Waltron AQUALERT® Division

Water Chemistry Measurement & Control

Quantichem® 3001C TOC Analyzer

Instruction Manual

Manual Version 1.05

WALTRON CUSTOMER COMMITMENT

This instruction manual is a technical guide to aid the customer in the set-up and maintenance of their new Waltron measuring system. Waltron provides continuous product improvement and reserves the right to make any modifications to the information contained herein without notice.

Technical questions concerning this product should be addressed to:

Waltron Technical Service Department

Phone: +31 77 2082955 **Fax**: +31 77 2082956

www.waltron.net

Please be ready to provide the following information:

- Date analyzer was purchased.
- Analyzer model and serial number.
- Recent maintenance history.
- Calibration slope values and detailed description of problem.

Waltron's technical expertise and extensive experience provides personalized solutions to the water quality industry. It is Waltron's commitment to provide the customer with timely and accurate technical service and support.

Waltron fully expects the customer to be satisfied with the quality, performance, and cost of this product. If there are any questions or concerns regarding this product, please feel free to contact Waltron.

Thank you for choosing Waltron!

Please note Waltron mailing and shipping addresses:

DIRECT ALL CORRESPONDENCE TO:

Waltron LLC
P.O. Box 70, 50 Tannery Rd.
Whitehouse, NJ 08888
US

Waltron BV
Industrieterrein 40F
5981 NK Panningen
The Netherlands

Safety:

Please observe proper safety and handling precautions when installing, operating, maintaining, and servicing this product. The following should be noted and adhered to:

- √ Read and understand manual before working with analyzer.
- √ Pay special attention to warning labels on enclosures, containers, packages and chemicals.
- √ Only qualified personnel should be involved in the installation, operation, and servicing of the analyzer.
- √ Follow safety precautions when operating analyzer in conditions of high pressure and/or temperature.
- √ Keep analyzer chemicals away from heat and extreme temperatures. Reagent powders must be kept dry.
- √ Follow all regulations and warning labels when disposing of chemicals. Do not mix chemicals.

*To obtain analyzer safety information or **Material Safety Data Sheets (MSDS)**, please contact Waltron or logon to www.waltron.net .*

Warranty Agreement

If, within one year from the date of shipment, the customer experiences any equipment defects or is not satisfied with the analyzer manufacturing, Waltron will repair, or at its option, replace any defective part(s) free of charge. This warranty requires that the defective part(s) be returned to Waltron with shipping charges prepaid.

At Waltron discretion, a Technical Service Specialist may be sent out to repair or replace the defective part(s) on location. Traveling time and expenses of the Technical Service Specialist is at the customer's expense.

Equipment sent to Waltron must be appropriately packaged and the following information must be provided prior to returning to Waltron:

- √ The Return Authorization (RA) number assigned to the customer by the Waltron Technical Service Department.
- √ Customer name, address and department.
- √ Name and telephone number of the individual responsible for returning items for repair.
- √ Brief problem description.

Checklist of Materials

In order to ensure customer satisfaction, Waltron does its best to provide adequate and timely packaging and shipping services. Please perform the following after receiving a shipment:

√ Inspect all shipping containers upon receipt and record any visible damage. If there are any outward signs of damage, please retain all containers and packages for inspection by carrier. Please retain all packing material so that it can be used for future moving and shipping needs.

√ Check all items received against those on the packing list. Chemicals are usually shipped in a separate package and will be itemized accordingly.

√ Verify that the number of packages received agrees with the packing list and shipping papers.

√ Notify both Waltron and the carrier if any problems occur.

Important Notice

√ All monitors are inspected and tested prior to shipment.
√ In normal use, the unit should require only minor maintenance and should operate correctly and without fault over a long period of time.
√ Please note that if electronic components need to be replaced, it may be necessary to adjust and/or calibrate the monitor.
√ Failure to carry out correct maintenance procedures may result in inaccurate monitor reading.

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.SECTION 1 – SAFETY PRECAUTIONS AND HAZARDS

1 .1 General information

Before to proceed with analyzer installation, please read through and fully understand this instruction manual for proper operation. Pay attention to all caution and dangers labels present on the analyzer and all caution and dangers statements written on this manual. For analyzer installation and use, please refer carefully to all information and recommendations present in this manual.

Failure to do so and non-observance of hazards or dangers warnings could result in death or serious injury to the operators or damage to the analyzer.

Before to use the analyzer is necessary to check visually for damages of safety devices and report to your reference head even if they don't cause analyzer stop or malfunction.

All analyzer's components are installed inside a metallic enclosure which door is equipped with a special key opening, only endowed qualified maintenance personnel. (ref. section 3.3). The door opening for visual inspection is possible also with the analyzer working in normal operation only if all the safety precautions and hazards and dangers labels have been strictly observed.

1.2 List of warnings and potential dangers

The table below is a list of hazards and dangers warning labels that is possible to find on the analyzer and/or in this manual. In case of aging of these labels, they should be replaced with new ones by the analyzer owner.

Table 1-1: List of hazards and dangers

Hazard of electrical shock

This symbol is used to present a hazard of severe electric shock or electrocution. All controls and maintenance on electrical devices labeled with this symbol should be made by qualified personnel in accordance with national or local regulations. Qualified Personnel means person who has been fully trained and has professional experience to avoid electricity hazards and dangers. To avoid potential fatal electrical shock and/or analyzer damage always disconnect input power to analyzer before servicing.

Involved parts:

- fans
- air compressor
- UV power supply
- main power supply
- peristaltic pump motor
- UV lamp
- input terminal

Hazard of chemical burns

This symbol is used to present a hazard of severe burns and serious injury for dangerous chemicals manipulation. All handling and manipulations operations maintenance on chemicals labeled with this symbol should be made by qualified personnel in accordance with national or local regulations. Qualified Personnel means person who has been fully trained and has professional experience to avoid chemical hazards and dangers. Before to proceed to every handling of chemicals and to proceed with service operations , read the material safety data sheets supplied with each chemical to take all the necessary precautions when handling.

Involved parts:

- fluidics section
- reagent container

Hazard of UV radiation

This symbol is used to present a hazard of ultraviolet radiation. It is absolutely necessary to wear eyes protection to operate with the UV lamps labeled with this symbol.

Never look directly at a lighted UV lamp. UV radiation exposure can cause severe and permanent damage skin and eyes.

Involved parts:

❖ UV lamp

b

Warning of general hazard

This symbol means that is necessary read this manual before to proceed to any service operation to know exactly how to operate in proper way. Only qualified and trained personnel on analyzer use and maintenance are allowed to proceed with service operations on the unit.

Involved parts:

- TOC analyzer

1.3 Vent waste gas

Waste gases coming from analyzer oxidation process depend on the user's sample composition. They are labeled on the external side of the cabinet as VENT outlets. It is suggested to provide for safe venting to the atmosphere in well ventilated area or to classified as safe area.

1.4 Sample

Take appropriate precautions to avoid direct contact with sample stream. It is responsibility of the user collect all the information and take all the precautions regarding physical, chemical, radiation and/or biological hazards and dangers coming from sample stream and/or sample vapors. It is also responsibility of the user to collect all the information and potential hazards regarding the chemical and physical compatibility of sample stream with analyzer materials.

Table 1-1 : List of materials used in TOC analyzer

Pump tubing	Pharmed
Fittings	Polypropylene
Connection tubing	PFA
U-tube, Condenser	Glass
UV reactor	Quartz
Halogens and sodalime filter body	Glass
Filters contents	Copper wool (halogens filter) , sodalime (sodalime filter)
UV lamp	Quartz
Electro valves (parts on sample contact)	Peek , viton
IR cell	Stainless steel

1.5 UV Lamps disposal

Used or replaced UV lamps contain a small quantity of mercury and they must be disposed according with national or local environmental regulations regarding hazardous and poisonous materials.

1.6 ANALYZER GENERAL HAZARDS

Electrical precautions and hazards

General information

In all electrical devices 220 VAC powered is present the hazard of electrical shock or electrocution.

To protect all the personnel involved in analyzer use and maintenance, the door of the analyzer enclosure is equipped with a special key opening.

If necessary to operate inside the analyzer's enclosure with the unit powered on, please consider that this operation must be made only by qualified personnel in accordance with national or local regulations. Qualified Personnel means person who has been fully trained and has professional experience to avoid electricity hazards and dangers.

Service qualified personnel will receive the special key to open the analyzer's enclosure.

Before to service the analyzer or parts of that electrically powered, turn off power avoiding risks of electrocution.

To turn off power from an electrical device is necessary to interrupt the power line using a circuit breaker or an isolating switch to be sure that there is no power in the area to service.

Inside the analyzer's enclosure the lower level of protection against direct contacts is IP2X. Analyzer's enclosures are IP54 (because of air fan holes).

Protection against indirect contacts is guaranteed by efficient grounding of all isolated metal masses. Grounding screw is located inside the electrical enclosure, in upper left position.

⇨ **It will be user's task to check and guarantee periodically the perfect efficiency of analyzer's grounding.**

Users and qualified maintenance personnel must proceed as follows:

- take care of electrical shock and/or electrocutions labels placed on the analyzer
- always isolate power before servicing the analyzer

In case of loss of power the analyzer stops and automatically restarts as soon as it will be re-powered.

Operating precautions and hazards

HAZARD*:* Mechanical hazards caused by moving parts of fans, pumps, motors and air compressors

PREVENTIVE ACTIONS

To avoid risks the analyzer's moving parts have been designed, built and located in closed enclosure with a special opening key. When present inside the enclosure, these parts have protection covers to avoid any contact and physical injuries to users.

HAZARD*:* Hazards of burns caused by hot parts of UV lamp, pump motor and air compressor

PREVENTIVE ACTIONS:

To avoid risks, the analyzer's parts that become very hot to the touch have been designed, built and located in closed enclosure with a special opening key. When present inside the enclosure, these parts have protection covers and warning labels to avoid any contact and physical injuries to users.

HAZARD: Hazard of poisoning a caused by waste gas coming out from VENT line

PREVENTIVE ACTIONS

Install the analyzer in location of adequate dimensions and well ventilated.

HAZARD: Hazards of UV radiation exposure caused by UV lamps

PREVENTIVE ACTIONS:

To avoid risks, the analyzer's parts that produce UV radiation emissions have been designed, built and located in closed enclosure with a special opening key. When present inside the enclosure, these parts have protection covers and warning labels to avoid any contact and/or exposure and/or physical injuries to users.

HAZARD: hazard of burns and poisoning caused by contact with dangerous chemicals

PREVENTIVE ACTIONS:

To avoid risks, the analyzer's parts that can cause contact with chemicals have been designed, built and located in closed enclosure with a special opening key. Before to service the liquids section, read the material safety data sheets supplied with each chemical to take all the necessary precautions when handling. Wear eye protections, gloves, mask and clothes if necessary.

HAZARD: Hazard of electric shock and/or electrocution in the electrical enclosure

PREVENTIVE ACTIONS:

The analyzer's electric equipment complies with EN 60204 requirements.

To avoid risks, the analyzer's parts that can cause hazard of electric shock and/or electrocution have been designed, built and located in closed enclosure with a special opening key. When present inside the enclosures, these parts have protection covers and warning labels to avoid any contact and serious injuries or death to users.

Note:

Electrical equipments of input power and grounding must comply the national or local regulations and laws.

Check that the source voltage to be used corresponds with that requested by the analyzer.

Check periodically the power cord as well as the analyzer grounding.

1.7 Chemical and waste gas hazards

The analyzer has been designed, built and equipped to avoid risks caused by physical and chemical factors as noise, vibrations, radiations, dust, waste gas etc.

.SECTION 2 – INTRODUCTION

1 Analyzer description

This manual provides general information regarding the principle of operation and for a proper installation and operation of the analyzer.

