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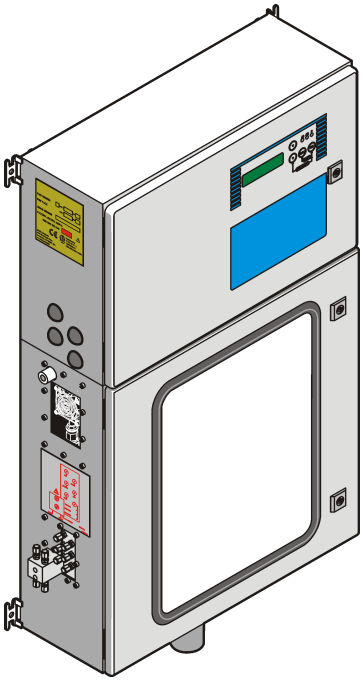
astroTOC UV/Turbo Analyzer

03/2012, Edition 1

User Manual



Specifications

Specifications are subject to change without notice.

Specification	Details
Dimensions (W x D x H)	60 x 21 x 98.1 cm (26.6 x 8.3 x 38.6 in.)
Enclosure	Rating: NEMA 4X/IP66 Material: Cold-rolled epoxy powder-coated steel, optional stainless steel (304)
Weight	54 kg (120 lb)
Power requirements	Single phase, 115 or 230 VAC ±10%, 50/60 Hz (not rated for BI or multi phase)
Power cable	18–12 AWG
Maximum power consumption	300 W
Fuses	IEC127 Sheet III Type 2: 1 A anti-surge, 250 V; 2 A anti-surge, 250 V; 4 A anti-surge, 250 V; 4 A quick blow, 250 V
Pollution degree/overvoltage category	2/II
Operating temperature	5 to 40 °C (41 to 104 °F)
Operating altitude	2000 m (6570 ft) maximum
Storage temperature	5 to 40 °C (41 to 104 °F)
Maximum relative humidity	80% to 31 °C decreasing linearly to 50% at 40 °C
Relays	5 output relays and 1 input relay, 3 A at 250 VAC; 0.5 A at 30 VDC
Analog outputs	Two analog outputs, user configurable, optically isolated, self powered. Maximum resistive load 600 Ω.
Analysis method	UV persulfate oxidation with acid sparging for TIC removal followed by CO_2 NDIR detector measurement
Measurement range (each model has a specific range)	Standard: 0–5 to 0–20,000 mg/L TOC
	Turbo: 0–50,000 µg/L (0-50 mg/L) TOC
Response time	Standard: T90 ≤ 8 minutes; T20 ≤ 3 minutes (range-dependent)
	Turbo: T90 ≤ 5 minutes (0–5 mg/L); T20 ≤ 3 minutes
Accuracy/Repeatability/Linearity	Standard: ±2%, full-scale undiluted; ±4%, full-scale diluted
	Turbo: ≤ 4% or 8 µg/L (whichever is greater)
Method detection limit	Standard: ≤ 0.015 mg/L at 0–5 mg/L 25 °C (77 °F)
	Turbo: ≤ 5 µg/L at 0–5000 µg/L
Signal drift (60 days)	< 2% with auto clean and auto calibration
Sample pressure	At atmospheric pressure
Flow rate	25–200 mL/minute 25–60 mL/minute with an external cooler
Sample temperature	2 to 70 °C (36 to 158 °F)
Carrier gas	Clean, CO_2-free air at 2.8 bar (40 psi) minimum to 3.8 bar (55 psi) maximum. Recommended 3.1 bar (45 psi).

Specification	Details
Carrier gas usage	Standard: 450 mL/min in TOC mode; 250 mL/minute in TC mode
	Turbo: approximately 380 mL/minute at atmospheric pressure
Certifications	CE certified, Listed to UL and CSA safety standards by ETL
Warranty	US: 1 year; EU 2 years

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/98/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxillary items for proper disposal.*
	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates the need for protective eye wear.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol indicates that the marked item requires a protective earth connection. If not provided with a plug on a cord, connect positive earth to this terminal (U.S. cord set provides ground).

Product overview

⚠ DANGER	
	Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.

⚠ DANGER	
	Chemical hazard. Do not use the analyzer to measure samples that contain chlorine compounds as chlorine compounds react with UV light and produce harmful gases.

⚠ CAUTION	
	Chemical exposure hazard. The UV lamps in this instrument contain mercury. Dispose of chemical wastes in accordance with applicable local, regional and national regulations.

This instrument uses the EPA-approved UV persulfate oxidation method to measure total organic carbon (TOC) or total carbon (TC) in:

Standard units

- Boiler feed water
- Pharmaceutical process water
- Condensate and cooling water
- Bulk chemical
- Outfall units
- Industrial wastewater
- Industrial effluents

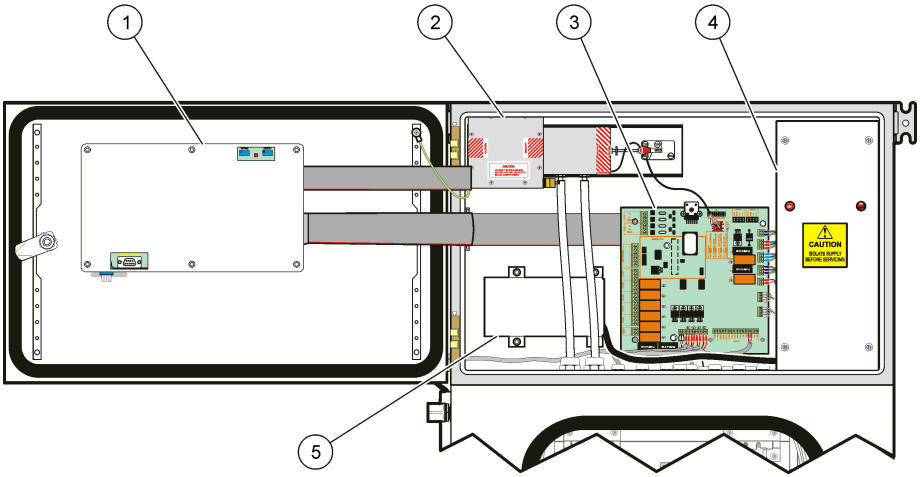
Turbo units

- Boiler feed water
- Pharmaceutical process water
- Condensate and cooling water
- Semiconductor reclaimed water

This instrument has an EPA mode to comply with the USEPA requirements for drinking water. The dual-stream inlet block must be used with the EPA mode. This instrument has two enclosures:

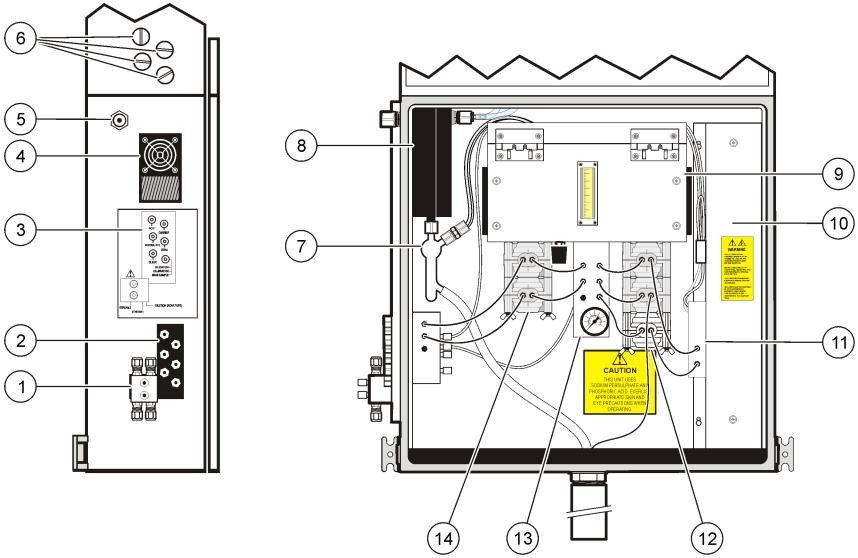
- Top enclosure for electronics (Figure 1)
- Bottom enclosure for liquids (Figure 2)

Figure 1 Top enclosure



1 8000 display/controller board	**4** Power supply
2 Infrared (IR) bench	**5** Surge suppressor
3 8001 I/O board	

Figure 2 Side view and bottom enclosure

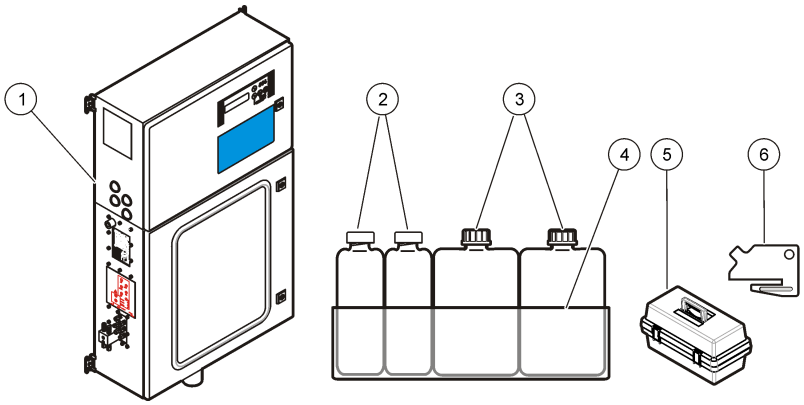


1 Single stream inlet block	**8** Condenser
2 Plumbing ports	**9** Pump module assembly and flow controller
3 Label for the plumbing ports	**10** UV lamp assembly
4 Condenser fan	**11** UV reactor manifold
5 Waste gas vent	**12** Persulfate and resample pumps
6 Electrical access ports with plugs	**13** Sparger manifold and pressure gauge
7 Gas liquid separator (GLS)	**14** Acid and sample pumps

Product components

Make sure that all components have been received. Refer to Figure 3. If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

Figure 3 Instrument components



1 astroUV/Turbo analyzer	**4** Tub
2 4-liter container (2x)	**5** Tool box
3 19-liter container (2x)	**6** Tubing loading key[1]

[1] Put in the tool box.

The tool box contains:

- Quick reference card
- Cap and tubing assembly for 19-liter bottle (2x)
- Cap and tubing assembly for 4-liter bottle (2x)
- Modified cap for 4-liter bottle (2x)
- Drain pipe
- Cable strain relief fittings (2x)
- Fuse, 1 A
- Fuse, 4 A
- Hex ballend driver (4x)
- Nut driver
- Replacement tubing and fittings
- TC conversion parts

Installation

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Installation guidelines

Install the analyzer:

- In a dry, well ventilated, temperature controlled location
- As close to the sample source as possible to decrease analysis delay
- Near a drain and the carrier gas source
- Near a vent to outdoors to plumb the waste gas vent outdoors
- So that the power cable plug or power disconnect switch are visible and easily accessible

Mechanical installation

Lift the instrument

⚠ WARNING	
	Personal injury hazard. Instruments or components are heavy. Use assistance to install or move.

Lift the instrument with a forklift. Put the blades of the forklift under the enclosure on each side of the drain. Make sure that the top of the enclosure does not tilt during travel.

