



Online TOC-Analyzer Model 800

The TOC-800 represents the newest generation of LFE's on-line TOC-analyzers. These have both proven themselves with considerable success in use at many chemical plants as well as other important industrial companies since the beginning of the '80s.

The LFE TOC-800 has evolved out of real-world applications as an on-line analyzer for the continuous TOC registration of highly- as well as low contaminated water. The demands placed on every component of such an on-line TOC-analyzer require special design solutions.

Features

- **continuous analysis with high carbon conversion level (at up to 1100°C)**
Only the high-temperature combustion method guarantees the nearly complete conversion of all organic carbon-compounds for the subsequent CO₂-analysis.
- **extraordinarily stable measuring qualities**
High demands are placed on the stability of the system-components. For this reason, LFE developed a low-maintenance, high-precision metering pump for its on-line TOC-analyzers.
LFE's modified version of the BINOS® NDIR-photometer system is ideally suited because of its excellent long-term stability and flexibility.
- **outstanding reactor service-life**
The dimensioning of the analytical parameters allows maximum possible reactor service-life in combination with the fastest possible response time.
- **special detailed solutions**
The wetted components of the TOC-800 are composed of corrosion-resistant materials such as aluminum-oxide, glass and PTFE/PVDF.
The IR-photometer is fitted with an analysis cell specially developed by LFE. This cell is constructed out of glass with specially bonded sapphire windows. The extreme long-term stability of the NDIR-photometer is further enhanced by a unique gain controller.
- **increased reliability**
Increased long term reliability is obtained through the enclosure of all electronic components, protecting them from adverse environments.
Separate cabinets for the analytical and the electronic components: The upper cabinet containing the NDIR-photometer as well as the majority of electrical components is purgable.
- **improved handling**
Maintenance and servicing of the instrument is facilitated through even better accessibility and handling.
- **intuitive User-Interface**
The TOC-800 is amazingly simple to operate despite its inherent complexity. The intuitive operation of the instrument is supported by a user-interface structure recommended by the NAMUR¹ commission.
- **automatic self-monitoring**
A wide range of system functions are continuously monitored. The intelligent self-monitoring places system failures into either of two categories: "maintenance required" or "instrument fault". The system status is available as floating relay-contacts and is displayed on the LC-display in plain text for easy diagnosis.



- **signal & status read-out**

The TOC-800 provides 4 individually-configurable, isolated 0(4)-20mA analog outputs. The available ranges (depending on instrument configuration) or even peripheral system values (e.g. reactor pressure) can be distributed over the 4 outputs.

In addition various status signals are available via the digital interface.

The instrument status, among other things can be read out using the 3 floating contacts provided for this purpose. The contacts provide the following general information (according to NAMUR recommendation):
Instrument fault / Maintenance required / Maintenance

Options



- **Acidifier/ Sparger/ Multiplexer-unit** (ASM-unit; wall mounted)
The basic TOC-800 instrument functions as a TC-analyzer.
The ASM-unit facilitates the removal of inorganically bound carbon (TIC).

This unit can be equipped with further options:

- automatic calibration for 3 test solutions
(1x zero level + 2x span solutions)
- Multiplex capability (3 sample streams)
- Dilution stage (max. dilution factor: 6)
- **simultaneous, selective VOC- or TIC- analysis** (see below)
in conjunction with 2nd NDIR measuring channel and the Acidifier/ Sparger/ Multiplexer-unit
- **RS-232 serial interface**
- **built-in line recorder or data logger**

VOC Analysis Package (optional)

Background

Aside from the intentional removal of inorganically bound carbon (TIC) the sparger air can also inadvertently expel volatile organic carbon (VOC) compounds which escape detection.

The TOC-800 can be fitted with an optional package in conjunction with a 2nd photometer channel which **simultaneously and continuously** measures the VOC-level independent of the TOC- (or DOC-) analysis.

Functional Principle

The potentially VOC enriched sparger air is split into two parallel gas streams each containing a CO₂ background level representative of the TIC level of the water sample as well as possible VOC.

- The 1st gas stream is passed unaltered through the reference cell of the differential CO₂-photometer channel.
- The 2nd gas stream is passed through a catalytic converter stage in which any VOC is oxidized to CO₂ and added to the background CO₂ level. This stream is sent to the sample side of the differential CO₂ photometer.