The analyzer measures Total Organic Carbon in liquid samples using the EPA approved method based on UV persulfate oxidation and detection of generated carbon dioxide using a Non Dispersive Infrared Analyzer. This method meets also the requirements of European ISO/CEN guidelines. The analyzer provides these measurements on liquid samples ranging from 0-20 mg/l to 0-1000 mg/l (others upon request)

The analyzer is conformed to EPA, DIN, CE , ASTM, NAMUR regulations.

Fig. 2-1 : TOC, 3001C front view

2.2 Applications

The analyzer measures Total Organic Carbon (TOC) in water.

It has been designed for the following applications:

- Industrial waste water and effluents
- Laboratory
- Boiler feed water
- Condensate and cooling water
- Drinking and surface water
- Industrial and municipal water treatment plant inlet/outlet

For different applications or different aqueous matrix is recommended to contact our facilities to verify your application with our specialist.

2.3 Operating principle

The TOC is an on-line analyzer for batch-wise analysis. The sample is taken by a peristaltic pump (sample pump), driven by motor M1, that provides to flush the inlet tubing and to fill the sample loop.

In case of online applications, the water from the sample source (directly from the sampling point through the optional filtration unit) is driven to the fast loop reservoir, a sampling device (optional) mounted on the external left side of the analyzer. This device provides to drain the sample excess and is equipped with a level sensor to check the sample presence. This device allows a good sample refreshment and provides to put the analyzer in stand-by condition in case of loss of sample.

After the sampling time, the sample, which volume is fixed by the loop length, is driven by the carrier gas directly to the reactor (the UV lamp is off in this first stage) and mixed with the reagent (a mixture of phosphoric acid and sodium persulfate) delivered by a micro pulse pump (Reagent pump). The inorganic removal is performed using ambient air generated by an internal air compressor (ref. Air pump). This first process stage lowers the pH of sample and causes the conversion of carbon contained in carbonates to carbon dioxide and the carbon dioxide dissolved in water is then driven out by the sample using the carrier air (produced by the air compressor and cleaned by carbon dioxide through the sodalime filter)

and transferred to the NDIR for TIC measurement.

The acidified and sparged sample is then exposed to the oxidation stage. The UV lamp is switched on and the reactor temperature increases up to 80°C.

The presence of a strong oxidizing agent combined with high level UV radiation and high temperature (~ 80°C) generated by a heater located around the UV reactor causes the oxidation of organic compounds. When the oxidation time is delayed, the carrier gas removes the dissolved carbon dioxide coming from organics oxidation and flows it to the infrared analyzer (NDIR), passing in sequence through the U-tube, a glass condenser and an halogens filter. These devices are used to prevent condensation and corrosion inside the stainless steel cell of the IR.

The carrier gas used for the oxidation and detection stages is generated by the same air compressor used for inorganic removal, passed through a sodalime filter (CO2 remover). The carbon dioxide free gas passes through a pressure regulator, a capillary tube and a digital flow meter (flow meter) to reach finally the UV reactor or the IR detector depending on the position NO or NC of gas solenoid valve.

All these devices are necessary to guarantee a high precision and stability of carrier gas flow as well as to control and to have the reading of this flow on the display by the microprocessor. The IR signal during peak time is acquired by electronic input device and the peak area is used to calculate the analysis result.

When the analysis is finished and the result displayed, a clean flush is performed adding D.I. water and reagent to the spent sample to fill the reactor and discharging it through the drain line.

2.4 COMPONENTS

The analyzer is assembled in a metallic enclosure. The lower section, called FLUIDICS SECTION, includes all the components involved in sample and reagent flows as well as their mixing in sparging and oxidation stages. This enclosure is properly vented by a fan to allow good air refreshment inside the cabinet. The higher section, called ELECTRONICS sections, includes the main power supply, the UV power supply, the carrier gas generation and flow adjustment devices, the controller PCB assembly and the infrared detector.

Fig. 2-1 Flow diagram

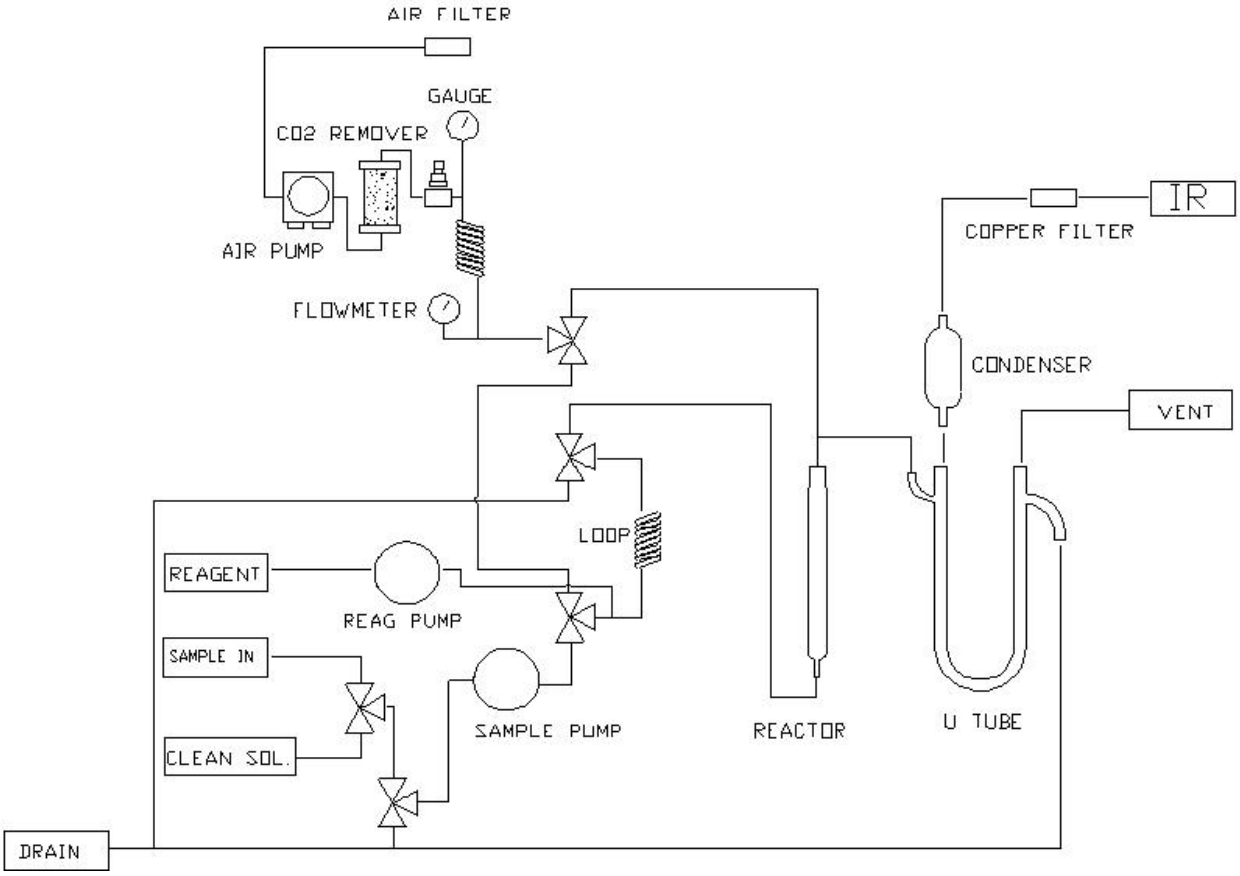
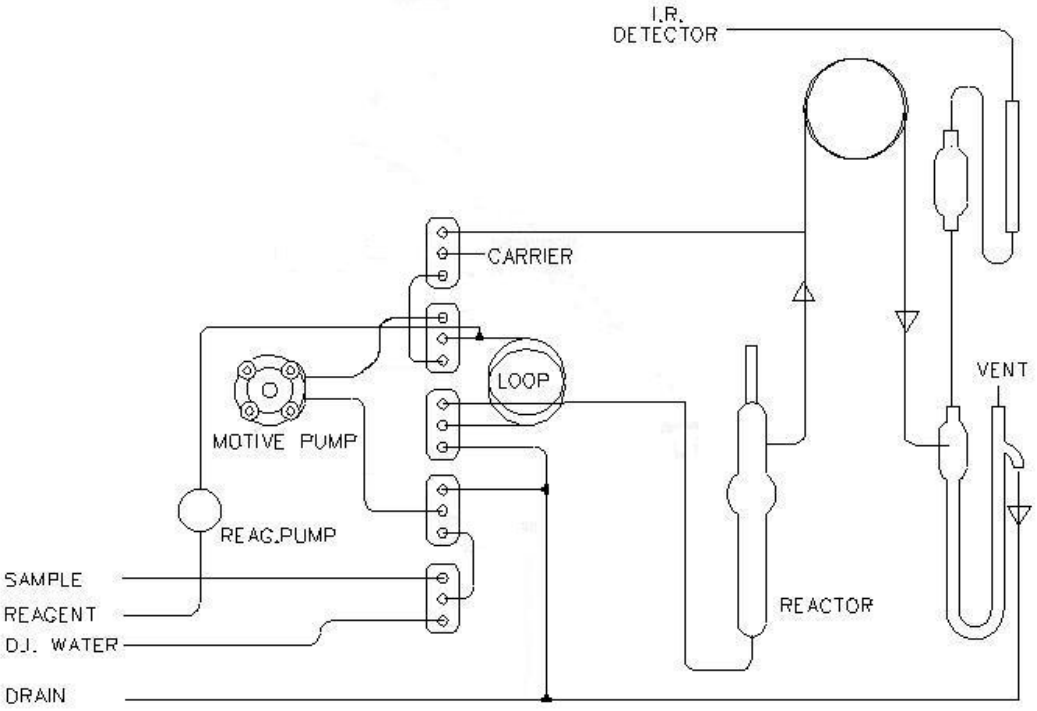
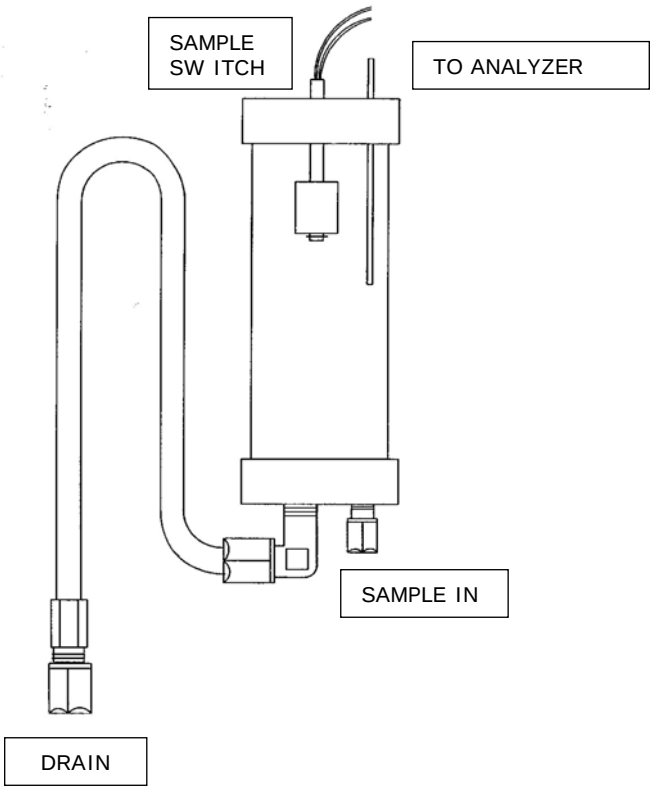


Fig. 2-2 Flow diagram- solenoid valves


I.R.
DETECTOR
CARRIER
LOOP
VENT
MOTIVE PUMP
REAG.PUMP
SAMPLE
REAGENT
D.I. WATER
DRAIN
REACTOR

2.4.1 Fast-loop reservoir

Fig. 2-3 : sample fast-loop reservoir drawing



The external reservoir, installed just in case of online applications, allows having a fast circulation of the sample coming from the sampling point or from the optional filtration unit. Inside the fast-loop reservoir the sample is at atmospheric pressure and this allows the sample pump to work in proper way with constant delivery and no overpressure.