Wall mounting

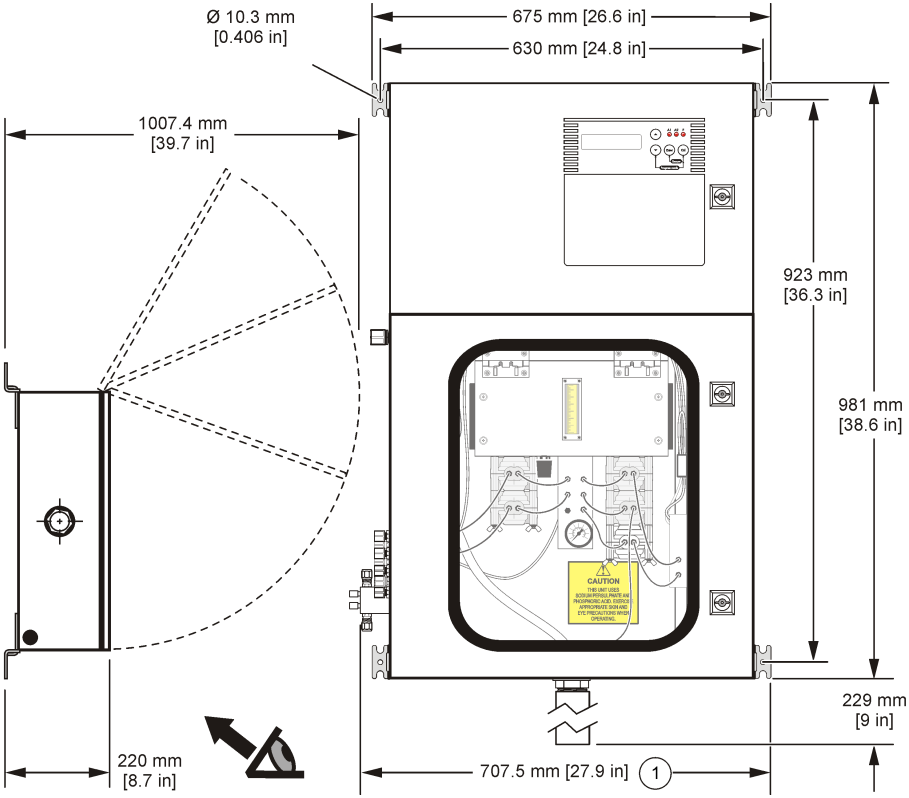
⚠ DANGER	
	Risk of injury or death. Make sure that the wall mounting is able to hold 4 times the weight of the equipment.

Mount the analyzer to a wall with the four mounting brackets on the analyzer.

Mount the analyzer so that the display is at or slightly above eye level.

Make sure that there is at least 400 mm (16 in.) of clearance on the sides and bottom, and 1000 mm (40 in.) in the front of the analyzer. Refer to Figure 4 for dimensions.

Figure 4 Analyzer dimensions



1 Single stream inlet block shown. 784.5 mm (30.9 in) with dual stream inlet block.

Optional rack mount

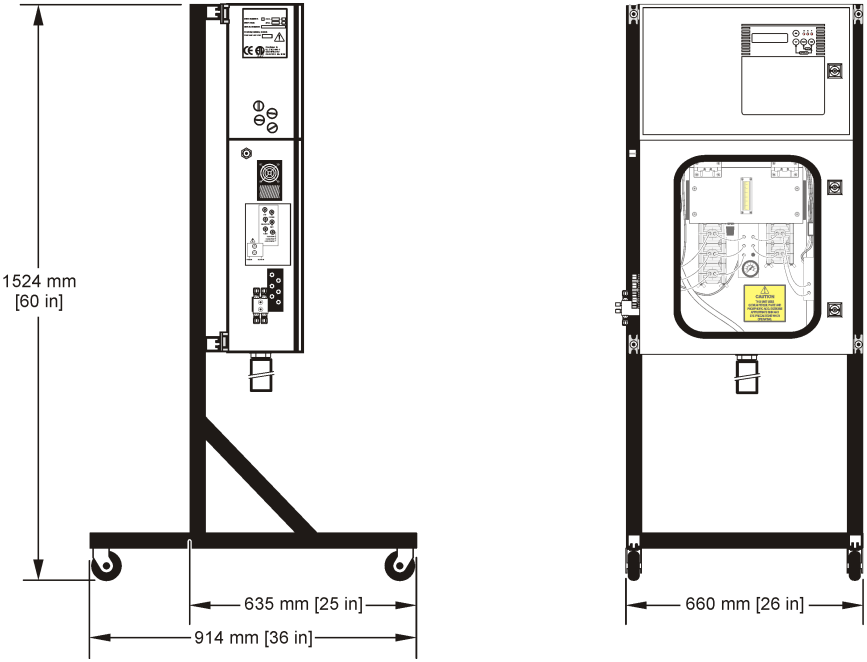
⚠ DANGER

Personal injury hazard. Make sure that the equipment is stable and use assistance to install and move.

Mount the analyzer to the rack with the four mounting brackets on the analyzer. Only use the rack assembly in Table 30 on page 79.

Make sure that there is at least 400 mm (16 in.) of clearance on the sides and bottom, and 1000 mm (40 in.) in the front of the analyzer. Refer to Figure 4 on page 12 and Figure 5 for dimensions.

Figure 5 Rack dimensions



Electrical installation

DANGER

Electrocution hazard. Always remove power to the instrument before making electrical connections.

DANGER

Electrocution hazard. If this equipment is used outdoors or in potentially wet locations, a Ground Fault Circuit Interrupt (GFCI/GFI) device must be used for connecting the equipment to its main power source.

DANGER

Electrocution hazard. Protective Earth Ground (PE) connection is required.

Use shielded twisted-pair cable for all electrical connections except input power. Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than the allowed levels.

To prevent shock hazards from ground currents in inadequate ground systems, connect the shield at only the analyzer end. Do not connect the shield wire at both ends.

Electrostatic discharge (ESD) considerations

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Refer to the steps in this procedure to prevent ESD damage to the instrument:

- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.
- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

Electrical access ports

Make electrical connections through the electrical access ports. Refer to Figure 2 on page 9. Remove plugs as necessary.

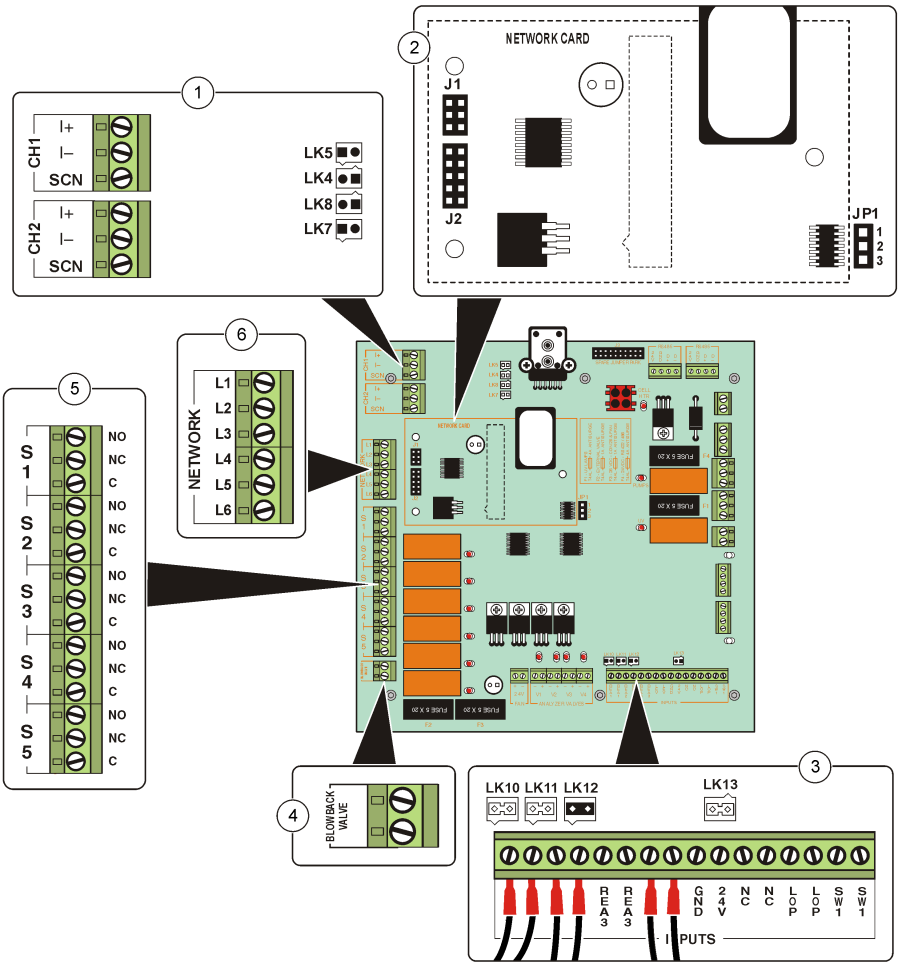
To keep the environmental rating and for safety:

- Make sure that all electrical access ports that are not used have the supplied plugs installed.
- Use sealing-type PG11 fittings or equivalent for power cords, wiring and conduit. Refer to Figure 7 on page 17.

Refer to Specifications on page 5 for wire gauge requirements.

Wiring overview

Figure 6 8001 I/O board connections



1	Analog output connectors and links	**4**	Blowback valve connector
2	Location for optional communications card and JP1	**5**	Output relay connectors
3	Level detector connectors (REA1-REA3), level detector links (LK10-LK13) and input relay connector (SW1)	**6**	Communications card connectors[1]

[1] Use only when the optional communication card is installed.

Wiring for power

⚠ DANGER

Fire hazard. Install a 15 A circuit breaker in the power line. A circuit breaker can be the local power disconnect, if located in close proximity to the equipment.

⚠ WARNING

Electrocution hazard. Only the hot (L) connection is fused. Connect only single phase power sources to equipment. Do not use bi-phase or poly-phase supply sources.

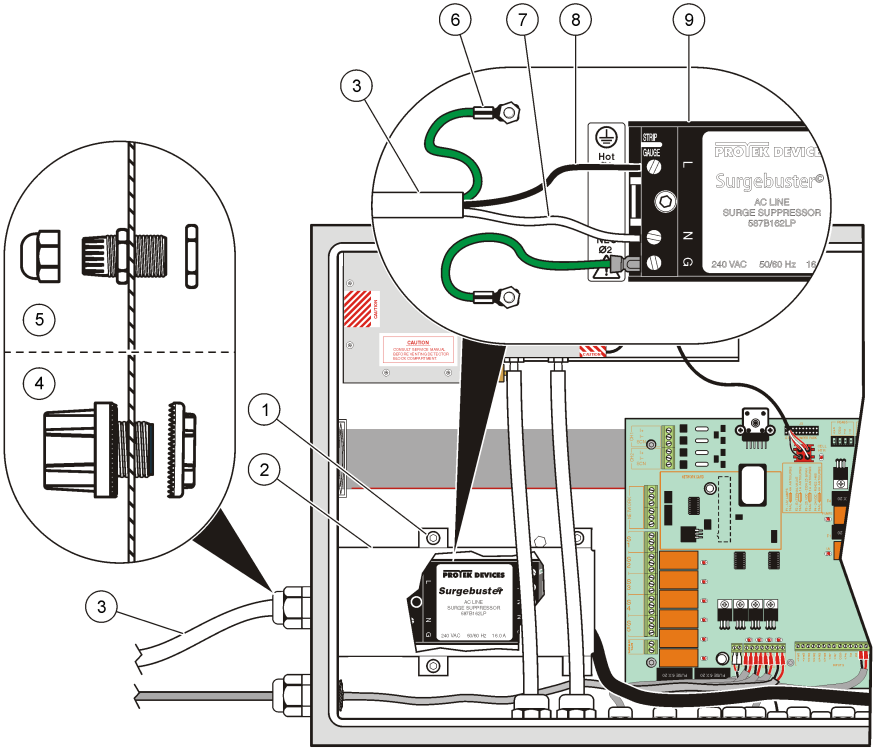
Connect power with conduit or a power cable. Refer to Figure 7 and Table 1.

