relays:

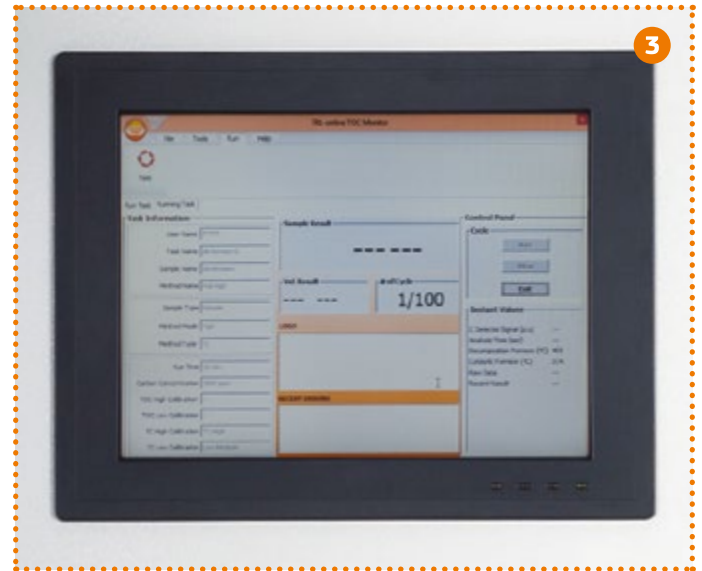
The user can set alarm limits, based on which over-limit message for the results above upper limit and under-limit message for the results below lower limit are generated and are available as relay contacts.

Intelligent software and user interface:

Software allows smooth operation as well as flexible analysis cycle management.

- > Auto range adjustment: As accuracy of measurement is based on setting a measuring range of the monitor, the user, even though sets a measuring range to initialize monitor, does not need to worry about setting a proper range; TRL-onlineTOC takes care of setting a proper measuring range for best accuracy, even if it was set wrongly by the user it resets based on the result it generates from the first measurement
- > Auto mode shift: TRL-onlineTOC operates based on its own and unique mode concept, that is related to the range of analyte (carbon) content of the sample. The user, sets a mode, either "low" or "high", to initialize the monitor, however does not need to worry about setting the correct mode; TRL-onlineTOC takes care of shifting to the proper mode for best repeatability even if it was set wrongly by the user it resets based on the result it generates from the first measurement
- > A USB port is available and pre-configured for transferring of the logged data and messages to the memory stick provided by the monitor
- > Touch screen keyboard-monitor in the enclosure is available for user settings. User profiles and authorities are set as to describe functions allowed for every user level. Administrator is the manager of the system
- > Sampling and monitoring frequency, parameter to be monitored, user definition and sample definition are set through the touch screen keyboard

- > Calibration files are developed through the touch screen, saved and called as necessary by the user, authorized to make calibration files as well as calibration of the monitor
- > As many calibration files as the user likes is saved in the memory to call/define for a specific type of monitoring, as needed
- > Unlimited measurement and log results are saved in the hard disk of the monitors built-in computer



Online TOC Applications and TRL-onlineTOC Configurations

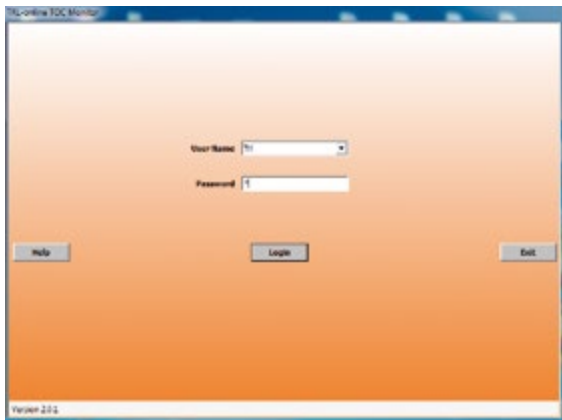
TRL-TOC is designed to be used in various applications. For each applications different configurations and specifications are available.

- > Industrial process water(requiring medium range of TOC, TC and IC up to 5.000ppm)
 - To control and monitor different processes where water is used for heating or cooling
 - To quantify and qualify efficiency of different production units
- > Industrial and municipal waste water (requiring high measuring range of TC, TOC, IC and TN up to 50.000ppm carbon)
 - To control wastewater treatment operation
 - To prevent contamination of the environment and meet effluent permits
 - To control wastewater treatment operation
- > Tap water-Drinking water(requiring very low measuring range for TC, TOC, IC and TN up to 50ppm)
 - To assure public health and hygiene
 - To control drinking water treatment plant's performance
 - To control DI water quality in pharmaceutical industry