In addition to this, the fast-loop reservoir is a useful extra quantity of sample to avoid wrong alarms in case of short loss of sample as well as to eliminate air bubbles from the sample line or caused by the cleaning cycle of the optional filtration unit.

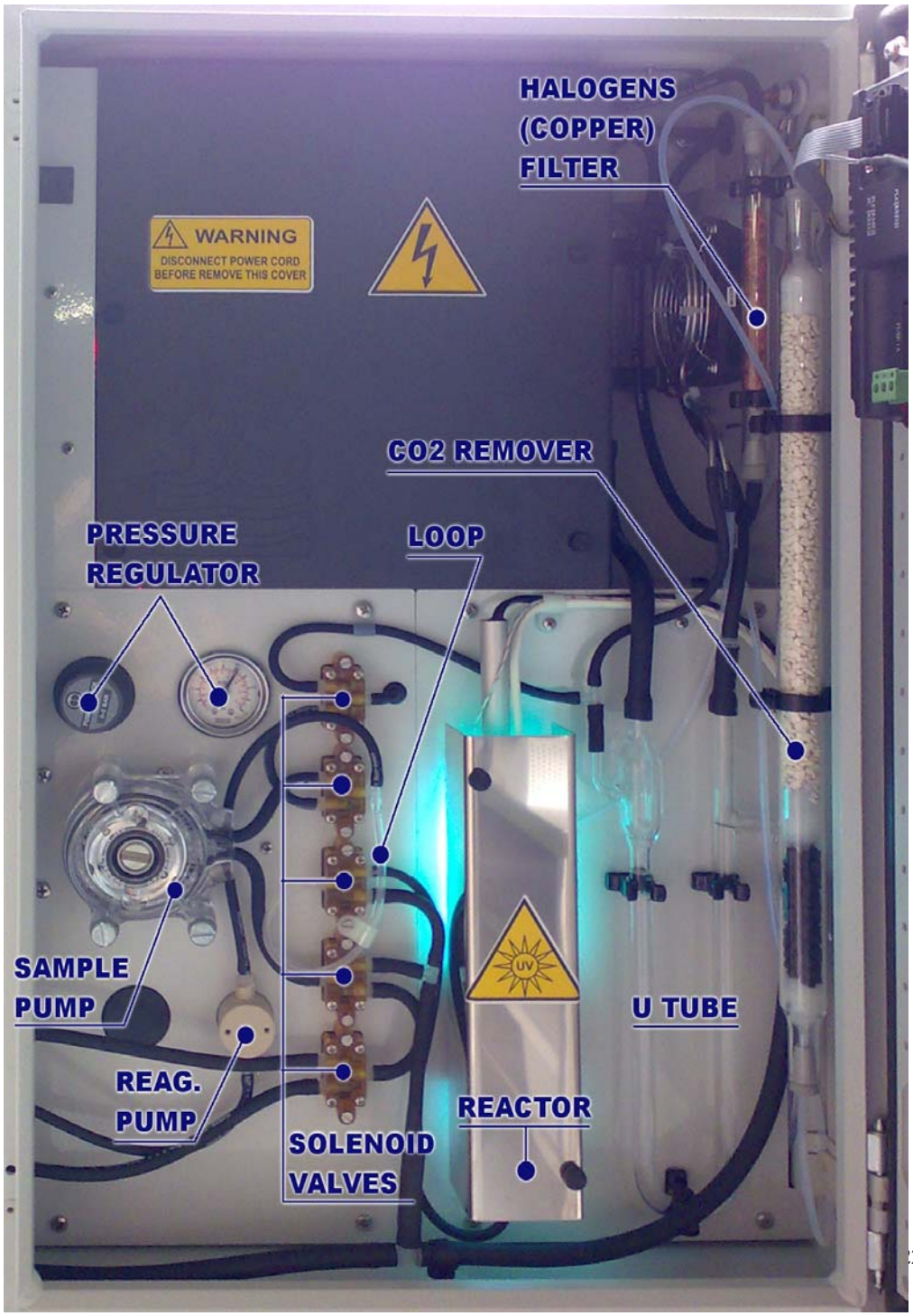
The stainless steel drain tubing keeps a constant water level inside the container and allows a proper sample circulation to avoid suspended solids accumulation.

The sample flow should be adjusted to have the complete sample overflow through the stainless steel tube, U shaped. A small hole at the stainless steel tubing allows emptying the fast-loop reservoir for cleaning purposes just with the finger pressure.

Inside the reservoir a level sensor checks for water presence. The loss of sample switch provides to put the analyzer in stand-by conditions at the end of the current cycle. When the sample will come again in the reservoir to move the sensor, the analyzer will start automatically with a new cycle.

Connect the fast loop reservoir to the analyzer.

Fig. 2-4: TOC components



2.4.2 Pumps

The analyzer uses two different pumps:

The sample pump head shown in flow diagram as sample pump is a peristaltic pump; it's driven by a reversible motor (M1) and it is located in central position, on the left side of the fluidics section; it pumps forward the sample (from an external reservoir or from the fast-loop reservoir) or the cleaning D.I. water inside the sample loop to have a fast and precise refresh of the sample and to minimize the response time. It provides to move the sample in the different analysis steps, to clean the reactor and to drain the sample as soon as the cycle is over.

The reagent pump head shown in flow diagram as reagent pump is a pulse pump driven by a specific motor (24 VDC powered). It's located in lower position on the left side of fluidics compartment. It mixes the reagent coming from the reagent container with the sample when required and it provides to clean all the fluidics when necessary.

2.4.3 UV reactor

The UV reactor shown in flow diagram as REACTOR is located in vertical position near the U-tube in the middle of fluid compartment. It is a quartz cylinder that has a double function: it works as a sparger in the inorganic removal stage and as a real UV reactor in the organics oxidation stage.

In the inorganic removal step and next TIC detection, the sample is mixed with reagent and transferred from the sample loop inside the UV reactor. The acidified sample is then sparged by the carrier gas coming from the internal air compressor. In this stage the carbon dioxide coming from the inorganic carbon present in the sample is sparged out from the sample and directed through the condenser and the halogens filter to the NDIR for TIC detection.

At the end of the inorganic removal stage, the sample is ready for the next oxidation step.

In the oxidation stage the high energy UV lamp is turned on; A heater (controlled by a thermocouple) and a cover are used to keep constant the oxidation temperature.

The reaction of oxidation is catalyzed by UV radiation in terms of decomposition of sodium persulfate and creation of strongly oxidizing radicals. These conditions, promoted by an oxidation temperature around 80°C, are extremely useful to have the best recovery of organics present in the sample.

During all other steps and in stand by position the reactor temperature decrease at 50°C.

2.4.4 Gas-liquid separator (U tube)

The gas-liquid separator shown in flow diagram as U-tube is located in the fluidics section. It appears like a glass device, U shaped , with an inlet and three outlet points. It provides to separate the liquid part of the analyzed sample eventually coming out of the UV reactor from gaseous stream directed to the infrared analyzer. It provides also to drain the spent sample during cleaning step.

2.4.5 Glass condenser

This device, shown in flow diagram as condenser, is positioned sequentially between U tube and the halogens filter. It provides to prevent water condensation inside the IR cell, simply using the temperature difference between its glass body, cooled by a fan, and the hot treated gas coming from sparger.

2.4.6 Halogens filter

The halogens filter shown in flow diagram as copper filter is located immediately before the IR detector inlet. It appears as glass container full of copper wool; the gas coming from the condenser is forced to go through this device to prevent from corrosive effects due to gases like chlorine or chlorine dioxide that could be generated in the oxidation stage.

2.4.7 Peristaltic pump and pump motor

The peristaltic pump allows moving liquid through fluidics by using a 1/4" O.D. Pharmed or norprene tube. It is located in the fluidics compartment on the left side. The pump motor 20 RPM drives clockwise and counterclockwise the peristaltic sample/clean pump.

2.4.8 Air compressor

The air compressor shown in flow diagram as air pump is located in the internal part of liquid section, on the left side. It provides to generate the carrier gas . It's extremely less expensive than external air treatment system and it eliminates the compressor air as requested utility.

2.4.9 Sodalime and charcoal filter

This filter shown in flow diagram as CO_2 remover is located in the right side of the analyzer enclosure. It's a glass cylinder full of charcoal and sodalime to provide the carbon dioxide absorption from atmospheric: This allows thee analyzer to use CO_2 free air for its purposes.

2.4.10 Pressure regulator and digital flow meter

These two devices located in the left upper side of fluidics section. They are used to have a highly precise and reliable adjustment for the carrier gas flows.

2.4.11 NDIR

The infrared analyzer shown in flow diagram as IR is located in higher part of electronics section, protected by a plastic cover. It appears like a PCB board equipped with an aluminum (ss fitted) cylinder , as IR cell . It's a Non-Dispersive Infrared Analyzer (NDIR) with high stability and reliability performances.

2.4.12 Microprocessor

The microprocessor and its PCB assembly shown in flow diagram as MP are located in higher part of electronics section, under the IR detector and the protection cover. It provides to control the entire analyzing system. It handles the analyzer operations, it collects all the information and data coming from the different analyzer devices and it controls all the I/O apparatus to dialogue with the user touch screen interfaces and transfer data equipments.

2.5 Technical data

Analysis:	TOC, TIC, TC, COD
Method:	Total Organic Carbon (TOC) measurement with TIC removal by acidification and sparging, sodium persulfate UV promoted oxidation, CO2 detection by non dispersive infrared analyzer (NDIR)
Ranges:	from 0-20 to 0-1000 mg/l (others upon request)
Response time:	approximately from 8 minutes, depending on range and settings
Accuracy:	+/- 2% of full scale
Repeatability:	+/- 2% of full scale
Drift:	less of 2%
Power requirements:	
Power supply:	220VAC, 50/60 Hz
Power consumption:	150 watt
Installation requirements:	
Mounting:	wall or support rack
Environmental temperature:	5-40°C
Cabinet:	cold rolled epoxy powder coated steel
Dimensions:	210 x 600 x 380 mm
Weight:	Kg. 25 (approximately depending on range configuration)
Reagent consumption:	Reagent: 1 cc/analysis approx.; DI water : 6 cc/analysis approx.
Analog output:	4-20 mA for measurement data
Alarm:	1 SPDT contact for fault alarm
Sample requirements:	
Inlet pressure :	atmospheric
Outlet pressure:	atmospheric
Sample flow:	160-210 cc/min
Sample connection tubing fast-loop reservoir inlet :	flexible tubing ext. diam. 6 mm.

.SECTION 3 – INSTALLATION

3.1 Unpacking and inspecting

The analyzer is assembled and fully tested for proper performances directly in our facilities and it are delivered inside its box. Before to proceed with analyzer installation, it is recommended to check carefully that box and analyzer have not been damaged during transportation. Take extreme care during analyzer unpacking and moving. Refer to the packing list attached.

3.2 Analyzer handling

Take extreme care when lifting or moving the analyzer, its weight is about 25 kg. Before to move the analyzer it is recommended to empty manually all the fluidics and especially the glass U tube liquids using an appropriate plastic syringe.