For installation with conduit, install a power disconnect switch or circuit breaker near the analyzer and mark it as the disconnect device for main power to the analyzer.

For installation with a power cable, make sure that the power cable is:

- Less than 3 m (9 ft) in length
- Rated for at least 60 °C (140 °F) and applicable to the installation environment
- Not less than 18 AWG
- A power cable with a three-prong plug (with ground connection) that is applicable to the supply connection
- Connected through a cable gland (strain relief) that holds the power cable securely and seals the enclosure when tightened
- Does not have a locking type device so it can be used as the power disconnect device

Figure 7 Connect power



1 Cover screw (4x)	**6** Protective earth ground (G)
2 Surge suppressor cover	**7** Neutral (N)
3 Power cable	**8** Hot (L)
4 Conduit fitting	**9** Surge suppressor
5 Strain relief fitting for cables and wiring	

Table 1 AC wiring information

Connection	Color—North America	Color—EU
Hot (L)	Black	Brown
Neutral (N)	White	Blue
Protective earth ground (G)	Green	Green with yellow stripe

Connect the relays (optional)

⚠ WARNING

Potential Electrocution Hazard. Power and relay terminals are designed for only single wire termination. Do not use more than one wire in each terminal.

⚠ CAUTION

Fire hazard. Relay loads must be resistive. Always limit current to the relays with an external fuse or breaker. Obey the relay ratings in the Specifications section.

⚠ CAUTION

Fire and electrical shock hazard. Obey relay load limitations of the external circuits specified in the Specifications section. The circuit application will determine the wire gauge needed; however, wire gauge less than 18 AWG is not recommended.

The analyzer contains:

- Five output relays (S1–S5)—single-pole changeover relays with volt-free contacts
- One input relay (SW1)—normally open contact relay with volt-free contacts

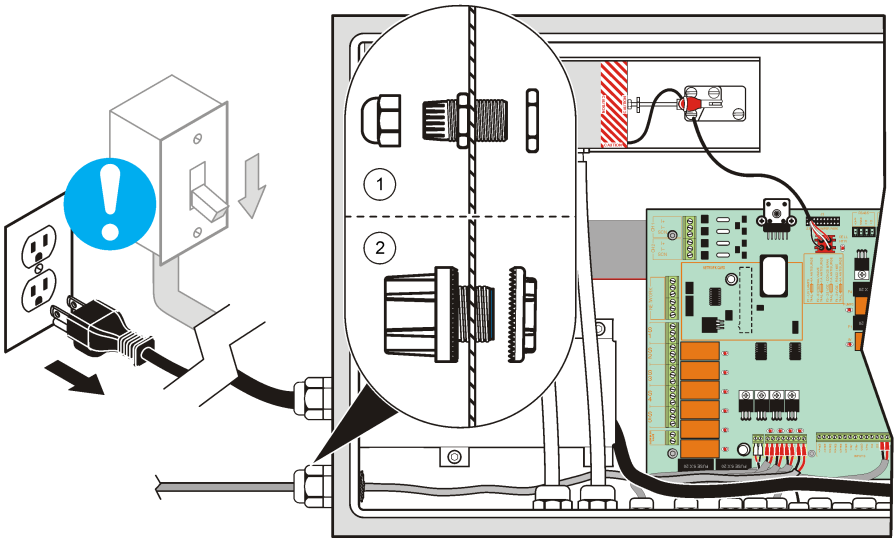
Use the relays at either all high voltage (greater than 30 V-RMS and 42.2 V-PEAK or 60 VDC) or all low voltage (less than 30 V-RMS and 42.2 V-PEAK, or less than 60 VDC). Do not configure a combination of both high and low voltage.

Use the output relays to output the status of the analyzer. Refer to Set a condition to each output relay on page 39.

Use the input relay to remotely control the analyzer (e.g., stop measurements or start an auto calibration). Refer to Set a condition to the input relay on page 40.

Refer to Figure 6 on page 15, Figure 8 and Table 2 to make relay connections.

Figure 8 Connect relays



1 Strain relief fitting for cables and wiring	**2** Conduit fitting

Table 2 Output relay wiring

NO	NC	COM (C)
Normally open	Normally closed	Common

Connect the analog outputs (optional)

NOTICE

Use double-insulated shielded cables to connect to external digital or analog circuits.

The analyzer contains two isolated analog outputs (CH1 and CH2). Use the analog outputs for analog signaling or to control external devices.

Assign the analog outputs to a measured parameter (i.e., pH, temperature, flow or calculated values). Refer to Set a condition to each the analog output on page 37.

Refer to Figure 6 on page 15 to make analog output connections. Refer to Specifications on page 5 for wiring and load impedance specifications.

The default analog output is 4–20 mA (no jumpers). Install jumpers across the links as shown in Table 3 to change the analog outputs to 0–10 V or 4–20 mA with I– terminals connected to ground (PE) as necessary.

If the configuration of the analog output jumpers is changed, it may be necessary to calibrate the analog outputs. Refer to Calibrate the analog outputs on page 70.

Notes:

- The analog outputs are isolated from the other electronics, but are not isolated from each other.
- The analog outputs are self-powered. Do not connect to a load with voltage that is independently applied.
- The analog outputs cannot be used to supply power to a 2-wire (loop-powered) transmitter.

Table 3 Set the analog output

Analog output	Connector	Link
0–10 V	CH1	LK5
	CH2	LK7
4–20 mA with the I- terminal grounded	CH1	LK4
	CH2	LK8

Connect the optional communications network card

Install the communications card. Refer to the installation instructions supplied with the card.

Connect a remote device to the communications card connector. Refer to Figure 6 on page 15 for connectors. Refer to Table 4 for communication connections.

For RS422 or RS485 communications, install a jumper across pins 2 and 3 on JP1 on the 8001 I/O board.

Configure the communications card. Refer to Configure serial communications on page 41.

Table 4 Communication connections

Pin	RS232	RS422	RS485
L1	RD	RD–A	D+
L2	—	RD–B	D-
L3	TD	TD–A	—
L4	—	TD–B	—

Table 4 Communication connections (continued)

Pin	RS232	RS422	RS485
L5	Signal common	Network signal common	Network signal common
L6	Shield	Shield	Shield

Connect an optional blowback filter valve

Install a blowback filter valve. Refer to the installation instructions supplied with the blowback filter valve.

Connect the blowback filter valve to the blowback valve connector. Refer to Figure 6 on page 15.

The blowback valve connector is a relay that supplies 24 VDC (maximum 500 mA) to one valve on an extended blowback filter system. Configure the relay output for separate on and off time intervals. Refer to Schedule validations, calibrations and cleaning on page 33.

If more than 500 mA is necessary to operate the blowback valve or more than one blowback valve is necessary, put a power supply between the blowback valve connector and blowback filter valve(s).

Connect optional level detectors

Install up to four level detectors. Refer to the installation instructions supplied with the level detectors.

The optional level detectors give warnings of low reagent levels or a high wastewater level in the drain pan.

Connect the level detectors to the level detector connectors. Refer to Figure 6 on page 15 and Table 5.

If a connector is not used, put a jumper on the link for the connector. Refer to Table 5.

Table 5 Connector and jumper assignments

Level detector	Connector	Link
Reagent 1	REA1	LK10
Reagent 2	REA2	LK11
Reagent 3[1]	REA3	LK12
Drain pan	REA4	LK13

[1] A third reagent is typically not used.

Plumbing

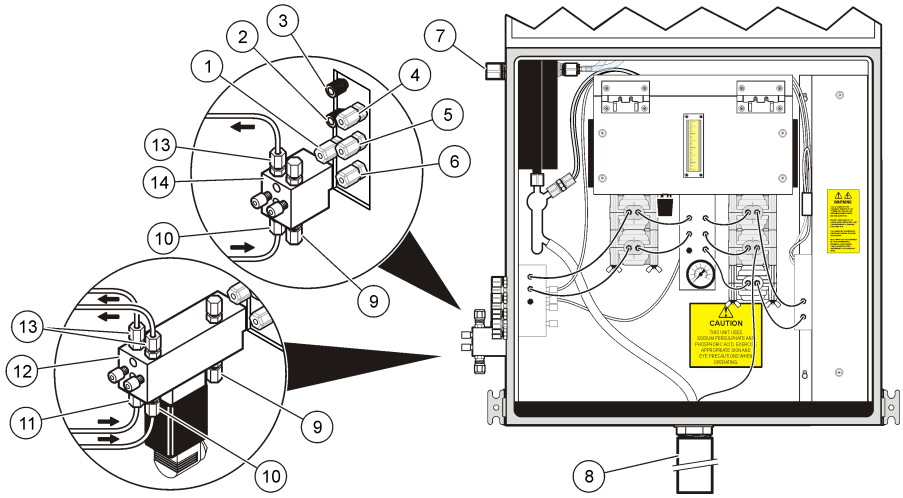
Make sure to use the size specifications given for tubing. The flow path must increase in diameter as water flows through the system to prevent build-up of backpressure.

Plumbing overview

To keep the environmental rating, make sure that the plumbing ports that are not used are closed.

Tubing and plumbing hardware are supplied by the user.

Figure 9 Plumbing ports



1 Cleaning solution inlet	**6** Span standard/grab sample inlet	**11** Sample stream 2 inlet
2 Sodium persulfate inlet	**7** Waste gas vent	**12** Optional dual stream inlet block
3 Phosphoric acid inlet	**8** Drain	**13** Sample bypass outlet(s)
4 Carrier gas inlet	**9** Dilution inlet	**14** Single stream inlet block
5 Zero standard inlet	**10** Sample stream 1 inlet	

Install the optional dual stream inlet block

Refer to the installation instructions supplied with the dual stream inlet block.

Plumb the drain

⚠ DANGER

Potential Electrical shock and fire hazards. The drain line must be connected to a drain system that is at ambient pressure.

⚠ CAUTION

Chemical hazard. If there is a leak in the fluid system, hazardous substances may leak out of the lower enclosure. Put the supplied reagent bottle tray or a bucket under the drain to catch any spills.

⚠ CAUTION

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

1. Remove the drain fitting from the drain under the enclosure.
2. Put the stainless steel pipe through the drain fitting.
3. Install the drain fitting on the drain.

Plumb the sample line and sample bypass

1. Plumb tubing to the sample inlet(s).

2. Put the tubing in the zero standard container.
3. When the start-up is complete, plumb a sample source to the sample inlet(s) and plumb the sample bypass outlet(s). Refer to Figure 9 on page 21.

   Refer to Specifications on page 5 for sample requirements.
4. Install a check valve on the sample line near the analyzer so that the sample stream can be stopped for maintenance.

Sample line considerations

Select a good, representative sampling point for the best instrument performance. The sample must be representative of the entire system.

To prevent erratic readings:

- Collect samples from locations that are sufficiently distant from points of chemical additions to the process stream.
- Make sure that the samples are sufficiently mixed.
- Make sure that all chemical reactions are complete.