The difference in IR radiation absorption in the photometer channel corresponds to the VOC concentration of the water sample.

The inherent response of a differential NDIR photometer to varying background levels is dynamically corrected for by the implementation of **LFE's patented gain stabilization / common mode rejection algorithm**. This is made possible by the use of a specially modified BINOS[®] photometer system (Emerson Process). First introduced by LFE in 1989, this unique method **totally eliminates** the need for a CO₂ scrubber. The resultant maintenance requirements for the VOC analysis are minimal.

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Technical Data

General technical data

TOC-Analyzer (main instrument cabinet)			
Cabinet:	2-section 19" cabinet on lockable rollers; active ventilation via filtered fans, electronics section purgeable		
Dimensions:	height: 168 cm width: 65 cm depth: 65 cm		
Power consumption:	230 VAC/ 50 Hz continuous operation: 550 VA (Warm-up phase: 900 VA)		
Acidifier / Sparger / Multiplexer unit (option)			
Construction:	Components on polypropylene panel for wall mounting		
		Basic unit	Extended unit
Dimensions:	(height x width)	500 x 500mm	500 x 665mm
Components: (available options)	acidifier-/sparger stage	•	•
	automatic calibration	•	•
	stream multiplex	•	•
	supplemental peristaltic bypass feed pumps		•
Power consumption:	low voltage (24V) supplied by main instrument		
Miscellaneous:	Connecting cable set	Distance between TOC-800 and acidifier-/sparger unit	
	standard 2.5 meters	approx. 2 meters	
	optional: 5 meters (max.)	approx. 4.5 meters (max.)	

Inputs and outputs

Read-out:	LC-display (40 characters x 16 lines) and user interface based on NAMUR recommendation Language switchable between English and German
Analog signal output:	4x current outputs 0 (4) - 20 mA $R_{Load} = 600\Omega$ max. all outputs isolated and individually configurable <ul style="list-style-type: none"> • 0-20 mA or 4-20mA • 4-20mA with superimposed instrument status • Test signal levels
Digital inputs:	8 configurable inputs (6 – 24VDC; 10mA max.) Sample stream selection, calibration solution selection, initiation and cancellation of AutoCal
Digital outputs:	12 configurable outputs (relay contacts 28V max.; 350mA max.) Instrument status, feedback as to sample stream, calibration solution and AutoCal etc.
Instrument Status:	Plain text description on the LC-display as well as categorization into one of the following states (NAMUR recommendation): INSTRUMENT FAULT, MAINTENANCE REQUIRED, MAINTENANCE

Analytical-/Operational data

Measured quantity:	Basic instrument:	TC
	with optional sparger-unit:	TOC or DOC & VOC (option)
Measurement principle:	DOC measurement principle	VOC measurement principle (option)
	High temperature combustion (typically 950°C; adjustable up to 1100°C) of water sample with subsequent photometric CO ₂ analysis in the dried reactor exhaust (Peltier sample-gas cooler). Possible ranges ² (DOC-channel): lowest range : 0 - 5 [mg C/l] (lower ranges on request) highest range : 0 - 5000 [mg C/l]	Sparger air analyzed for volatile organic carbon components utilizing catalytic conversion with subsequent photometric CO ₂ analysis in a dedicated channel. The differential operation of this channel alleviates the need for a CO ₂ -scrubber. Possible ranges ² (VOC-channel): lowest range : 0 - 10 [mg VOC/l] highest range : 0 - 300 [mg VOC/l]
Response : Time (τ_{90}) ²	typically 5 min (continuous measurement)	typically 2 min (continuous measurement)
Precision:	$\leq \pm 1\%$ of FSO (full scale output)	$\leq \pm 1\%$ of FSO (full scale output)
Accuracy:	$\leq \pm 1\%$ of FSO	$\leq \pm 2.5\%$ of FSO

Specifications subject to change without notice

¹ **NAMUR**: Standardization commission for measuring and control technology in the chemical industry (sub-committee for operability of microprocessor-controlled process analytical- instrumentation)

² dependant on instrument configuration; range specifications using standard instrument parameters; without optional sample dilution