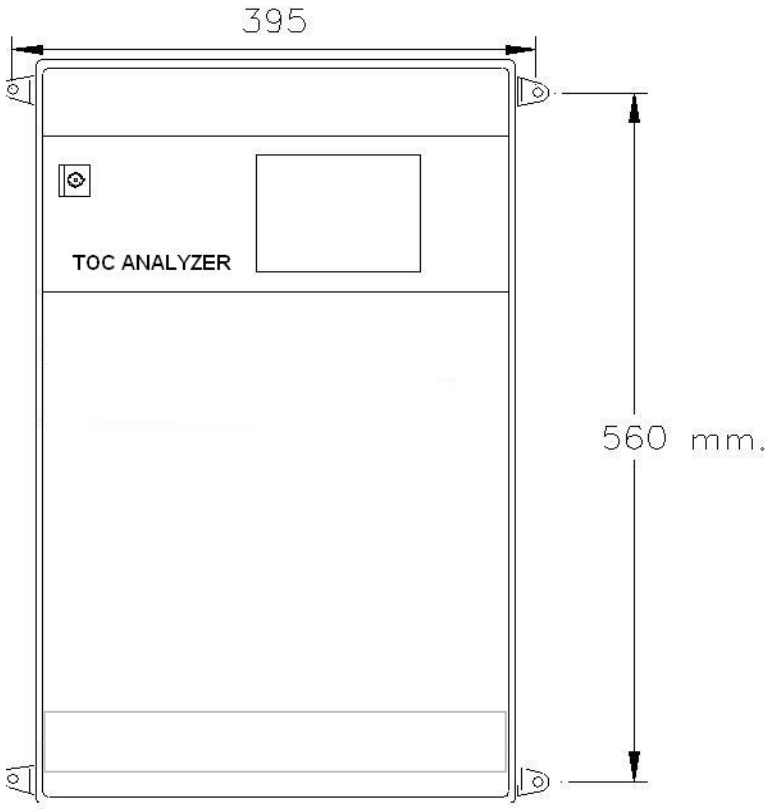
3.3 Location and mounting instructions

It is recommended to install the analyzer in a suitable position. The location is to be clean, covered and properly enclosed to provide the analyzer with good ventilation and low dust concentration. Operating environmental conditions are: temperature between 5 and 45°C at max 93% relative humidity (only with dryer unit connected).

Because of chemicals and waste gases it is absolutely necessary a well ventilated location for the analyzer.

The analyzer is supplied with four mounting brackets for wall or stainless steel support rack installation. Use 4 screws M8 to fix the analyzer.

Fig. 3-1: TOC, Type 3001C - dimensions



3.4 Precommissioning requirements

This a list of key points that must be followed to have an ideal installation:

- the installation site should be as near the sampling point as possible to reduce delay in response time (in case of online applications)
- the drain line should be properly dimensioned and positioned at a downward slope to allow the drain of analyzed sample (**for gravity**) and the overflow coming from external fast-loop reservoir (if used)

⇨ ***WARNING: the sample drain of the analyzer must be at ambient pressure with no restriction or counter pressure. Please verify that this condition has been strictly respected during installation.***

- Clearance requirements for the analyzer should be 40 cm on either side and 100 cm on the front
- Sufficient space for the reagent container should be provided on side or beneath the analyzer; if necessary, the reagent container should be positioned in a suitable basin in case of spills
- Dedicated waste gas line should be provided for safe venting in atmosphere or in a well ventilated area of adequate dimensions

⇨ ***ATTENTION: depending on the sample chemical composition, its oxidation should generate hazardous gases; it's strictly necessary to provide a safety system to allow waste gases vent to the atmosphere***

3.5 Electrical connections

General information

In all electrical devices 220 VAC powered is present the hazard of electrical shock or electrocution.

To protect all the personnel involved in analyzer use and maintenance, the door of the analyzer enclosure is equipped with a special key opening.

If necessary to operate inside the analyzer's enclosure with the unit powered on, please consider that this operation must be made only by qualified personnel in accordance with national or local regulations. Qualified Personnel means person who has been fully trained and has professional experience to avoid electricity hazards and dangers.

Service qualified personnel will receive the special key to open the analyzer's enclosure.

Before to service the analyzer or parts of that electrically powered, turn off power avoiding risks of electrocution.

To turn off power from an electrical device is necessary to interrupt the power line using a circuit breaker or an isolating switch to be sure that there is no power in the area to service.

Inside the analyzer's enclosure the lower level of protection against direct contacts is IP2X. Analyzer's enclosures are IP54 (because of air fan holes).

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Protection against indirect contacts is guaranteed by efficient grounding of all isolated metal masses. Grounding screw is located inside the electrical enclosure, in upper left position .

⇨ **It will be user's task to check and guarantee periodically the perfect efficiency of analyzer's grounding.**

Users and qualified maintenance personnel must proceed as follows:

- take care of electrical shock and/or electrocutions labels placed on the analyzer
- always isolate power before servicing the analyzer

In case of loss of power the analyzer stops and automatically restarts as soon as it will be re-powered.

To avoid potential fatal electrical shock and/or analyzer damage always disconnect input power to analyzer before servicing (disconnecting the 220VAC plug)

ALWAYS ISOLATE POWER BEFORE SERVICING

3.5.1 AC power connections

The analyzer is designed for operation with 220VAC, 50 Hz power. It is provided with 2 meters long power cord and European Schuko plug (ref. CEE 7/ VII regulation). The power cord wires are already connected to terminals of AC section of terminal block ES1 (terminals L,G,N). AC power enters on the top side of the electrical compartment through the supplied power cord.

All the connections must be made in accordance with national or local regulations.

The analyzer is equipped with an internal magnetic thermal switch (2,0A) located in the left side of electronics section. It is anyway recommended that the analyzer have its own dedicated circuit with a circuit breaker or an isolating switch installed near the unit.

3.5.2 Analog output, alarm output, auxiliary output, RS232 output

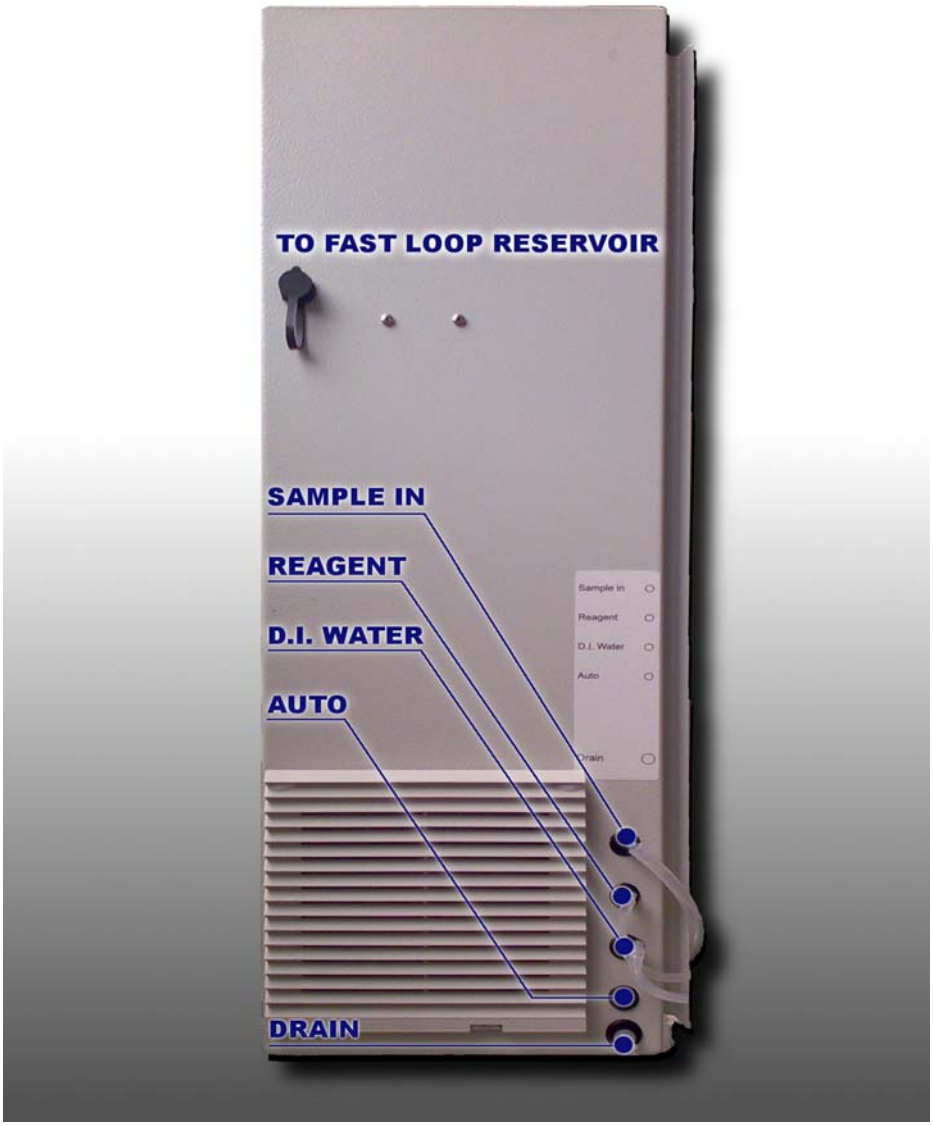
The analyzer provides two 4-20 mA outputs. The first one is for TOC value (terminal block ES4), the second is available for the user and can be configurated for TC or COD value (ES5). For these connections use a twisted-pair signal cable.

A volt-free contact is activated in case of alarm and it can be used as NO or NC referring to the terminal block ES13; on terminal block ES6 of the internal I/O board is also available an auxiliary contact (input or output) for an external device (ex. sampler) and a RS232 output.

3.6 Hydraulics connections

In the left part of the analyzer, a label shows the hydraulic connections of the analyzer. Connect the tubing supplied in the start-up kit following the indications put on the tubing and on the analyzer. See picture 3-2.

Fig. 3-2: hydraulics connections



.SECTION 4 - CONSUMPTION

4.1 persulfate and phosphoric acid solution consumption

Consumption: approx 1 ml each analysis cycle.

.SECTION 5 – ANALYZER INITIAL START-UP

Before to proceed with analyzer start-up it is absolutely necessary to check that all the operations for a proper installation and reagent preparation has been made with accuracy. Please verify that all the suggestions and recommendations have been respected.

After this double check, please proceed as follows:

- Connect the sample line inlet (or the outlet of the optional filtering unit) to the fast-loop reservoir installed on the left side of the TOC analyzer (only for on-line applications)
- Connect the overflow of the fast-loop reservoir to the drain (only for on-line applications)
- Connect the sample inlet tubing to the SAMPLE port fitting using 1/8" I.D. flexible tubing (tygon, pharmed or norprene is recommended). The sample will be taken in this way from atmospheric pressure by the sample peristaltic pump.
- Connect the reagent inlet (coming from the reagent container located on the side or beneath the analyzer and correctly positioned at the bottom of the container) to the REAGENT port fitting using 1/8" I.D. flexible tubing (tygon, pharmed or norprene is recommended). Maximum length allowed for this tubing is 70 cm. The reagent will be taken by the internal reagent micro pump.
- Connect the D.I. water inlet (coming from the D.I. water container located on the side or beneath the analyzer and correctly positioned at the bottom of the container) to the D.I. WATER port fitting using 1/8" I.D. flexible tubing (tygon, pharmed or norprene is recommended). Maximum length allowed for this tubing is 70 cm. The D.I. water will be taken by the sample peristaltic pump. The consumption is about 6 cc/analysis cycle.
- Connect the analyzer drains to waste line to the DRAIN port fitting using a 3/8" flexible tubing. The drain line should be properly dimensioned and positioned at a downward slope to allow the drain of analyzed sample (**for gravity**) and the overflow coming from external fast-loop reservoir (if used)

WARNING: the sample drain of the analyzer must be at ambient pressure with no restriction. Please verify that this condition has been strictly respected during initial start-up operations

- Check sample presence in fast-loop reservoir, if used, and adjust the sample flow rate to allow to have a complete reservoir discharge with the simple finger pressure on the hole placed at the top of stainless steel drain line (only for on-line applications)
- Turn on the analyzer. External fans, microprocessor and infrared analyzer will start. The warm-up window will appear on the display. Wait until the stand-by condition will be reached by the analyzer
- Press the SERVICE button on the touch screen and then press the button PUMP PRIMING (this command is active only when the analyzer is in stand-by condition, yellow led blinking) and wait for end of the step. The only way to stop this operation is to press the EMERGENCY STOP key in the COMMANDS Menu. For the first start-up repeat 3 times this operation.
- If the internal glass U tube is completely empty (first start up) select a CLEAN CYCLE command from SERVICE Menu . Wait up to the end of the operations (until the standby mode is reached) and do it again one more time if necessary
- Press the DISPLAY button and check the carrier gas FLOW; the right value in stand-by conditions, after at least 30 minutes of warm-up) should be approximately 200 cc/min. Use the pressure regulator knob to adjust the flow, if necessary
- Close all the menu windows and press ONLINE button to start with measurements for online operation or SINGLE button for a single analysis cycle.