Connect the sample stream

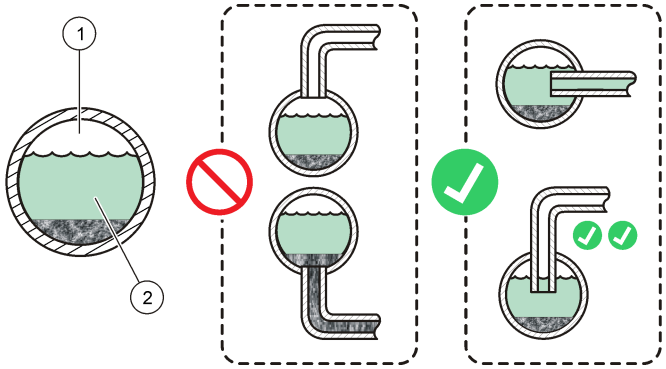
Install each sample line into a larger process pipe to minimize interference from air bubbles or pipeline bottom sediment. A sample line going into the center of a process pipe is best.

Figure 10 shows examples of good and bad methods of sample line installation into a process pipe.

Keep sample lines as short as possible. Sediment can accumulate in long sample lines.

Sediment absorbs total organic carbon during occurrences of high concentration. Later, total organic carbon dissolves into the sample and causes high readings or longer response times to sample concentration changes.

Figure 10 Sampling methods



1 Air	**2** Sample flow

Plumb the cleaning solution line

1. Plumb tubing to the cleaning solution inlet (CLEAN port). Refer to Figure 9 on page 21.
2. Put the tubing in a container of cleaning solution.

Plumb the sample dilution line

Refer to Figure 16 on page 54 to identify if the analyzer has a dilution pump. If the analyzer has a dilution pump, plumb the sample dilution line.

1. Plumb tubing to the dilution inlet. Refer to Figure 9 on page 21.

2. Put the tubing in a container of deionized water.

Plumb the waste gas vent

⚠ DANGER

Chemical exposure hazard. Inhaled gases from toxic waste can cause death. Plumb the waste gas line to air outside the facility, so that toxic gas does not collect indoors.

⚠ WARNING

Potential gas inhalation hazard. The waste gas port must be connected to outside air or a fume hood.

Attach a carrier gas

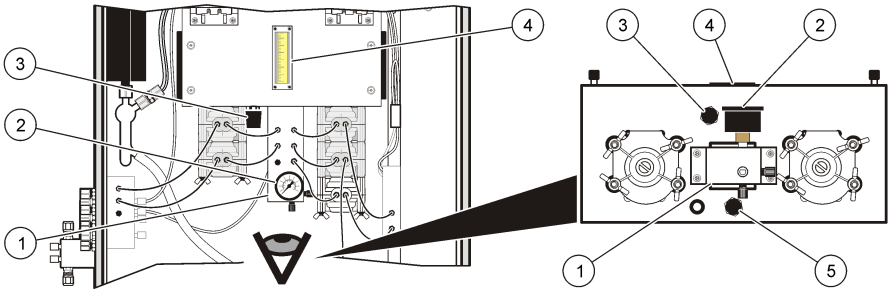
1. Attach an external source of compressed, CO_2-free air or pure nitrogen to the carrier gas inlet (Carrier port). Refer to Figure 9 on page 21.

   Do not use oxygen.

   Note: *As an alternative, a 300 SCF bottle of CO_2 free air or nitrogen can be attached. A 300 SCF bottle typically supplies gas for 2 to 3 weeks.*
2. Install a regulator on the carrier gas line to keep the carrier gas pressure 55 psi or less.
3. Set the carrier gas pressure according to the carrier gas requirements in Specifications on page 5.
4. Turn the pressure regulator knob in the analyzer until the reading shown on the pressure gauge is 172 kPa (25 psi). Refer to Figure 11.

   The pressure regulator knob is behind the sparger manifold.

Figure 11 Front view



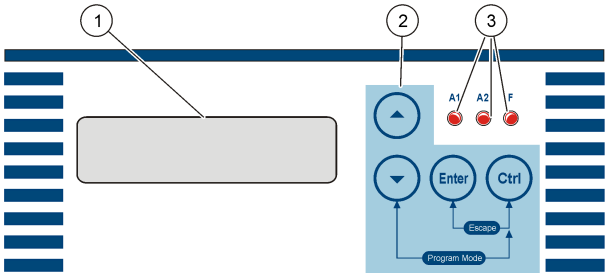
1 Sparger manifold	**4** Flow meter
2 Pressure gauge	**5** Pressure regulator knob
3 Flow adjustment knob	

User interface and navigation

User interface

Figure 12 shows the keypad and display. Table 6 gives descriptions of the indicator lights.

Figure 12 Keypad and front panel display



1 Display	**3** Indicator lights
2 Keypad	

Table 6 Indicator lights

Light	Name	Description
A1	Alarm 1	Illuminates when the TOC (or TC) reading is greater than the limit set for Alarm level 1.
A2	Alarm 2	Illuminates when the TOC (or TC) reading is greater than the limit set for Alarm level 2.
F	Fault or maintenance event	Illuminates when one or more maintenance event occurs. Flashes when one or more fault event occurs. Push ▲ one time from the main screen to show the fault or maintenance event(s) that has occurred.

Display description

Refer to Figure 13 for descriptions of the data shown on the main screen.

When dual stream is selected in the configuration, the main screen shows the selected sample stream for 6 seconds. Then, the stream that is not selected is shown for 3 seconds and the time the stream was last measured.

From the main screen, push ▲ to scroll to the Event screen, Status screen and then the Prim v Cal screen.

- Event screen—Shows the fault or maintenance event(s) that has occurred. If there is more than one event, each event is shown for 3 seconds. Push **ENTER** to clear any latched events that are no longer present.
- Status screen—Refer to Figure 14 for descriptions of the data shown.
- Prim v Cal screen—Shows the ratio between the current calibration and primary calibration.

Figure 13 Main screen

1 TOC (or TC) reading	**3** Operating status
2 Analog output range or event code (Table 7)	**4** Time in 24-hour clock format

Table 7 Analog output ranges and event codes

Value	Description
R1–R4	The analog output range selected. Refer to Range select in Select the level criteria for alarms and analog output ranges on page 36.
Fxx	A fault event has occurred. Refer to Fault codes on page 68.
Mxx	A maintenance event has occurred. Refer to Maintenance codes on page 65.

Figure 14 Status screen

1 Calculated liquid TOC concentration (ug/L or mg/L)	**3** Flow cell temperature of the IR detector
2 Rate of change of the current concentration	**4** CO_2 concentration in the IR detector (ppm)

Navigation

Use the navigation keys to go to the different screens and menus.

If a key is not pushed within 30 seconds, the display goes back to the main screen. Push **ENTER** to keep the current screen shown. Push an arrow key to go to another screen or menu.

Table 8 Navigation keys

Key	Description
▲	Scroll up the menu or increase the value
▼	Scroll down the menu or decrease the value
ENTER	Confirm, enter or select
Ctrl	Always used with another key. Push and hold Ctrl before the second key is pushed.
Ctrl ENTER	Go up one menu level Push and hold **Ctrl**, then push **ENTER**.
Ctrl ▼	Go to the Service and Setup menus Push and hold **Ctrl**, then push ▼.

Security

A passcode must be entered to change some menu functions. A passcode is not necessary to go to any of the screens.

The passcode is 1953. The passcode cannot be changed. Use the arrow keys to select 1953, then push **ENTER**.

Startup

Reagent preparation

⚠ WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current material safety data sheets (MSDS) for safety protocols.

Reagent preparation guidelines

Atmospheric CO_2 can be absorbed by the reagents and affect results. Obey the guidelines that follow to minimize contamination.

- Use glass containers to mix and store solutions.
- When not in use, fill the empty space in the container with an inert gas and seal the container tightly. Plastic films, such as Parafilm®, are not sufficient.
- Keep solutions that contain volatile compounds in a refrigerator.
- Keep in mind that basic solutions absorb more CO_2 than acidic solutions. Cold water absorbs more CO_2 than hot water.

Prepare the acid solution

The phosphoric acid solution removes the inorganic carbon (TIC) from the sample.

1. Add approximately 15 L of DI water to a clean 20-L analyzer container.
2. Find the volume of 85% phosphoric acid (weight %) from Table 9 or Table 10.
3. Slowly add the phosphoric acid to the container.
4. Dilute with DI water to 20 L.
5. Put the cap on the container and mix.

   Note: *Measure the sample pH from the drain line and make sure that the sample pH after the acid addition is ≤ 3.0. If the pH is > 3.0, increase the concentration of the phosphoric acid until the pH is ≤ 3.0. The pump rate may need to be increased to keep the pH of the sample ≤ 3.0.*

Table 9 Preparation for 20 L acid solution, standard units, 30 usage days

Instrument		10 mg/L (C) TIC removal		100 mg/L (as C) TIC removal	
4195/6195-	**mg/L TOC**	**mL H_3PO_4 (85%)**	**Molarity**	**mL H_3PO_4 (85%)**	**Molarity**
1010/3010 1020/3020 1030/3030 2000/4000 2010/4010	5 10 25 100 200	137	0.1	819	0.6
1040/3040	50	68	0.05	410	0.3
1050/3050 1060/3060 1070/3070 2050/4050 2060/4060 2070/4070 2080/4080	100 200 500 2000 5000 10,000 20,000	27	0.02	137	0.1

Table 9 Preparation for 20 L acid solution, standard units, 30 usage days (continued)

Instrument		10 mg/L (C) TIC removal		100 mg/L (as C) TIC removal	
4195/6195-	mg/L TOC	mL H_3PO_4 (85%)	Molarity	mL H_3PO_4 (85%)	Molarity
2020/4020 2030/4030	500 1000	55	0.04	410	0.3
2040/4040	1000	55	0.04	137	0.1

Table 10 Preparation for 20 L acid solution, turbo units, 60 usage days

Instrument		10 mg/L (C) TIC removal		20 mg/L (C) TIC removal	
4195-	mg/L TOC	mL H_3PO_4 (85%)	Molarity	mL H_3PO_4 (85%)	Molarity
All turbo units	All ranges	683	0.5	1365	1.0

Prepare the persulfate solution

The sodium persulfate solution oxidizes the organic carbon in the sample.

1. Add approximately 15 L of DI water to a clean 20-L analyzer container.
2. Find the amount of sodium persulfate (MW: 238.10) from Table 11 or Table 12.
   Note: *Use only the molarity of sodium persulfate that is specified for the instrument.*
3. Slowly add the sodium persulfate to the container.
4. Dilute with DI water to 20 L.
5. Put the cap on the container and mix until the powder fully dissolves (3 to 5 minutes).
6. Let the container stand until the solution is clear (approximately 30 minutes).