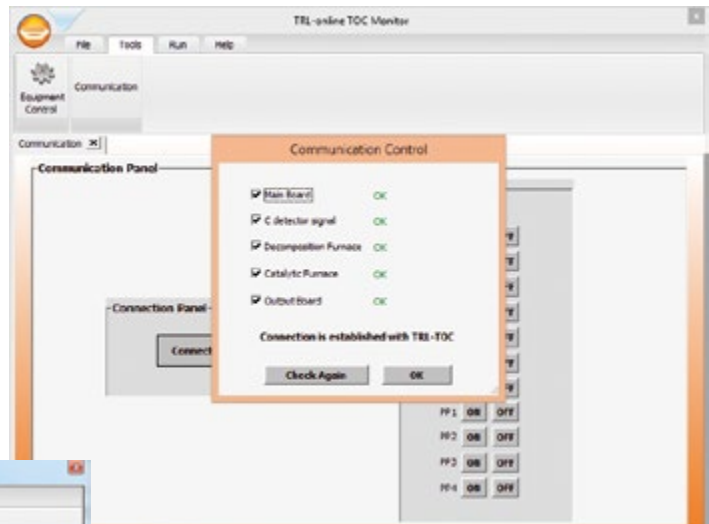
Software functions

The user interface of TRL-onlineTOC is a dedicated software with its icons, messages and display characteristics. The operator can run diagnostic functions as well as introduce sample, method, calibration and task descriptions.

It is very user friendly and functional in a way as to allow user hierarchies, limitless calibration point and calibration files, results, error and prompt messages, event logs storage

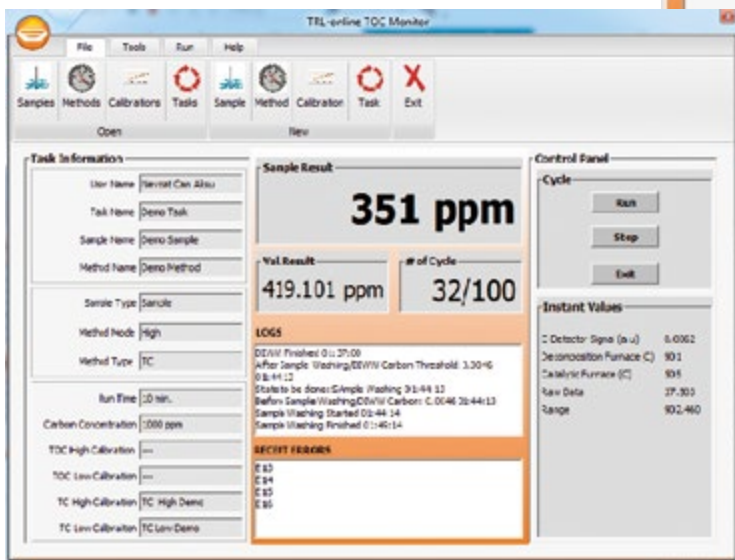


Login page asks for user name and password to authorize login or reject. Authorization should already have been given by the administrator.

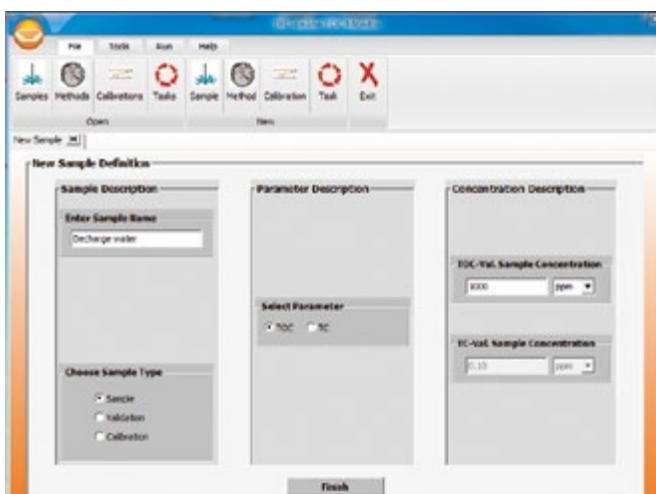


As soon as TRL-onlineTOC is turned on an automatic diagnostic cycle runs through checking all essential components of the monitor, if they are communicating with the software. This control cycle can be checked manually whenever the operator wishes to do.

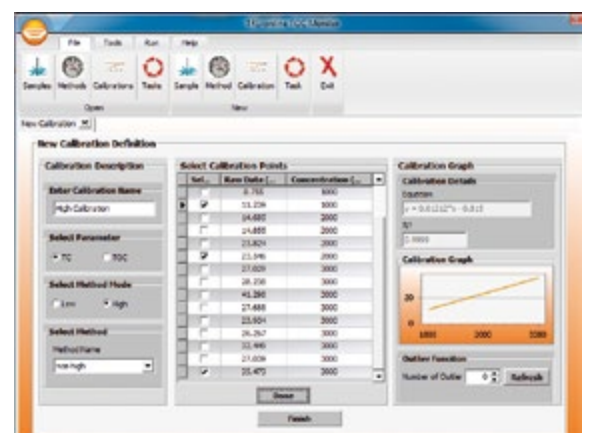
As TRL-onlineTOC is a mechatronic equipment, there are quite a number of valves, motors running in a sequence managed by the firm and the software. Any one of these components can be initiated manually through the "equipment control" menu by the operator, as he needs to see if there is something wrong with any one of the individual functions. This helps in quick maintenance of the equipment.