It is recommended to proceed with a complete calibration cycle (after 2-3 conditioning cycle) before leaving the analyzer in online conditions (ref. Section 6).

WARNING:

The analyzer cannot handle samples containing more than 1 gr/lt of chloride concentration

Do not use any cleaning solution as bleach, chlorine products, hydrochloric acid etc.

Periodically check the halogens filter and replace the internal copper wool, if oxidized.

While the U-tube is full of water, do not rotate the analyzer but keep it in vertical position

.SECTION 6 – ANALYZER CALIBRATION

The infrared analyzer located at the end of fluidics provides continuously the CO2 concentration value expressed in ppm generated by the analyzed sample. In normal conditions the infrared analyzer is drift-free and its calibration should be verified approximately every two years by qualified personnel of TRE-ESSE.

6.1 Calibrate TOC ZERO

This calibration should be performed in case of reagent replacement and every time a manual calibration is required.

The zero manual calibration procedure is manually performed disconnecting the sampling tubing coming from the fast-loop reservoir (if present), connecting the manual sample tube and introducing it in a distilled water container. In these conditions as soon as an analysis cycle will be activated the analyzer will sample DI water. The CO2 concentration in ppm detected by the NDIR is assumed as ppm of CO2 produced by reagent and DI water. This value is manually stored as ZERO AREA TOC, from CALIBR menu selecting TOC option of MANUAL CAL menu and keeping pressed the CALIBRATE TOC ZERO key with the analyzer in STAND-BY conditions. This operation will refresh the stored ZERO AREA TOC value; it can be executed only after a complete analysis cycle, with the analyzer in stand-by conditions.

It is recommended to proceed to a cal parameter refreshment at least after three analysis cycles performed with DI water.

6.2 Calibrate TOC SPAN

The span manual calibration procedure is manually performed disconnecting the sampling tubing coming from the fast-loop reservoir (if present), connecting the manual sample tube and introducing it in a TOC standard solution container. In these conditions as soon as an analysis cycle will be activated the analyzer will sample the TOC standard solution. The CO2 concentration in ppm detected by the NDIR is assumed as ppm of CO2 produced by used TOC standard solution. Subtracted the stored ZERO TOC AREA , this value is manually stored as SPAN AREA TOC, from CALIBR menu selecting TOC option of MANUAL CAL menu and keeping pressed the CALIBRATE TOC SPAN key with the analyzer in STAND-BY conditions. This operation will refresh the stored SPAN AREA TOC value; it can be executed only after a complete analysis cycle, with the analyzer in stand-by conditions.

It is recommended to proceed to a cal parameter refreshment at least after three analysis cycles performed with the TOC standard solution.

6.3 How to perform a manual calibration

- Disconnect the sampling tubing coming from the fast-loop reservoir (if present), connecting the manual sample tube and introducing it in a distilled water container
- Start an analysis cycle from the COMMANDS menu pressing the SINGLE key. In these conditions as soon as an analysis cycle will be activated the analyzer will sample DI water
- Repeat two times the previous step to be sure to perform a correct ZERO calibration
- With the analyzer in STAND-BY conditions, press CALIBR key to open the calibration menu window, press TOC (or TIC) key of MANUAL CALIBRATION menu and keep pressed the CALIBRATE ZERO button. This operation will refresh the stored ZERO AREA value.
- Set the standard solution value used for calibration pressing the STD STANDARD VALUE mg/l and choosing the desired value using the < and > buttons.
- Put the sampling tubing in the standard solution container
- Start an analysis cycle from the COMMANDS menu pressing the SINGLE key. In these conditions as soon as an analysis cycle will be activated the analyzer will sample the TOC standard solution.
- Repeat two times the previous step to be sure to perform a correct SPAN calibration

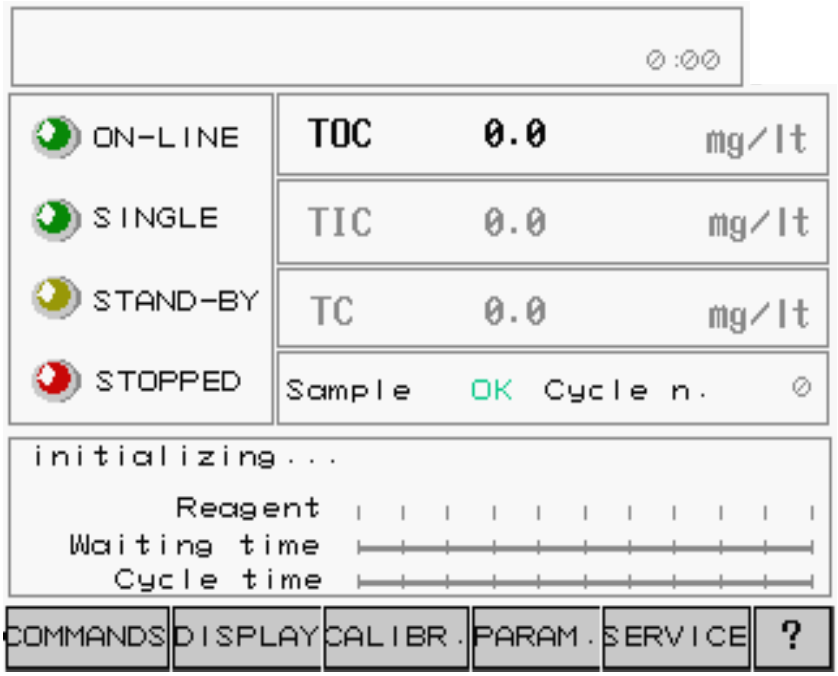
- With the analyzer in STAND-BY conditions, press CALIBR key to open the calibration menu window, press TOC (or TIC) key of MANUAL CALIBRATION menu and keep pressed the CALIBRATE SPAN button. This operation will refresh the stored SPAN AREA value
- Remove the manual sample tube and reconnect the sample tube to the fast-loop reservoir (if present).

.SECTION 7 – USER INTERFACE

7.1 USER INSTRUCTIONS

The user's interface consists of the touch screen located on the front panel of the analyzer enclosure, on the right side. All the output/input data, information, alarms and fault conditions are shown on the display while all the commands and settings may be transferred to the analyzer simply pressing the touch screen buttons.

Fig. 7.1 : Main page



7.2 MAIN SCREEN

The main screen displays three different read only sections, an alarms section and the lower section that allows accessing the sub-menus.

The section located on the upper left position of the main screen displays the analyzer status, showing if it's performing a single or a cyclic online analysis, if it's in stand-by or in fault conditions.

On the right it's possible to read the TOC, TIC,TC or COD values, in mg/l, the analysis cycle progressive number and the presence of sample status (OK or FAIL).

On the upper section will be displayed the alarms regarding warning or fault conditions.

On the lower section are displayed the active step of the analysis in progress and three bar graphs: the first one controls the reagent consumption, the second shows the waiting time between the last performed analysis and the next programmed analysis, the third one displays the current time of the analysis in progress.

The lowest section shows the buttons that allows to access the different menus of the analyzer.

ANALYZER OPERATING STATUS		
ON-LINE	GREEN FLASHING LIGHT ON	The analyzer is performing a continuous cyclic analysis based on the frequency set in the PARAMETERS menu and started when the ONLINE button of the menu COMMANDS has been pressed. As soon as the analyzer will complete the analysis cycle, it will restart with a new analysis. This condition is identified as online condition
SINGLE	GREEN FLASHING LIGHT ON	The analyzer is performing just a single analysis cycle. As soon as the cycle will be completed the analyzer will turn in the stand-by condition
STAND-BY	YELLOW FLASHING LIGHT ON	The analyzer is waiting for a user's command; IR detector and electronics are on. 4-20 mA is in hold at the last valid reading
STOPPED	RED FLASHING LIGHT ON	The analyzer has been forced to stop. A message in the upper section of the main menu shows the fault condition has been verified or the EMERGENCY STOP OCCURRED message, if activated by the user

MEASUREMENTS INDICATORS	
TOC ____ mg/l TIC ____ mg/l COD ____ mg/l	It displays the TOC, TIC, TC or COD value measured in the last performed analysis, in mg/l
SAMPLE	It shows if the sample is present (OK) or not (FAIL), when the external sample is used (online applications). The eventual loss of flow is detected by the level sensor which is mounted inside the reservoir. In case of loss of sample flow, the analyzer will turn in stand-by condition
CYCLE N. __	It's a counter and displays the total number of analysis cycles performed by the analyzer from the last counter reset.

BARGRAPHS	
REAGENT	This bar graph shows the reagent consumption (referred to 1 liter bottle) in order to allow to the user to provide for new reagent addition or replacement. In normal conditions the bar graph is green colored; as soon as the reagent level reach the 15% value, the bar graph will become red colored; if the reagent level goes below 4% value, the analyzer goes in FAULT alarm and stops automatically. The alarm message will be displayed in the upper section of the main menu and the FAULT contact will be activated. Every time the reagent level is restored, it's necessary to reset the bar graph in the SERVICE menu (reagent filled up)
WAITING TIME	It shows the delayed time between the last performed analysis and the next programmed analysis
CYCLE TIME	It shows the delayed time of the analysis in progress

MENU ACCESS BUTTONS	
COMMANDS	This menu allows to control manually the analyzer forcing it to specific operations as start single or cyclic analysis, stop etc.
DISPLAY	This menu displays all process and analysis data and conditions as well as the trend screens (peak charts and data screens)
CALIBR	This menu is dedicated to analyzer manual calibration procedure and it displays all tle calibration parameters
PARAM	This menu allows to set the delays of the analysis steps
SERVICE	This menu allows to reset the counters and the fault alarms, enable or disable the loss of sample alarm, to handle the 4-20 mA output.
?	It shows the software version installed on the analyzer.

7.3.1 Menu COMMANDS

ON-LINE : this command allows to force the analyzer to online operations; this means that pressing this button the analyzer will perform a continuous cyclic analysis based on the frequency set in the PARAMETERS menu This condition is identified as online condition. In off position this button will be green coloured, when active it will be red coloured

SINGLE: this command allows starting the analyzer performing a single analysis. At the end of the cycle, the analyzer will turn in stand-by conditions waiting for a new user's command

END CYCLE STOP: if pressed in online conditions, this command allows stopping the analysis in progress at the end of the cycle; the analyzer will turn in stand-by conditions waiting for a new user's command; if pressed while the analyzer is in waiting time, this command will force immediately the analyzer in stand-by conditions

EMERGENCY STOP: this command will stop immediately the analyzer at the current step of the analysis in progress; the analyzer will goes in STOPPED conditions with motors, UV lamp and air compressor off. On the upper section of the main screen will appear the message "emergency stop occurred" and the FAULT contact will be activated.