Table 11 Preparation for 20 L persulfate solution, standard units

4195/6195-	mg/L TOC	Sodium persulfate (g)	Molarity	Usage days
1010/3010	5	950	0.2	90
1020/3020 1050/3050	10 100	1900	0.4	90
1060/3060	200	2380	0.5	90
1030/3030 1040/3040 1070/3070	25 50 500	2860	0.6	90
2000/4000	100	3330	0.7	30
2030/4030 2040/4040 2070/4070	1000 1000 10,000	4280	0.9	30
2060/4060 2080/4080	5000 20,000	5710	1.2	30
2010/4010	200	6660	1.4	30
2050/4050	2000	7140	1.5	30
2020/4020	500	7620	1.6	30

Table 12 Preparation for 20 L persulfate solution, turbo units, 60 usage days

4195-	mg/L TOC	Sodium persulfate (g)	Molarity
1006/3006	10	950	0.2
1002/3002 1005/3005	2 5	1900	0.4
1007/3007	25	2850	0.6
1008/3008	50	5225	1.1

Prepare the zero standard

Use reagent-grade deionized (DI) water, Type I, with less than 50 µg/L TOC for the zero standard. Put the zero standard in a clean 4-L analyzer container.

Prepare the span standard

Required items:

- Volumetric flask, borosilicate glass (e.g., Pyrex®), cleaned with 0.5 M H_3PO_4
- Reagent-grade Type I DI water, < 50 µg/L TOC
- Organic compound, ACS grade, from Table 13

KHP or ethylene glycol is a suitable span (calibration) standard for most applications. Do not mix two or more standards together.

1. Fill a 1-L volumetric flask ½ full with DI water.
2. Measure the amount of the organic compound from Table 13.
   Note: *If more than 1 L of standard is prepared, multiply the value accordingly.*
3. Slowly add the organic compound to the flask.
4. Dilute to the mark with DI water and mix fully.
   Note: *Do not add HCl as a preservative.*
5. Put the standard in a clean 4-L analyzer container.

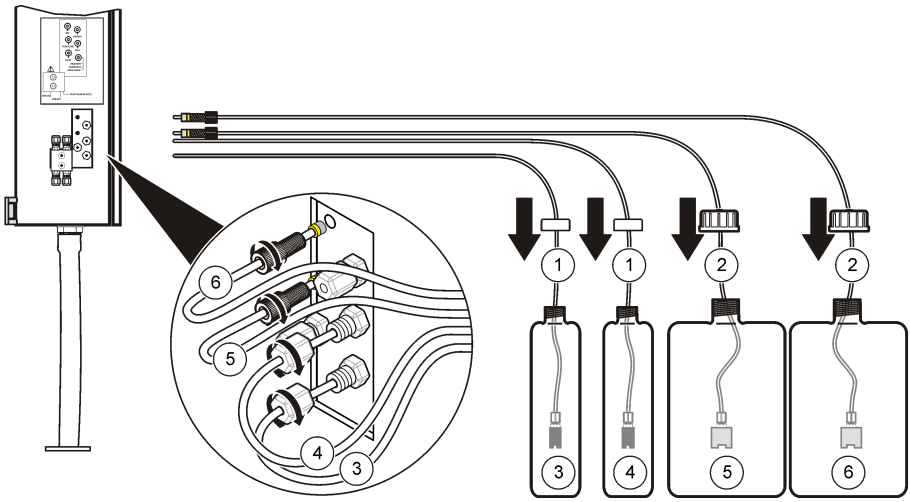
Table 13 Preparation for 1 L span standard

Organic compound	Amount for 100 mg/L C	Amount for 1000 mg/L C
KHP	0.212 g	2.12 g
Ethylene glycol	0.233 mL	2.33 mL
Ethanol	0.242 mL	2.42 mL
Methanol	0.337 mL	3.37 mL
Acetic acid	0.250 g	2.50 g
Sucrose	0.238 g	2.38 g
1,4 Benzoquinone	0.150 g	1.50 g
Urea	0.500 g	5.00 g

Plumb the reagent solutions

Install the reagent solutions as shown in Figure 15.

Figure 15 Reagent connections



1 Tubing assembly (4 L)	**3** Span solution	**5** Persulfate solution
2 Tubing assembly (19 L)	**4** Zero solution	**6** Acid solution

Turn on the analyzer

Turn on the main AC power to the analyzer.

After a purge, the pumps and UV lamps turn on and the IR detector increases to operating temperature. The analyzer goes online when the IR detector is at operating temperature (50 °C).

After a loss of power or a software reboot, the analyzer turns on and a purge is done before the analyzer goes online. To skip the purge, push **ENTER**.

Start-up checks

1. When the display shows "Purging", make sure that the analyzer has the correct range for the intended application.
2. Make sure that the sample inlet line(s) is in the zero standard container.
3. Let the analyzer operate for 30 minutes.
4. Look for any leaks in the analyzer. Fix all leaks.
5. Make sure that the reagent weights are at the bottom of the reagent bottles.
6. Make sure that there are no bubbles in the small ($^1/_8$-inch) tubing located to the left of the sparger manifold. Refer to Figure 2 on page 9.

   Bubbles in the tubing cause a "NO SPARGER FLOW" fault.
7. Make sure that the ½-inch wide vertical chamber located in the sparger manifold is full of bubbles (TOC analyzers only).
8. Make sure that there are no bubbles in the small ($^1/_8$-inch) tubing located in the UV reactor manifold.

   Bubbles cause a "NO UV FLOW" fault.

9. Make sure that the bottom of the GLS U-tube is full of liquid and the liquid flows over the U-tube to the drain. Refer to Figure 2 on page 9.
10. Stop the analyzer. From the main screen, push ▼ until "Stop Analyzer" is shown, then push **ENTER**.

    The UV lamps and pumps turn off.
11. Make sure that the concentration of the carrier gas decreases to less than 20 ppm.

    a. From the main screen, push the up arrow two times.
    b. Push **ENTER** to keep the Status screen shown.

       The carrier gas concentration (ppm) is shown on the display.

    If the carrier gas concentration is greater than 20 ppm, the carrier gas is not good, a leak is present or the IR bench is out of calibration.

    If the concentration quickly decreases to 0.0 ppm, the IR bench is out of calibration. Contact the manufacturer for service.
12. To identify a carrier gas leak, do the steps in Identify a carrier gas leak on page 65.

Validate the installation

1. Start the analyzer. From the main screen, push ▼ until "Start Analyzer" is shown, then push **ENTER**.

   The UV lamps and the pumps turn on.
2. Close the enclosure doors.
3. Let the analyzer operate for 1 hour.
4. Do a validation. Refer to Do a validation manually on page 48.
5. If the mg/L concentration reading is not ±2% of the value of the span calibration standard, go to Adjust the analyzer on page 30.
6. Connect a sample source(s) to the sample inlet(s) and plumb the sample bypass outlet(s). Refer to Plumb the sample line and sample bypass on page 21.

Adjust the analyzer

Adjust the analyzer if the analyzer fails the initial validation.

1. Make sure that the zero standard container is plumbed to the ZERO port.
2. Make sure that the span standard container is plumbed to the CALIBRATION port.
3. Put the sample inlet tubing in the span standard container.
4. Make sure that the reading on the flow meter is within the correct range. Refer to Table 14.
5. From the main screen, push the up arrow two times. Push **ENTER** to keep the Status screen shown.

   The CO_2 reading is shown on the display.
6. Turn the flow adjustment knob until the CO_2 reading on the display is the value shown in Table 14 for the correct line voltage frequency (50 or 60 Hz). Refer to Figure 11 on page 23.
7. After 10 minutes, do step 6 again.

   Set the carrier gas flow rate to between 30 and 150 cc/minute.
8. Record the value shown on the flow meter for reference during maintenance checks.
9. Make sure that the CO_2 reading stays in this range for a minimum of 5 minutes.
10. Do a primary span calibration.

    a. Push the down arrow until "Calibration" is shown, then push **ENTER**.
    b. Push the down arrow until "Primary Span" is shown, then push **ENTER**.
    c. Complete the instructions on the display.

d. As the span standard has already been measured, push **ENTER** repeatedly to skip the elapsing time and go to the final screen.

11. Put the sample inlet tubing in the zero standard container.

12. Let the CO_2 reading become stable and become less than 30 ppm.

13. Do a primary zero calibration.

a. Push the down arrow until "Calibration" is shown, then push **ENTER**.
b. Push the down arrow until "Primary Zero" is shown, then push **ENTER**.
c. Complete the instructions on the display.
d. As the span standard has already been measured, push **ENTER** repeatedly to skip the elapsing time and go to the final screen.

14. Connect a sample source(s) to the sample inlet(s) and plumb the sample bypass outlet(s). Refer to Plumb the sample line and sample bypass on page 21.

Table 14 Carrier gas flow rates and response times

UV 4195- / 6195-	1010/ 3010	1020/ 3020	1030/ 3030	1040/ 3040	1050/ 3050	1060/ 3060	1070/ 3070	2000/ 4000
Reactor carrier[1] (cc/minute)	55	110	170	160	125	150	175	70
Sparger carrier[1] (cc/minute)	200	200	200	200	200	200	200	200
Response time (minutes) (T90 at 60 Hz)	10	8	8	12	12	12	14	10
CO_2 at span (ppm)	950	950	950	950	950	950	950	9500

[1] Flows are approximate at sea level.

UV 4195-	2010/ 4010	2020/ 4020	2030/ 4030	2040/ 4040	2050/ 4050	2060/ 4060	2070/ 4070	2080/ 4080
Reactor carrier [1] (cc/minute)	140	165	85	75	150	115	95	120
Sparger carrier[1] (cc/minute)	200	200	200	200	200	200	200	200
Response time (minutes) (T90 at 60 Hz)	10	14	20	13	12	13	16	15
CO_2 at span at 50 or 60 Hz (mg/L)	9500	9500	9500	9500	9500	9500	9500	9500

[1] Flows are approximate at sea level.

Line voltage frequency	4195-1002/-3002	4195-1005/-3005	4195-1006/-3006	4195-1007/-3007	4195-1008/-3008
CO_2 at span at 50 Hz (ppm)	300 ±30	750 ±30	800 ±30	3100 ±200	3400 ±200
CO_2 at span at 60 Hz (ppm)	380 ±30	950 ±30	900 ±30	3300 ±200	3600 ±200
Carrier gas flow rate[1] (cc/minute)	80	80	120	55	100

Select the time, date and language

Select the time, date and language for the display and CSV (comma-separated value) output.

1. Push **Ctrl** and the down arrow.
   The Service screen is shown.
2. Push the up arrow.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push the up arrow until "Timing" is shown, then push **ENTER**.
5. Push the up arrow until "Times" is shown, then push **ENTER**.
6. Push the up arrow until "Time/Date" is shown, then push **ENTER**.
   The Set time screen is shown.
7. Use the arrows to scroll through the time and date screens.

Option	Description
Set time	Sets the time of day in 24-hour clock format.
Set day	Sets the day of the month.
Set month	Sets the month of the year.
Set year	Sets the year.
Date format	Sets the date format—USA (mm/dd/yy) or International (dd/mm/yy).

8. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
9. Use the arrows to change the value, then push **ENTER**.
10. To change the language:
    a. Do steps 1–3.
    b. Push the up arrow until "Tolerances" is shown, then push **ENTER**.
    c. Push the up arrow until "Language" is shown, then push **ENTER**.
    d. Push **ENTER**.
       Asterisks flash on both sides of the value.
    e. Use the arrows to select the language, then push **ENTER**.

Operation

Configuration

Select standard or EPA applications

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Application" is shown, then push **ENTER**.
   Asterisks flash on both sides of the value.
5. Use the arrow keys to select Standard or EPA, then push **ENTER** to save.
   When a dual-stream inlet block is used, select EPA.
   Do not select USP as USP/EP applications are not supported.

Select the number of sample streams

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Stream" is shown, then push **ENTER**.
   Asterisks flash on both sides of the value.
5. Use the arrow keys to select Single (one stream) or Dual (two streams), then push **ENTER** to save.