Task information page is the display in default operation. Recent results, concentration of validation standard, cycle number, sample-method definitions, instant values of furnace temperature, detector signal, range and current step within the running task are shown.



It is possible to register a sample definition along with the required analysis parameter to monitor, like TC or TOC or IC. In this page, just before start running the monitoring task, the operator is supposed to describe the concentration of the validation standard that is placed in its position and to be used in case of validation requirement either by once every that many cycles or any inconsistency that TRL-onlineTOC recognizes by its intelligence.



All are intelligently brought into attention of the operator so that he can not disregard any one of the fields, to be filled in.

Specifications

Analysis method	High temperature combustion
Measured parameters	TC and TOC standard; IC and TN optional
Furnace design	Patented two zone furnace system to assure complete combustion of all organic carbon and nitrogen in the sample including in the particulates; one operating at 600-1000°C(adjustable) and the next at 400-600°C(adjustable)
Range	From 0-5 up to 0-5,000mg/L TOC, automatically adjusted, without dilution; optional range up to 0-50,000mg/L TOC, automatically adjusted, with auto-dilution; optional 0-50mg/L range only; for drinking and pharmaceutical water
Accuracy (with one outlier)	± 5 % of range at ranges less than 1000mg/L ± 2 % of reading at ranges over 1000mg/L
Repeatability (with one outlier)	± 5 % of range at ranges less than 1000mg/L ± 2 % of reading at ranges over 1000mg/L
Minimum detection limit	< 0.25mg/L for 0-5mg/L TC/TOC range; < 0.05mg/L for 0-5mg/L only configuration
Suspended solids	Up to 1200um diameter particles are flowing through the tubing without blokage; magnetic stirring in the sparger is standard
Sample and liquid delivery	6 peristaltic pumps; common for acid, sample, DI water(1 pump); waste(2 pumps), internal delivery(3 pumps)
Response time	≤ 8 minutes for 5,000 mg/L range configuration
Analysis cycle time	Depends on wash cycle numbers; nominally 20 minutes
Sample inlet pressure	Atmospheric to 1 barg
Air flow rate	Nominally 200mL/min, adjustable
Sample temperature range	5°C to 45°C
Operating temperature range	5°C to 40°C
Analog outputs	4-20mA analog TC/TOC concentration output along with 4-20mA analog range identification output in TC/TOC standad configuration; separate 4-20mA outputs for IC and TN in IC and TN options
Digital outputs	Date(dd/mm/yy), Time(hh/mm), Sample type: calibration standard/validation sample/line sample, Mode (TC or TOC in standard configuration; IC and TN optional), Concentration, Status: normal/ warning, error message and stand-by, Under-limit or Over-limit message
Relay contacts	Over-upper and below-lower limit alarms as relay contacts
Software functions	System diagnostics, data storage, calibration function and calibration file storage; auto-ranging; validation once every user-settable run cycles; design of an analytical cycles as to include as many DI wash and sample wash runs as required; maintenance cycle management and warning of replacement parts based on run cycles; automated validation run in case of unexpected results; generation of warning messages
Safety and Reliability	Continuous control of sample, acid and DI water flows, liquid leakage, furnaces temperature, air flowrate and air leakage
Lighting on the front panel	Green light: system is running and everthing is well in order Yellow light: there is something to deal with, however running properly Red light: there is something wrong and system is at standby
Auto-stand-by	In case of following conditions, the system is down and taken into stand-by: Acid bottle empty Sample-acid-DI water leakage Air leakage Furnace temperature failure Power up after power cut off
Power	115/230 VAC 50/60 Hz (switch selectable); 1600VA
Connections	1/8" Swagelock sample in, DI water in, Acid in, 1/8" swagelock compressed air in, ¼" quick-fit Drain out, 1/8" Swagelock Gas vent standard; Optional according to user specifications
Carrier Gas	Hydrocarbon and CO2 free air at 2-6 bar, al nomintotal consumption 800mL/min, adjustable
Standard methods	5310B, EPA 415.1
Enclosure	NEMA 4, wall mount; optional 19" rack mount
Dimensions	145cm tall, 60cm wide, 45cm deep wall mount standard
Weight	110 kg
Configurations	User selectable, either TC or TOC, standard Simultaneous TC, IC and TOC Simultaneous TC, IC, TOC and TN
Multi-point monitoring	Optional manifold is available for multi-point sampling

As we are continuously improving the performance of our equipment, specifications are subject to change without notice.

We:

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processes and equipment, for:

research
production
analysis

in the field of:

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