WARNING: before to restart the analyzer after an emergency stop is necessary to reset the fault in the SERVICE menu to force the analyzer in stand-by conditions and then to start with a new analysis cycle

7.3.2 Menu DISPLAY

CO_2 ppm : it shows the current CO_2 value detected by the IR detector, in gas parts per million

OUTPUT mA A: it shows the current value in mA of the analog output, available on the outputs terminal block, referred to the last performed TOC analysis cycle

OUTPUT mA B: it shows the current value in mA of the analog output, available on the outputs terminal block, referred to the last performed COD or TC (depending on user selection) analysis cycle

FLOW cc/m : displays the carrier gas flow value through the digital flow meter in cc/min. If this value decreases below a presented value (100 cc/m) because of some malfunction of fluidics the analyzer will stop immediately and the FAULT message will appear in the alarms section of the main screen. The fault contact will be activated.

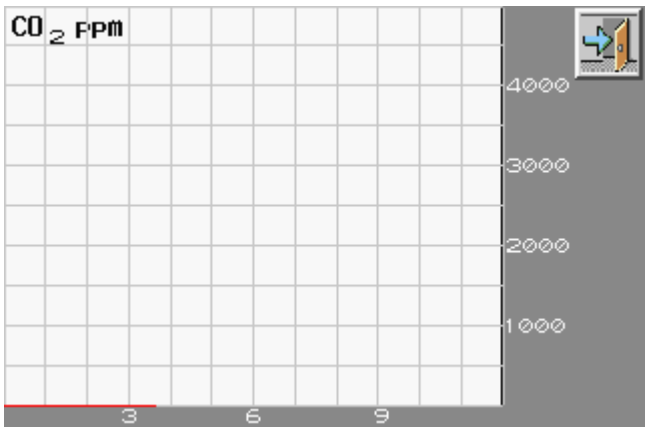
REACTOR TEMP °C : it shows the current temperature of UV reactor, controlled by the thermocouple and expressed in Celsius degrees; in stand-by conditions the reactor temperature is kept at 50°C; if, because of a malfunction, this temperature drops below 45°C the analyzer will stop immediately and the FAULT message will appear in the alarms section of the main screen and the fault contact will be activated.

During the “oxidizing” step of the analysis cycle the rector temperature increases until to 80°C. If, because of a malfunction, after ten minutes from starting the oxidizing step the reactor temperature doesn’t reach the set value, the analyzer will stop immediately and the FAULT message will appear in the alarms section of the main screen and the fault contact will be activated.

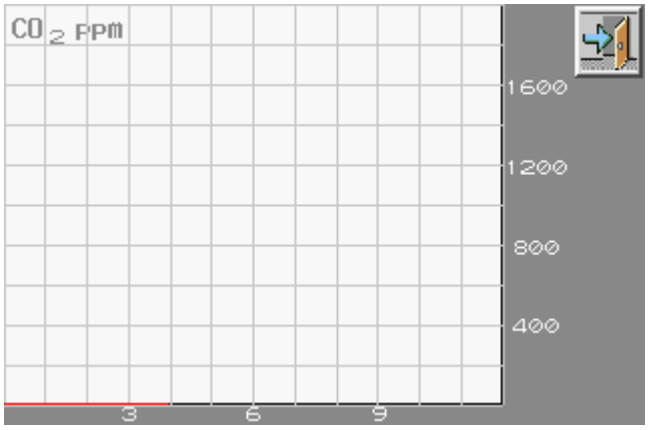
BASELINE ppm : it shows the CO_2 value in ppm detected by the IR detector immediately before to start the “oxidizing” step of the analysis cycle. It’s the baseline of the TOC peak. If this value exceeds the 200 ppm value, the analyzer will stop immediately and the FAULT message will appear in the alarms section of the main screen and the fault contact will be activated

AREA TIC: it shows the value in calculation unit of the CO_2 peak area. This CO2 is generated by the acidified sample sparging and detected by the IR during the current analysis cycle

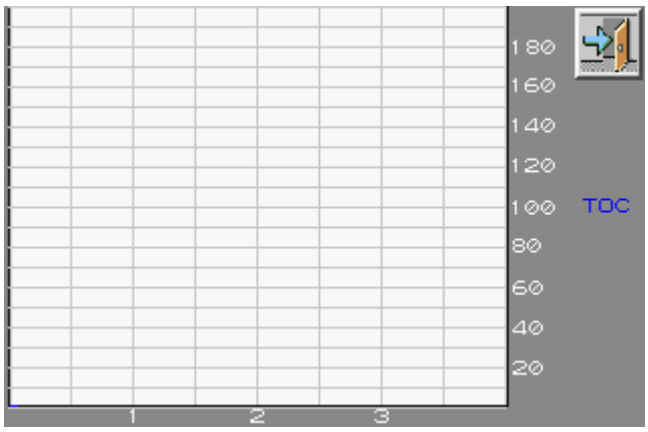
AREA TOC: it shows the value in calculation unit of the CO_2 peak area. This CO2 is generated by the oxidation of organics present in the sample and detected by the IR during the current analysis cycle

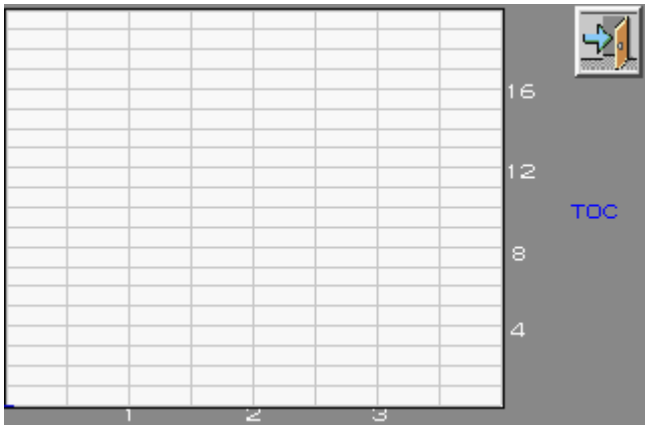


PEEK CHART: it displays in a graphic the CO2 concentration trend (in ppm) versus the time (in minutes) during the current analysis cycle. The CO2 concentration axis has a higher full scale and a lower resolution to allow to see the complete profile of the peak on the screen for the analysis in progress



ZOOM PEEK CHART: it displays in a graphic the CO2 concentration trend (in ppm) versus the time (in minutes) during the current analysis cycle. The CO2 concentration axis has a lower full scale to have a better resolution of the peak on the screen for the analysis in progress



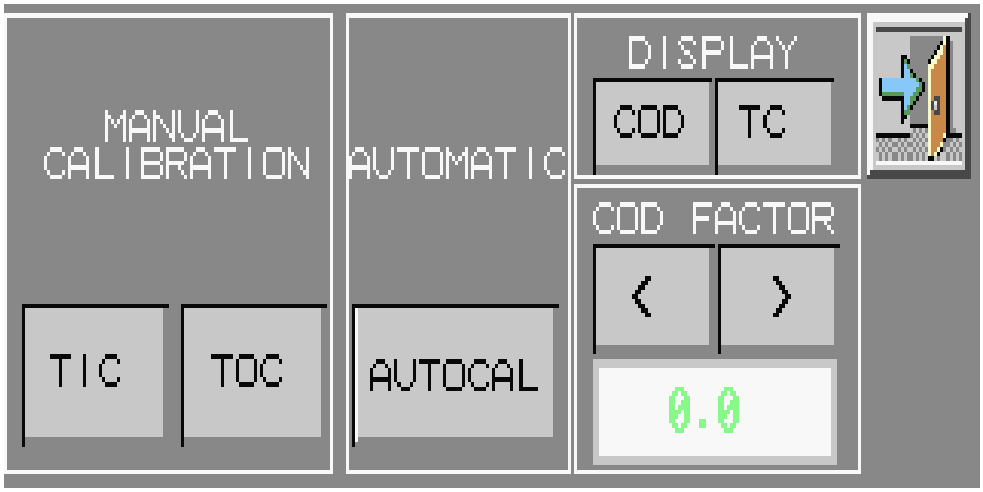


4H TREND : it displays in a graphic the trend of TOC value (in mg/l) versus the time (in hours) in on-line operations, with middle resolution. The TOC full scale of the graphic is better for medium-high TOC measurements

4H ZOOM : it displays in a graphic the trend of TOC value (in mg/l) versus the time (in hours) in on-line operations, with high resolution. The TOC full scale of the graphic is better for medium-low TOC measurements

24H TREND/ZOOM : see above for description; the only difference is the time

7.3.3 Menu CALIBR.



MANUAL CALIBRATION: this menu shows the stored calibration parameters, it allows to set the TOC standard value that has been used for the calibration and it allows to store the new calibration parameters as soon as a new TIC or TOC calibration is performed

AUTOMATIC: not available

DISPLAY: pressing the COD button the COD (Chemical Oxygen Demand) value will be displayed on the main screen. It will be calculated by the measured TOC value using the set COD factor (refer to COD FACTOR menu); pressing the TC button the TC (Total Carbon) value will be displayed on the main screen. It will be calculated by the summary of measured TOC and TIC values

COD FACTOR: pressing > or < is possible to set the TOC multiplying factor to have displayed on the main screen the right COD value

7.3.3.1 TIC CALIBRATION

ZERO AREA TIC: it shows the value in calculation unit of the CO_2 peak area generated by sparging the inorganic carbon eventually present in a distilled water reagent grade sample and in the used reagent, detected by the IR during a ZERO CALIBRATION cycle. This value is equals to ZERO TIC value in mg/l stored by the analyzer as blank.

SPAN AREA TIC: it shows the value in calculation unit of the CO_2 peak area generated by sparging the inorganic carbon present in a TIC standard solution (selected in SET STANDARD VALUE menu), after the reagent addition, detected by the IR during a SPAN CALIBRATION cycle. This value is equals to SPAN TIC value in mg/l stored by the analyzer.

SET STANDARD VALUE:

> : it allows increasing the TIC standard solution value to the concentration, in TIC mg/l, that it will be used in the next SPAN

< : it allows decreasing the TIC standard solution value to the concentration, in TIC mg/l, that it will be used in the next SPAN

CALIBRATE TIC ZERO: after one or more analysis cycles performed with distilled water reagent grade, ***with the analyzer in stand-by conditions***, this button, if pressed, will refresh the ZERO AREA TIC value previously described. It's practically necessary to do this operation every time a new ZERO TIC CALIBRATION of the analyzer will be performed.

CALIBRATE TIC SPAN: after one analysis cycle performed with the selected standard solution, ***with the analyzer in stand-by conditions***, this button, if pressed, will refresh the SPAN TIC AREA value previously described. It's practically necessary to do this operation every time a new SPAN TIC CALIBRATION of the analyzer will be performed.

PAST FROM TOC CAL?: pressing this key, at the end of an analysis cycle, with the analyzer in stand-by conditions, the analyzer will be forced to assume the stored ZERO and SPAN TOC values as ZERO and SPAN TIC values

7.3.3.2 TOC CALIBRATION

SET STANDARD VALUE:

- **>** : it allows increasing the TOC standard solution value to the concentration, in mg/l, that it will be used in the next SPAN calibration
- **<** : it allows decreasing the TOC standard solution value to the concentration, in mg/l, that it will be used in the next SPAN calibration

CALIBRATE TOC ZERO: after one or more analysis cycles performed with distilled water reagent grade, ***with the analyzer in stand-by conditions***, this button, if pressed, will refresh the ZERO AREA TOC value previously described. It's practically necessary to do this operation every time a new ZERO TOC CALIBRATION of the analyzer will be performed.

CALIBRATE TOC SPAN: after one analysis cycle performed with the selected standard solution, ***with the analyzer in stand-by conditions***, this button, if pressed, will refresh the SPAN TOC AREA value previously described. It's practically necessary to do this operation every time a new SPAN TOC CALIBRATION of the analyzer will be performed.