Schedule validations, calibrations and cleaning

Schedule validations, calibrations and cleanings to occur at intervals or daily.

- Intervals—start at a specified time and do again at set time intervals
- Daily—do daily at a specified time on selected days of the week

Schedule blowbacks if a blowback valve is present to clean the sample inlet filter.

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ two times.
   "Timing" is shown.
5. Push **ENTER**.
   The first option in the menu is shown, "Times".
6. Push **ENTER**.

The first option in the Times menu is shown, "Val time".

7. Use the arrow keys to scroll through the options.

Option	Description
Val time	Sets the start time for validation. Refer to Select validation, calibration and cleaning options on page 34 for more validation configuration.
Val interval	Sets the time interval between validations.
Daily validate	Selects the days of the week on which a validation is done at the Val time. Select Yes or No for each day of the week. Days set to Yes are selected. The Daily validate values are ignored if the Val interval setting is not zero.
Cal time	Sets the start time for calibration. Refer to Auto cal options in Select validation, calibration and cleaning options on page 34 for more calibration configuration.
Cal interval	Sets the time interval between calibrations.
Daily calibrate	Selects the days of the week on which a calibration is done at the Cal time. Select Yes or No for each day of the week. Days set to Yes are selected. The Daily calibrate values are ignored if the Cal interval setting is not zero.
Clean time	Sets the start time for a cleaning. Refer to Clean options in Select validation, calibration and cleaning options on page 34 for more cleaning configuration.
Clean interval	Sets the time interval between cleanings.
Daily clean	Selects the days of the week on which a cleaning is done at the Clean time. Select Yes or No for each day of the week. Days set to Yes are selected. The Daily clean values are ignored if the Clean interval setting is not zero.
Blowback off	Sets the time interval between blowbacks—0 to 999 minutes. Set to 0 to disable blowback function. The blowback valve pushes compressed air back through the sample inlet filter to remove any debris that has collected. The blowback off and on settings only apply if a blowback valve is used.
Blowback on	Sets the time interval that compressed air is blown back through the sample inlet filter—0 to 100 seconds.

8. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
9. Use the arrow keys to change the value, then push **ENTER** to save.

Select validation, calibration and cleaning options

⚠ DANGER

Chemical hazard. Make sure to keep the UV lamps off during cleaning if the cleaning solution can react with UV light and produce harmful gases.

Select the auto validation, auto calibration and auto cleaning options.

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.

The first option in the Setup menu is shown, "Level Criteria".

4. Push ▲.
   "Auto Options" is shown.
5. Push **ENTER**.
   The first option in the menu is shown, "Cal after val".
6. Use the arrow keys to scroll through the options.

Option	Description
Cal after val	Enables or disables a calibration to be done automatically after an auto validation fails. Push **Enter** to select Yes or No. The change is saved when the screen is exited.
Validation tol	Sets the validation tolerance (%). If the validation result (%) is different by more than the validation tolerance, the analyzer fails validation.
Spill threshold	Sets the spill threshold (%). If the TOC level is greater than the spill threshold, a cleaning cycle is done for the spill recovery time. After the cleaning cycle, a purge cycle is done, then the analyzer goes online to measure the other sample stream. This lets the analyzer go back to online status as soon as the spill is fixed.
Spill recovery	Sets the spill recovery time—0 to 99 minutes. The spill recovery is the time period that the analyzer stays offline until a spill, as identified by the spill threshold, is fixed.
Clean options	Sets two cleaning options. Push **Enter**, then select Yes or No for each option. • Clean with lamps on—Always set to No. Refer to danger statement. • Clean before cal—Set to Yes recommended. When set to Yes, a cleaning is always be done before an auto calibration. Push **Enter** to select Yes or No. The change is saved when the screen is exited.
Auto cal options	Sets what calibration adjustments are done when an auto calibration is done—zero only, span only or zero and span.

7. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
8. Use the arrow keys to change the value, then push **ENTER** to save.

Select the amount of time for analyzer phases

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ two times.
   "Timing" is shown.
5. Push **ENTER**.
   The first option in the menu is shown, "Times".
6. Push ▲.
   "Periods" is shown.
7. Push **ENTER**.
   The first option in the Periods menu is shown, "Pre zero period".

8. Use the arrow keys to scroll through the options.

Option	Description
Pre zero period	Sets the amount of time the analyzer is switched to the Zero standard inlet (Zero port) before a zero baseline is started—1 to 60 minutes.
Pre span period	Sets the amount of time the analyzer is switched to the Span standard inlet (Calibration port) before an auto span calibration is started—1 to 60 minutes.
Clean period	Sets the amount of time the analyzer is cleaned during an auto cleaning (or auto calibration mode if enabled during an auto calibration)—1 to 60 minutes.
Purge period	Sets the amount of time of a purge cycle—2 to 60 minutes. A purge cycle removes any liquid from the analytical system before that analyzer is put online. A purge is done after a calibration or validation, auto cleaning or a single (grab) sample analysis.
Stream 1 period[1]	Sets the amount of time the analyzer measures sample stream 1—0 to 999 minutes. Select 0 to stop measurements on sample stream 1. ***Note:*** *The stream period 1 and 2 do not include the purge period.*
Stream 2 period[1]	Sets the amount of time the analyzer measures sample stream 2—0 to 999 minutes. Select 0 to stop measurements on sample stream 2.

[1] Only available when a dual stream analyzer is selected.

9. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
10. Use the arrow keys to change the value, then push **ENTER** to save.

Select the level criteria for alarms and analog output ranges

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push **ENTER**.
   The first option in the menu is shown, "Alarm level 1".
5. Use the arrow keys to scroll through the options.

Option	Description
Alarm level 1	Sets the Alarm level 1 setpoint. When the TOC (or TC) reading is greater than the Alarm level 1 setpoint, Alarm level 1 is active. Alarm level 1 and 2 are rising level, unlatched alarms.
Alarm level 2	Sets the Alarm level 2 setpoint. When the TOC (or TC) reading is greater than the Alarm level 2 setpoint, Alarm level 2 is active.
Inhibit level	Sets the inhibit level setpoint. The inhibit level is a TOC percentage of the full scale range of the analyzer. To disable this feature, enter 0%. If the inhibit level setpoint is exceeded at the time of a scheduled calibration, validation or cleaning, the calibration, validation or cleaning cycle does not occur. Use this feature to continue monitoring a high carbon concentration even if a calibration, validation or cleaning is scheduled.

Option	Description
Range Change	Sets the Range Change percentage. The Range Change percentage only applies when Range Select is set to Auto ranging. ***Note:*** *The term range in this section applies only to the analog output range and not to the actual TOC range of the analyzer.* When the TOC reading increases, the analog output range goes up one level (e.g., R1 to R2) when the TOC reading is the range change percentage of the current analog output range. For example, if the Range Change is 90% and the analog output range is 0 to 1000 ug/L, the analog output range changes up when the TOC reading is 900 ug/L (90% of 1000) or more. When the TOC reading decreases, the analog output range goes down one level (e.g., R2 to R1) when the TOC reading is the Range Change percentage minus 5% of the analog output range that is the next level down. For example, if the Range Change is 90% and the analog output range of the next level down is 0 to 1000 ug/L, the analog output range changes down when the TOC reading is 850 ug/L (85% of 1000) or less.
Range Select	Sets the analog output range (R1–R4) for the two analog outputs (CH1 and CH2)—Fixed range or Auto range. Fixed range—Typically used. The analog output range stays in the selected range (e.g., R4). The other three ranges are not used (e.g., R1, R2 and R3). The main screen shows the current analog output range. Auto range—Not typically used. The selected analog output range automatically changes between R1, R2, R3 and R4 based on the current TOC (or TC) reading and Range Change setting. If Auto range is selected, set one of the analog outputs to Range ID and the other to one of the TOC reading options (Live mg/L, Zero mg/L or Latched mg/L) to identify the TOC reading. Refer to Set a condition to each the analog output on page 37. To calculate the TOC reading using the current values (4-20 mA) on the two analog outputs: 1. Use the Range ID value (mA) to identify the current analog output range (i.e. R1 or R4). Refer to Set a condition to each the analog output on page 37. 2. Identify the TOC reading range (i.e. 0 to 2,000 ug/L) of the current analog output range. Refer to Output Ranges. 3. Divide the TOC reading range (i.e. 2,000 ug/L) by 16 mA. 16 mA is the difference between 20 mA and 4 mA. 4. Subtract the current value of the analog output that is set to a TOC reading (i.e. 12 mA) from 20 mA. 5. Multiple the two results to get the TOC reading. For example, CH1 is set to the Range ID and is at 4 mA = R1. CH2 is set to a TOC reading and is at 12 mA. If R1 is 0 to 2,000 ug/L, divide 2000 by 16. Then, multiply the result by 12 mA. The result is 1000 ug/L.
Output Ranges	Sets the TOC ranges of the four analog output ranges (e.g., 0 to 1000 ug/L)—Output range 1 (R1), Output range 2 (R2), Output range 3 (R3) and Output range 4 (R4). The TOC ranges cannot be greater than the range of the analyzer. Make sure that the TOC range increases from R1 to R4.

6. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
7. Use the arrow keys to change the value, then push **ENTER**.

Set a condition to each relay and analog output

Set a condition to each the analog output

When one or both analog output connectors are used, set the analog output connector(s) that is used to an analyzer condition or reading to. Refer to Connect the analog outputs (optional) on page 19.

1. Push **Ctrl** ▼.
   The Service screen is shown.

2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Mapping" is shown.
5. Push **ENTER**.
   The first option in the Mapping menu is shown, "Map Analogs".
6. Push **ENTER**.
   The first option in the Map Analogs menu is shown, "CH1".
7. Use the arrow keys to scroll through the options.

Option	Description
Slope	Sets the current value (4-20 mA) at the analog output to change linearly according to the rate of change of the current concentration (mg/L per second). A change of ±1 results in a ±0.016 mA change in the current value. The rate of change range is -500 to +500. When the rate of change is -500, the current value is 4 mA. When the rate of change is 0, the current value is 12 mA. When the rate of change is 500, the current value is 20 mA.
Temperature	Sets the current value (4-20 mA) at the analog output to change linearly according to the temperature of the IR detector flow cell. A change of ±1 °C results in a ±0.16 mA change in the current value. The temperature range is 0 to 100 °C (32 to 122 °F). 0 °C (32 °F) = 4 mA, 50 °C (122 °F) = 12 mA, 100 °C (212 °F) = 20 mA
Live mg/L	Sets the current value (4-20 mA) at the analog output to change linearly according to the TOC (or TC) reading, even when the analyzer is offline (e.g., during a purge, cleaning or calibration). The TOC range is the current analog output range (Rx), which is shown on the main screen and selected by the user. Refer to Select range in Select the level criteria for alarms and analog output ranges on page 36.
Gas ppm	Sets the current value (4-20 mA) at the analog output to change linearly according to the CO_2 concentration in the IR detector (ppm). The concentration range is from zero to full scale (1,000 or 10,000 ppm).
Zero mg/L	Sets the current value (4-20 mA) at the analog output to change linearly according to the TOC (or TC) reading when the analyzer is online. The analog output is 0 mA when the analyzer is offline. The TOC range is the current analog output range (Rx), which is shown on the main screen and selected by the user. Refer to Select range in Select the level criteria for alarms and analog output ranges on page 36.
Latched mg/L	Sets the current value (4-20 mA) at the analog output to change linearly according to the TOC (or TC) reading and holds the last valid online reading when the analyzer is taken offline. The TOC range is the current analog output range (Rx), which is shown on the main screen and selected by the user. Refer to Select range in Select the level criteria for alarms and analog output ranges on page 36.
Fault ID	Sets the current value (4-20 mA) at the analog output to change according to the operating status of the analyzer. Online = 4 mA, Out of service (offline) = 8 mA, Maintenance event = 12 mA and Fault event = 16 mA
Range ID	Sets the current value (4-20 mA) at the analog output to change according to the selected analog output range (R1–R4). Only set the analog output to Range ID if the analog output range is set to Auto. Refer to Range select in Select the level criteria for alarms and analog output ranges on page 36 R1 = 4 mA, R2 = 8 mA, R3 = 12 mA and R4 = 16 mA For example: If R2 is the current analog output range, the current value on the analog output is 8 mA.

8. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
9. Use the arrow keys to change the value, then push **ENTER** to save.
10. Push ▲.
    "CH2" is shown.
11. Do steps 7–9 again to configure CH2.

Set a condition to each analog output for the EPA
For EPA drinking water applications, map the analog outputs to:

- CH 1—Latched mg/L 1 (Stream 1)
- CH 2—REM % (Stream 2)

In EPA mode, the stream number is added to the TOC mg/L options (e.g., Latched mg/L 1 and Latched mg/L 2) and REM % is available as an option.

Set a condition to each output relay
When one or more relay connectors are used (S1–S5), set the relay connector(s) to an analyzer event or status. Refer to Connect the relays (optional) on page 17.
Each relay may be selected as normally energized or normally de-energized. For example, if relay S1 is set to Alarm 1 and selected as energized, the relay coil is energized when Alarm 1 occurs.

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Mapping" is shown.
5. Push **ENTER**.
   The first option in the Mapping menu is shown, "Map Analogs".
6. Push ▲ until "Map Relays" is shown.
7. Push **ENTER**.
   The first option in the Map Relays menu is shown, "Relay S1".
8. Use the arrow keys to scroll through the options.

Option	Description
Alarm 1	Sets the relay to Alarm 1. Alarm 1 and Alarm 2 are rising level, unlatched alarms.
Alarm 2	Sets the relay to Alarm 1.
Online	Sets the relay to the online operating status. The online operating status indicates that the analog outputs are representative of the current TOC reading. When set to a relay, the online status lets DCS systems know when the analog output is representative of the current TOC reading. This is necessary because if the analyzer is not currently measuring the sample stream, the analog output may be latched to the last valid TOC reading when it was measuring the sample. The online relay will not be in its TRUE status during this time. Also, when the analog output has been set to Live mg/L, the output will reflect whatever is being measured.
Offline	Sets the relay to the offline operating status. ***Note:*** *The analyzer is offline during warm up, when in the service menu, during a purge, cleaning, calibration or validation cycle or when a grab sample is measured.*

Option	Description
Maintenance	Sets the relay to maintenance events. The relay is active when any of the maintenance events occur.
Fault	Sets the relay to fault events. The relay is active when any of the fault events occur.
Stream 1	Sets the relay to Stream 1. The relay is active when Stream 1 is selected. ***Note:*** *On available on dual stream analyzers.*
Sample	Sets the relay to a true or false sample. True sample— when the analyzer is any phase of measurement of a true sample, including a purge phase. False sample— when in any phase of cleaning, calibration, validation or grab sample measurement, or when the analyzer is offline.
Mxx	Sets the relay to an individual maintenance event—M05, M06, M07, M09 or M11.
Fxx	Sets the relay to an individual fault event—F01, F02, F03 or F04.

9. Push **ENTER** to change the value on the screen.

   Asterisks flash on both sides of the value.

10. Use the arrow keys to change the value, then push **ENTER** to save.

11. When "Sx Energized?" is shown, select Yes or No. To change the value, do steps 9–10.

    When main power to the analyzer is off, a normally energized relay indicates the condition (e.g. Alarm 1 or Online).

    An illuminated LED indicates an energized relay. In either condition (energized or de-energized), both normally open and normally closed contacts are available.

12. Push ▲.

    "Relay S2" is shown.

13. Do steps 7–9 again until all the relay connectors used are configured.

Set a condition to each output relay for the EPA

For EPA use with drinking water analyzers, set a relay(s) to the EPA P/F option.
In EPA mode, relays can be set to EPA P/F (pass/fail criteria).

The relay holds the pass/fail criteria even when the analyzer is offline.

Set a condition to the input relay

When the input relay connectors is used (SW1), set the relay connector to an analyzer condition. Refer to Connect the relays (optional) on page 17.
Close or open the contacts of the input relay for 3 seconds to toggle the analyzer condition from one condition to the other. The condition can only be toggled back after 3 seconds. To enable this function, enable SW1 in the Service menu. Refer to Change the input status on page 70.

1. Push **Ctrl** ▼.

   The Service screen is shown.

2. Push ▲.

   The Setup screen is shown.

3. Push **ENTER**.

   The first option in the Setup menu is shown, "Level Criteria".

4. Push ▲ until "Mapping" is shown.

5. Push **ENTER**.

   The first option in the Mapping menu is shown, "Map Analogs".

6. Push ▲ until "Map Relays" is shown.

7. Push **ENTER**.
   The first option in the Map Relays menu is shown, "Relay S1".
8. Push ▲ until "?" is shown, then push **ENTER**.
9. Use the arrow keys to scroll through the options.

Option	Description
Start/Stop	Sets the relay to start the analyzer (close contacts) or stop the analyzer (open contacts).
Auto clean	Sets the relay to start an auto cleaning (close contacts). The analyzer goes back online when the cleaning is done.
Auto val	Sets the relay to start an auto validation (close contacts). The analyzer goes back online when the calibration is done.
Auto cal	Sets the relay to start an auto validation (close contacts). The analyzer goes back online when the validation is done.
Toggle stream[1]	Sets the relay to toggle the selected stream from the stream that is not currently selected (close contacts) to the previously selected stream (open contacts).
STR1 latched[1]	Sets the relay to keep Stream 1 selected (close contacts) or let the analyzer select the stream (open contacts).
STR2 latched[1]	Sets the relay to keep Stream 2 selected (close contacts) or let the analyzer select the stream (open contacts).

[1] Dual stream analyzer only.

10. Push **ENTER** to change the value on the screen.
    Asterisks flash on both sides of the value.
11. Use the arrow keys to change the value, then push **ENTER** to save.

Configure serial communications

If the optional communication card is installed, select the serial communications protocol and protocol settings.

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Serial" is shown.
5. Push **ENTER**.
   The first option in the Serial menu is shown, "Protocol".
6. Use the arrow keys to scroll through the options.

Option	Description
Protocol	Sets the communications protocol—CSV, X3.28, 8811 or Modbus RTU. CSV—outputs data logging and comma separated values. CVS protocol is used for monitoring only. Refer to Table 15 and CSV output on page 85. X3.28—for Manufacturer Service Representative use only. 8811—for connection to an 8811 multi-stream sequencer Modbus RTU—Industrial Standard Protocol. For more information about the Modbus Protocol, go to the Schneider Automation website at www.modicon.com and/or order the Modicon Modbus Protocol Reference Guide from Modicon (part number PI-MBUS-300).

Option	Description
CSV period	Sets the time in seconds between the output of CSV data from the serial port—2 to 3600 seconds. This option is only available when CSV is selected for protocol.
Address	Sets a multidrop address for the analyzer. This option is only available when X3.28 or Modbus RTU is selected for protocol. Each analyzer must have a different address. If no multidrop addressing is used, set to 0.
Float format	Sets the word order used by Modbus to represent real numbers (floating point numbers). This option is only available when Modbus RTU is selected for protocol.

7. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
8. Use the arrow keys to change the value, then push **ENTER** to save.

Table 15 Communication settings

Baud	Parity	Number of data bits	Stop bit
9600	none	8	1

Change the tolerance settings (not recommended)

NOTICE

The tolerance settings affect analyzer performance. The manufacturer recommends that tolerance settings not be changed from the factory settings.

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Tolerances" is shown.
5. Push **ENTER**.
   The first option in the Series menu is shown, "Zero tolerance".
6. Use the arrow keys to scroll through the options.

Option	Description
Zero tolerance	Sets the permitted CO_2 ppm variation (±) for an auto zero calibration.
Span tolerance	Sets the permitted CO_2 ppm variation (±) for an auto span calibration.
Maint % Primary	Sets the Maint % Primary percentage. If the difference between the current calibration and the primary calibration is more than the Maint % Primary percentage, a maintenance event occurs.
Fault % Primary	Sets the Fault % Primary percentage. If the difference between the current calibration and the primary calibration is more than the Fault % Primary percentage, a fault event occurs.
Averaging	Sets the numbers of sample readings that are used to calculate the moving average reading—low, medium, high, very high or adaptive. Adaptive is the recommended setting. Refer to Table 16. The Averaging setting is selected on the IR gas averaging screen, which is shown after the passcode is entered.

Option	Description
Maint Pressure	Sets the maintenance event threshold for UV reactor pressure. If the UV reactor pressure is greater than the Maint Pressure value, a maintenance event occurs.
Fault Pressure	Sets the fault event threshold for UV reactor pressure. If the UV reactor pressure is greater than the Fault Pressure value, a fault event occurs. ***Note:*** *A pressure sensor measures the pressure at the UV reactor manifold. When the pressure increases to greater than the threshold pressure, the analyzer automatically stops the pumps to prevent damage to the carrier gas system caused by the corrosive liquids in the analyzer.*

7. Push **ENTER** to change the value on the screen.
   Asterisks flash on both sides of the value.
8. Use the arrow keys to change the value, then push **ENTER** to save.

Table 16 Averaging options

Option	Sampling mode
Low	4 samples every 2 seconds
Medium	20 samples every 10 seconds
High	40 samples every 20 seconds
Very high	80 samples every 40 seconds
Adaptive	Adaptive filter

Change model and range

NOTICE

When the model and range are changed, all user-entered setting and calibration values are set to the factory defaults.

Before the model and range are changed, record:

- All user-selected settings
- The zero and span values for the two analog outputs (CH1 and CH2)

The zero and span values for the analog outputs are recorded on the Output Adjust screens in the Service menu.

1. Push **Ctrl** ▼.
   The Service screen is shown.
2. Push ▲.
   The Setup screen is shown.
3. Push **ENTER**.
   The first option in the Setup menu is shown, "Level Criteria".
4. Push ▲ until "Analyzer" is shown, then push **ENTER**.
   Asterisks flash on both sides of the value.
5. Use the arrow keys select the model number and unit of measure, then push **ENTER** to save.
6. After the automatic reboot, enter the recorded zero and span values for CH1 and CH2 in Output Adjust in the Service menu.

Typically when a different analyzer is selected, it is necessary to configure the hardware again. Refer to Hardware configuration on page 83.

Calibration

Calibration overview and options

Note: *In this manual, TOC is expressed in µg/L while CO_2 concentrations are expressed in ppm.*
The analyzer supports primary, manual, automatic and multi-point calibration.

Primary and manual calibrations are identical in operation. Do a primary calibration after a new peristaltic tube or lamp has been installed.

The three forms of multi-point calibrations are detailed in the Multi-point Calibrations section of this manual.