7.3.4 Menu PARAM

> : it allows increasing the delay in seconds of the respective analysis step. Keep pressed this button to increase fast the value.

<: it allows decreasing the delay in seconds of the respective analysis step. Keep pressed this button to decrease fast the value

Standard value for the parameters are:

Sampling delay	60 sec
TIC scrubber delay	120 sec
Reactor delay	90 sec
TOC scrubber delay	180 sec
Waiting delay	200 sec

SAMPLING DELAY (sec): it displays the number of seconds the sample pump is turned on to refresh the sample loop and path with the new sample allowing a good reconditioning of the fluidics

TIC SCRUBBER DELAY (sec) : it displays the number of seconds the analyzer will perform the inorganic removal after a first reagent addition and sample sparging inside the reactor

REACTOR DELAY (sec) : it displays the number of seconds the analyzer will perform the oxidation stage. During this time the sample present in the UV reactor will be heated and kept at 80°C, irradiated with UV energy in presence of reagent to allow the best oxidation possible of organics resent in the sample

TOC SCRUBBER DELAY (sec) : it displays the number of seconds the analyzer will perform the CO2 recovery coming from the oxidation stage, using its IR detector. Practically it's the time in which the TOC peak will be produced, eventually seen on the screen and integrated by the microprocessor

WAITING DELAY (sec) : it displays the number of seconds the analyzer will wait as soon as finished an analysis cycle before to start the next. This delay time is valid only in online operations

DEFAULT?: pressing this key, the analyzer will be forced to restore the default values of the different analysis step delays

: pressing this key is possible to print all the parameters shown on screen

7.3.5 Menu SERVICE

XXXX: using the increase/decrease buttons it's possible to access to the reserved menu through the password. As soon as the right code has been introduced, press the LOCK button to enter in the protected menu

OUTPUT SIGNALS

4-20 mA : pressing this key the 4-20 mA output will freeze to the last analysis value

TOC FS </> : using this key, it is possible to set the 4-20 mA full scale for the TOC measurement, depending on required resolution

COD FS </> : using this key, it is possible to set the 4-20 mA full scale for the TOC measurement, depending on required resolution

SAMPLE AL ENABLE : it allows to enable or disable the sample alarm in case of loss of sample ; this is possible only for online application, when the external fast loop reservoir is used

PUMP PRIMING : it allows a fast load of reagent and D.I. water to prime the tubing. It's useful for start-up or maintenance operations. It is active only with the analyzer in stand-by conditions

REAGENT FILLED UP : it allows to reset to 100% the reagent consumption bar graph. This operation should be done every time the 1 litre reagent container will be refilled

CLEAN CYCLE : it allows to start a cleaning cycle. It is active only with the analyzer in stand-by conditions

RESET COUNTER : it allows to reset the analysis cycles counter

FAULT RESET : it allows to reset the alarms, after an emergency stop or an analyzer failure; this operation will force the analyzer in stand-by conditions

.SECTION 8 - MAINTENANCE

An adequate maintenance is the main basis for excellent analyzer's performance. So it's extremely important to establish a scheduled maintenance program to keep the analyzer clean and in good general conditions.

Table 8-1 : List and frequency of preventive maintenance operations (frequency of the operations could change depending on the application).

OPERATION	FREQUENCY					
	Daily	Weekly	Monthly	Quarterly	Six-monthly	Annual
Visual check of FAULT alarm indicator	✔					
Visual check of liquid enclosures for leakages detection		✔				
Visual check of reagent /DI water presence in container		✔				
Reagent replacement			✔ (or when finished)			
DI water tank for cleaning refill			✔ (or when finished)			
Visual check of glass condenser			✔			
Sample line, plastic filter and fast-loop reservoir cleaning			✔ (or when dirty)			
Copper wool replacement in filter.				✔ (or every time is oxidized)		
Sodalime replacement in filter.				✔ (or every time is violet)		
Calcium chloride filter (dryer unit)				✔ (or every time is exhausted)		
IR detector 1 micron filter					✔ (or every time is	

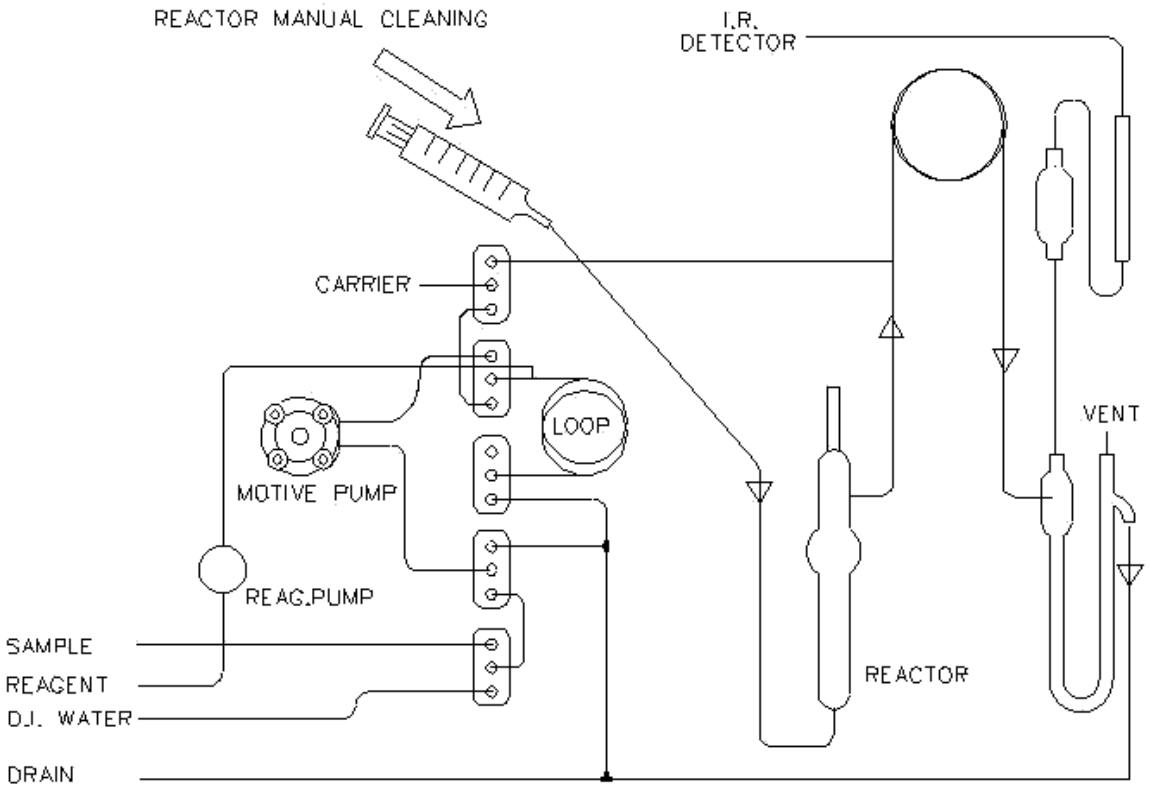
					necessary, for ex. when the level in the U tube is incorrect)	
Span calibration control			✔			
Pump tubing replacement					✔ (or every 5000 cycles)	
Hydraulic line cleaning				✔ (or every time is necessary)		
UV reactor check for leakages						✔
Diagnostic check of infrared analyzer (for qualified personnel only)						✔
Analyzer general inspection (for qualified personnel only)						✔

8.1 TOC MAINTENANCE PROCEDURE

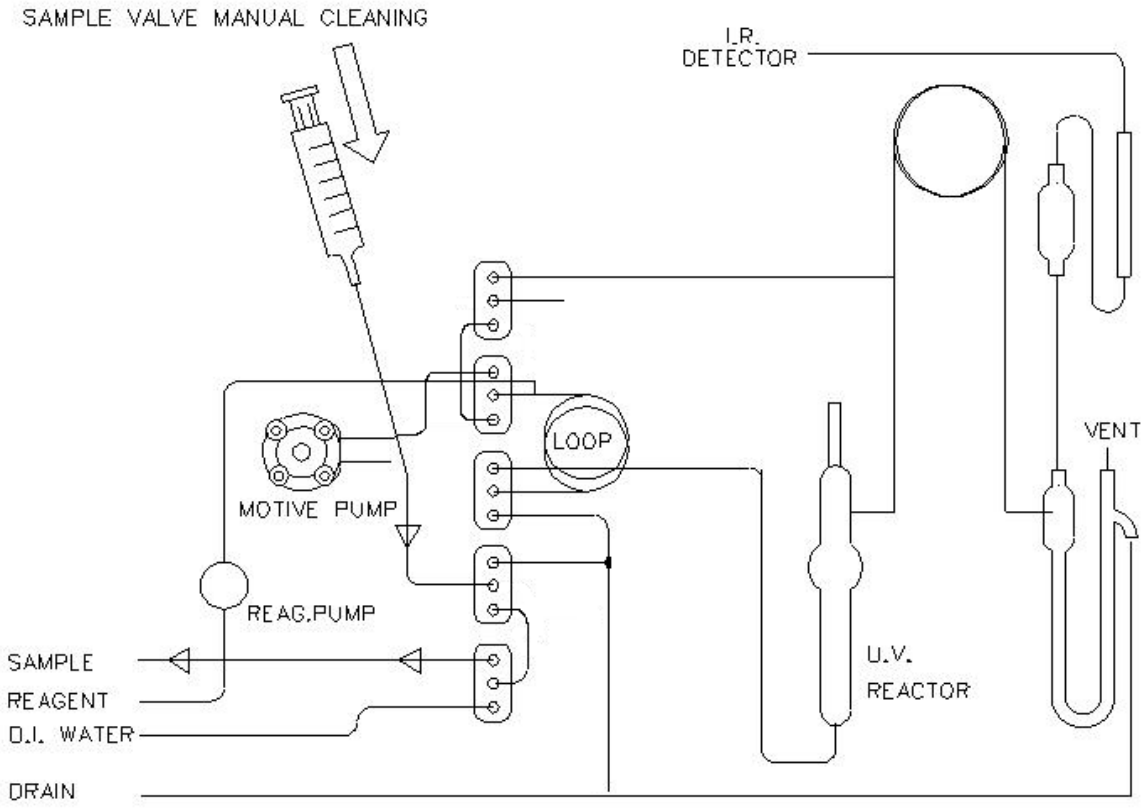
8.1.1 TOOLS / CONSUMABLES NEEDED FOR THE MAINTENANCE:

- 2 syringes (one new to be used with DI water and one for sample line cleaning)
- soda lime cartridge
- halogen (copper wool) filter
- Masterflex norprene tubing 16 for sampling peristaltic pump replacement
- Masterflex norprene tubing 14 for hydraulic lines
- Masterflex silicone tubing 17 for drain line
- fan filters
- DI water
- TOC standard solution for calibration
- gloves
- paper

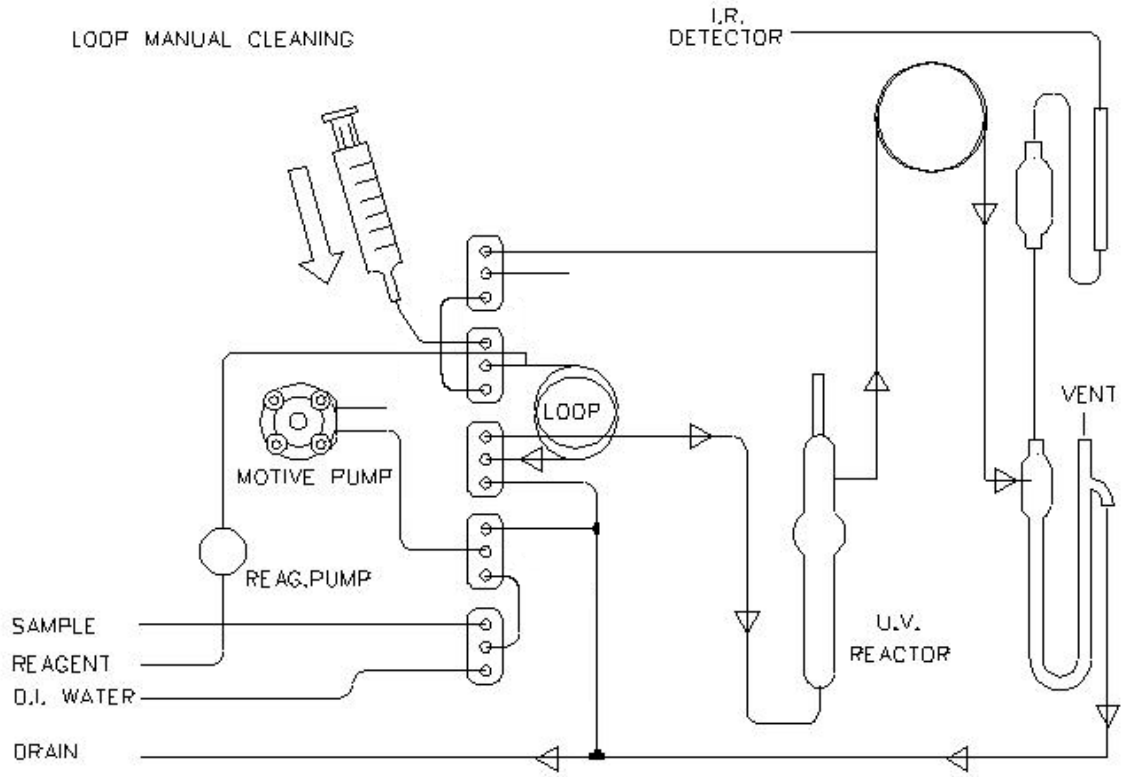
8.1.2 DESCRIPTION OF OPERATIONS

1	Check the reactor temperature > 65°C during the oxidation step and the carrier gas flow on menu 2 Display
2	COMMANDS ⇒ END CYCLE STOP to stop the analyzer at the end of the analysis cycle
3	Check the status of soda lime cartridge and halogen (copper wool) filter. Replace if necessary.
4	Check the level of the tank of DI water used for cleaning cycles. Refill if necessary.
5	Reactor cleaning with a syringe and DI water. For this operation disconnect the first tubing on the top of the third valve (see picture). 
6	Peristaltic pump replacement (at least every 5000 cycles, Masterflex norprene tubing 16). Reset the cycles counter (SERVICE ⇒ RESET COUNTER).

7	Cleaning of the sample line with a cleaning solution or with DI water. For this operation disconnect the first tubing on the top of the fourth valve (see picture).



8	Plastic filter on the sample line cleaning or replacement. Cleaning of the sample line.

9	Cleaning of the loop with DI water (third tubing on the second valve, see picture) and control of the drain. 
10	Fan filters, check the status, replace if necessary.
11	Freeze the 4-20 mA output during maintenance. (SERVICE ⇒ 4-20 mA FREEZE)

12	N°2 PUMP PRIMING. (SERVICE ⇒ PUMP PRIMING)
13	In the locked menu set the secret code 6699, set CLEAN DELAY time to 60 seconds.
14	N°2 CLEAN CYCLES. (SERVICE ⇒ CLEAN CYCLE). Set the cycle time as in point 13 to the previous value.
15	**CALIBRATION**: run n°3 analysis cycle on the standard solution chosen (use manual sample tubing). With the analyzer in STAND-BY conditions (COMMANDS ⇒ END CYCLE STOP), press CALIBR key to open the calibration menu window, press TOC key of MANUAL CALIBRATION menu. Check the value of the standard solution and modify if necessary. Keep pressed the CALIBRATE SPAN button. This operation will refresh the stored SPAN AREA.
16	Reconnect the sample line. Restart the analyzer on-lineCOMMANDS ⇒ RUN ON-LINE.
17	Activate the 4-20 mA output (SERVICE ⇒ 4-20 mA)

Write the maintenance operation on the scheduled maintenance report.

8.1.3 SCHEDULED MAINTENANCE REPORT

Date:
Operator:

TEMPERATURE	°C	CARRIER FLOW	cc/min

Halogen (copper wool) filter replacement	YES	Soda lime cartridge replacement	YES
	NO		NO

Reagent replacement	YES SERVICE ⇒ REAGENT FILLED UP	DI water cleaning tank refill	YES
	NO		NO

Peristaltic pump replacement (at least every 5000 cycles)	YES SERVICE ⇒ RESET COUNTER
	NO

ZERO AREA	
TOC STANDARD VALUE	mg/l
TOC SPAN AREA	

Signature:

_____

8.2 Pump tubing replacement

The peristaltic pump head is located in the fluidics section. Before to proceed to replace the tubing, please read with attention hazards and dangers list in section 1 and health and reagents safe data sheets); It is also recommended to wear adequate clothes, gloves and eyes protection and take extreme care sample spills during tubing replacement. Proceed as follows:

a) Stop the analyzer
b) using the key, open the liquids enclosure
c) unscrew manually the four wings nuts which hold the pump head.
d) disconnect the pump tubing from its inlet and outlet fittings, taking extreme caution of liquid spills
e) slide the pump head to left and remove the pump head
f) separate the two halves taking care of rotor and remove the used tubing taking caution of spills
g) place the pump half containing the rotor in one hand and place the rollers in the 2, 6 and 10 o' clock positions. Place tubing in the outer port and against the two rollers as shown, keeping your thumb on the tubing to hold it in place, Insert tubing key on the back of the rotor shaft and push in as far as possible. Tubing is now positioned in deep into the pump head body. With the key firmly pressed against the rotor, turn counterclockwise and push down while turning until tubing has surrounded the rotor
h) tubing is now on place. Remove key and position other pump half into the rotor shaft and snap shaft. Be careful not to pinch tubing between plastic pump halves
i) check if the pump turns correctly using the key
j) tighten with fingers the pump head slide it into the mounting screws moving the roller block with the key or with a screwdriver until the shaft aligns with the motor drive
k) Secure the four wing nuts tighten them with fingers until to have a firm mounting of the pump head.
l) Restart the analyzer

Figure 8-1: Pump tubing replacement details



8.3 Sodalime replacement in sodalime filter

The sodalime filter is located in the internal part of the analyzer enclosure (refer section 1 for hazard warnings); all handling and manipulations operations on chemicals labeled with symbol should be made by qualified personnel in accordance with national or local regulations. Qualified Personnel means person who has been fully trained and has professional experience to avoid chemical hazards and dangers




Warning: Sodalime (granules) is a strong oxidizer and should be handled with extreme care.

Irritating to eyes, respiratory system and skin. It causes burns. Avoid contact with skin. Do not breathe dust. Wear suitable gloves, face mask, clothes protection and operate in adequate environment. Before to proceed to sodalime replacement in sodalime filter, read with care the material safety data sheets supplied with this chemical to take all the necessary precautions when handling. Used sodalime must be disposed according with national or local environmental regulations regarding hazardous and poisonous materials.

Fig. 8-2: sodalime replacement in sodalime filter

a) open the analyzer's enclosure
b) disconnect the inlet and outlet rubber plugs of the filter
c) remove the filter glass body from its support clamps
d) pull out the cotton disc and discharge the used sodalime in a proper container for disposal, taking all precautions its handling
e) fill the glass body with new sodalime granules, insert the cotton disc and insert the upper cap
f) install the filter on its support clamps and reconnect inlet and outlet rubber plugs

.SECTION 9 – ANALYZER SHUT DOWN

For long shut down period, please proceed as follows:

1. replace the reagent in the container with distilled or tap water
2. disconnect the sample line and full the fast-loop reservoir (if present) with distilled or tap water
3. run the analyzer for at least 2 cycles in these conditions, with all the inlet tubing attached to a distilled or tap water container
4. empty the hydraulic line from water (for the U-tube use a syringe)
5. put the analyzer in stand-by conditions
6. turn off the analyzer main power disconnecting the plug from 220VAC power line.

SECTION 10 – SPARE PARTS LIST

P/N	Description	Package of	1 year suggested spare kit
T1000-001C	Pump head 7014	1	on request
T1000-002C	Pump head 7016	1	on request
T1000-003C	T fitting/PP/ tubing 16	1	2
T1000-004C	T fitting/PP/ tubing 14	1	2
T1000-005C	Straight connection fitting 17-16	1	2
T1000-006C	Straight connection fitting 16-14	1	2
T1000-007C	Quartz UV reactor	1	on request
T1000-008C	Gas-liquid separator	1	on request
T1000-009C	Glass condenser	1	on request
T1000-010C	Sample level sensor	1	on request
T1000-011C	Fast-loop reservoir assembly (complete)	1	on request
T1000-012C	Clamp diam. 12,5	1	on request
T1000-013C	UV lamp	1	on request
T1000-014C	Cooler fan 24 VDC	1	on request
T1000-015C	Air fan 220 VAC	1	on request
T1000-016C	UV power supply 220 VAC	1	on request
T1000-017C	Sample pump motor 220 VAC	1	on request
T1000-018C	Reagent pump motor 24 VDC	1	on request
T1000-019C	Air compressor 220 VAC	1	on request
T1000-020C	Pressure regulator 0-30 psi	1	on request
T1000-021C	Digital flow meter	1	on request
T1000-022C	Sodalime filter assembly (complete)	1	on request
T1000-023C	Sodalime filter glass body	1	on request
T1000-024C	Sodalime filter cap	1	on request
T1000-025C	Halogens filter assembly	1	on request
T1000-026C	Halogens filter glass body	1	on request
T1000-027C	NDIR assembly 2000 ppm	1	on request
T1000-028C	Microprocessor board	1	on request
T1000-029C	Coprocessor board	1	on request
T1000-030C	A/D board	1	on request
T1000-031C	D/A board	1	on request
T1000-032C	Touch screen – complete - TOC	1	on request
T1000-033C	3-ways valve - TOC	1	on request
T1000-034C	norprene tubing for 7014 pump	7,5 mt.	1
T1000-035C	norprene tubing for 7016 pump	7,5 mt.	1
T1000-036C	PFA tubing 1/16 / capillaries	7,5 mt.	on request
T1000-037C	PFA tubing 1/8"	7,5 mt.	on request
T1000-038C	Sodalime package	1 Kg	1
T1000-039C	Copper wool package for halogens filter	5	1

.SECTION 11 – GLOSSARY OF TERMS

Table 11-1: glossary of terms

TERM	DESCRIPTION
ACIDIFICATION	Aqueous solution pH lowering below 7 by acid addition
SODALIME	Chemical compound (in granular) capable to adsorb CO2 and humidity
EPA	Environmental Protection Agency
KHP	Chemical compound used for TOC standard solution preparation (Potassium Hydrogen Phthalate)
MG/L	Milligrams per litre (used to express the concentration of an aqueous solution)
NDIR	Non Dispersive Infra red analyzer
PERISTALTIC PUMP	It consists of two parts called rotor and housing. The tubing is placed between these two parts and it is squeezed by the rotor moving. The rollers on the rotor move across the tubing and push the fluid. The tubing behind the rollers recovers its shape, created a vacuum and draws fluid in behind it.
PFA	Perfluoroalkoxy / thermoplastic compound (Teflon® PFA) with high chemical resistance
PPM	Parts per million (used to express the concentration of an aqueous solution)
SPARGING	Removal of dissolved gas present in a liquid sample by a carrier gas flow in the liquid sample
TIC	Total Inorganic Carbon, defined as carbon present in a sample that is converted to CO_2 gas after acid addition and sparging
TOC	Total Organic Carbon, usually defined as carbon content in a sample that is converted to CO_2 gas by oxidation, after inorganic carbon removal
UV	Ultraviolet
VENT	Waste gas outlet