The analyzer is calibrated by measuring and storing the CO_2 gas ppm produced by at least two known TOC standards. A calibration set may be represented by at least two points on a graph of ppm CO_2 versus a zero and a span (µ/L TOC) so that a straight line interpolation and extrapolation can be done between the points. The lower point is defined by the gas ppm x_1 produced when DI water is applied to the analyzer. This defines the point (0, y_1) and is called the baseline. The higher point (x_2, y_x) is the span reading, though it is not always done at the full scale of the analyzer.

The slope of the interpolated/extrapolated line is the gain of the analyzer in ppm/µ/L (gas/TOC). Refer to Figure XX. The slope is given by the equation:

Gain = y_2-y_1/x_2

For example, if a 0-1000 µ/L analyzer is calibrated with 800 µ/L, the calibration is defined as (0,25) and (800, 7602). This gives a gain of (7602-25)/800, i.e., 9.475 ppm/µ/L. The gain of each analyzer slowly varies with time as the peristaltic pump tubing and the UV lamps get older. Following any manual calibration or auto-calibration, this aging can be identified by the % in the Pri v cal screen. An online TOC measurement of a sample is produced by measuring the CO_2 gas ppm and using the straight line to mathematically look up the TOC µ/L. If the calibration set (0, y_1) and (x_2, y_2) are used as the two point active calibration.

Online sample TOC (mg/L) = (y_x-y_1) * x_2/(y_2 - y_1) where y_s is the CO_2 ppm produced by the sample.

At any point in time, four distinct calibrations are stored separately in the analyzer database. Only one calibration is used at any time to calculate the online TOC µ/L.

The primary, manual and auto calibrations are two point calibrations as described above. Minor variations of the data points will exist due to tolerances. These calibrations should yield the same gain (slope).

The fourth calibration is a multiple point calibration that uses measurements of CO_2 produced by more than two standards, one of them always being the zero.

Primary and Manual calibration
Primary and Manual Calibration are identical supervised calibrations that are run by the operator. The distinction between the two is that a primary calibration should be performed only after the peristaltic or lamp has been replaced, when the analyzer will have the best performance and theoretical gain. A successful primary calibration will automatically update the manual calibration data set as well as the primary calibration data set.

Auto calibration
This scheduled calibration sequence is automatically carried out by the analyzer. Zero and span standards are automatically drawn from the ports as required, to determine the auto-calibration data set. A successful auto-calibration will become the active calibration.

Active calibration
This is the calibration data set used to calculate the TOC during an online TOC measurement. The primary, manual, autocalibration or multipoint calibration may be manually set to be the active calibration.

The successful completion of any type of calibration will result in that calibration being used as the active calibration and the entry in the Manual Control/Active Cal screen will be changed to reflect the type of calibration just completed.

Active versus primary calibration % (Prim v cal)
This is the ratio of the gains of the active calibration set to the gain of the primary calibration set expressed as a percentage. The deviation from 100% will identify the change in the analyzer gain.

If the active calibration set gain

$g_a = (y_{2a} - y_{1a})/x_{2a}$

is compared to the primary gain

$g_p = (y_{2p} - y_{1p})/x_{2p}$

as a percentage, the result is

$100*g_a/g_p = 100 * x_{2p} * (y_{2a} - y_{1a})/x_{2a} * y_{2p} - y_{1p})$

After a primary calibration, this percentage will always be 100% because the active calibration is the primary calibration. If manual calibration is selected, it will still be 100% as the primary calibration copies to the manual calibration set. Only following the next calibration will the result be different. Thus a relative percent degradation of the performance can be determined and maintenance or fault events flagged to the operator. See Figure XX.

Calibration screen

Push ENTER while in the Calibration screen to display the calibration data set in use. When one of the three multi-point calibrations is selected, the screen shows the type of calibration and scrolls through each of the calibration points in use. An example follows of information that a screen might show.

Calibration

0 µg/l 1000 µg/l

19 ppm 950 ppm

The two gas ppm values shown are the current readings for zero (19 ppm) and span (950 ppm). Push ENTER again to select the calibration options.

Manual zero calibration

Push ENTER while in the Calibration menu. The first submenu in the Calibration menu is the Manual zero menu. The information in bold appears on the display screen.
Manual Zero

1. Push ENTER to select Manual Zero and move to a prompt screen.
2. Push ENTER. The screen shows the apparent TOC using the prior calibration, the pre zero countdown timer from the pre zero period, and the prior zero TOC µg/L.
   20 µg/l 285s

   Last 0.0 µg/l
3. Push the up arrow to display the equivalent screen displaying ppm CO_2 instead of µg/L TOC.
   20 ppm STAB

   Last 17 ppm
4. Push ENTER. This selects valves V1 and V2 and places the analyzer in an offline status, drawing water from the zero inlet port. The display changes, as shown.
   20 ppm 295s

   Last 17 ppm

   - 20 ppm is the current gas CO_2 ppm in the current calibration.
   - 295s is the current seconds in the countdown (from the pre-zero period).
   - Last 17 ppm is the prior calibration zero water gas CO_2 ppm.
5. After the pre-zero period, the analyzer shows the CO2 gas reading and a message indicating whether or not the reading is stable. Push ENTER to move to the next screen. The analyzer automatically detects the criteria for stability and shows STAB. However, the user is responsible for determining that the zero is sufficiently stable to proceed. A longer exposure to DI water creates a better zero calibration. This is especially true when the analyzer has been exposed to high concentrations of TOC immediately prior to gas calibration.

6. When the ppm CO_2 or µg/L TOC reading becomes stable, push ENTER to lock the signal in the analyzer and show a fixed screen that shows the live ppm CO_2 reading and prior zero ppm CO_2 reading.
7. Push CTRL then ENTER to go back to the prior screen and allow repeated update of the zero. A manual zero will automatically result in the active calibration being a manual calibration.

Manual Span Calibration

Push the up arrow from the Manual zero menu to enter the Manual Span calibration menu.
Note: *The span value is not necessarily the full scale span, but is the value of the span calibration standard. The displayed values (in ppm, µg/L and mg/L) may not match your analyzer.*

1. Push ENTER to select Manual Span and proceed to the calibration standard value screen.
2. Push ENTER to progress to the prompt screen to make sure the standard is connected to the calibration port.
3. Push ENTER. The screen shows the apparent TOC using the prior calibration, the pre span countdown timer, and the prior span TOC µg/L.
   Push the up arrow to display the equivalent screen displaying ppm CO_2 instead of µg/L TOC.
4. After the pre span countdown is completed, the analyzer displays the TOC µg/L reading and prompts to push the ENTER button when stable.
   For accurate calibration, high range analyzers benefit from long exposure to the span standard. The stability is tested before determining the result. However, the user is responsible for determining when the reading is stable. During this period, push ENTER to progress to the next screen.
5. Push ENTER to store the result of the calibration in the analyzer data base. A comparison screen between the live ppm and the span ppm results.
   At this point the manual calibration is made the active calibration, i.e., Cal to use is set to Manual.
6. Push ENTER to produce a final screen that displays the comparison of the calibration set with the primary calibration data set.

Primary Zero/Primary Span Calibration

Perform a primary zero and primary span calibration only when the pump tubing and/or lamp has been replaced. This allows progressive degradation of the tubes and lamps to be monitored.

A primary zero and primary span calibration follows a similar sequence of menu prompted operations as were displayed during manual zero and manual span calibration.

The difference between the two calibrations (Manual zero/Manual span and Primary zero/Primary span) is that the calibration set obtained during Primary zero/Primary span calibration is copied to two locations, while Manual zero/Manual span calibration set is copied to only one location.

Immediately following a primary zero or primary span calibration, the primary calibration is made the active calibration, i.e., Manual Control/Active Cal is set to Primary.

Autocal Standard Screen

The value shown on the Autocal Standard screen is the concentration of the standard that will be supplied to the calibration port and used during an auto calibration and auto validation.
The concentration value on the screen may be changed as follows:

1. Push ENTER.
2. Flashing asterisks will appear on either side of the displayed value. Use the up or down arrow to change the value.
3. Push ENTER when the desired value is displayed to enter the value in memory.

Multi-point calibrations

These are operator supervised calibrations using between 2 and 10 non-zero TOC standards.
The Multi-point add, Multi-point delete, Multi-point update, and Multi-point zero operations are used to perform the Multi-point calibration.

There is only one set of multi-point calibration data. The way the calibration data is used during an online measurement is different for each of the options selected in the Manual control/Active cal selection screen.

The multi-point calibration data set consists of a zero point (0,y_1) and up to ten non zero µg/L calibration span points, (x_2,y_2), (x_3,y_3)..... (x_{11},y_{11}). Menu entries are provided to add points, delete points, update points. The initial default entries in the multi-point calibration set are 0%, 10%, 25%, 50% and 100% of the full scale of the analyzer. For example, for the 1000 µg/L unit the points are (0,y_1), (100,y_2), (250,y_3), (500,y_4), (1000,y_5). The y_n gas CO_2 values are by default automatically chosen to define a perfectly linear graph. If a multi-point calibration set is selected as the active calibration, either manually or by performing any multi-point calibration, the Pri v Cal screen will only reflect the calculation based on the most recent calibration point measured and the multipoint zero.

Segmented

When this option is selected, the multi-point zero and the non zero multi-point standards will be used to calculate the TOC using a piece point linear representation.

TOC added

If the standards used for the TOC added calibration are analyzed after the calibration online, the TOC reported will be offset by the reagent water blank.

When this option is selected, the multi-point zero is not used. Only the non zero TOC calibration points are used to calculate the best-fit straight line calibration.

This line is used to calculate the reagent water blank and its associated ppm CO_2 value. A TOC added calibration is useful when calibrating a low range analyzer when the unknown carbon impurity in the DI water is significant.

Fitted

When this option is selected the multi-point zero and the multi-point TOC standards will be used to calculate the TOC using the best-fit straight-line calibration.

Multi-point add

For a point to be added to a multi-point calibration, the TOC standard must be specified and a calibration performed with this standard to get the corresponding CO_2 gas concentration. This procedure is similar to a manual calibration, except that the display returns to the edit µg/L screen. This way, after the initial point has been added, subsequent points may be entered. A new TOC value must not duplicate an existing entry and be at least 10% different from an existing entry. Points may be entered in any order. Following a successful calibration of a point, the entry is added to the calibration set and ordered from low to high.

Multi-point delete

A calibration point in the multi-point calibration set may be deleted. This is useful if the calibration point is bad or no longer required and the user does not wish to update the calibration point. Passcode entry is required to prevent inadvertent deletion. It is not possible to delete the last two points in the set or the zero point as a zero and span must always be retained.

Multi-point update

This procedure allows the re-calibration of existing calibration points. The screen sequence is similar to the manual calibration.

Multi-point zero

This procedure allows the zero in the multi-point calibration set to be established for segmented and fitted Active Cal selections. The screen sequence is similar to the manual zero procedure.

Validation

Do a validation to identify the validity of the current calibration.

Validations may be done manually and scheduled to occur automatically. Refer to Schedule validations, calibrations and cleaning on page 33 to schedule auto validations.

Show the results of the previous validation

1. Push ▼ until "Validation" is shown, then push **Enter**.

"Standard Validation" is shown.

2. Push **Enter**.

   The results of the previous validation are shown. The display alternately shows the:

   - TOC reading in mg/L
   - TOC reading as a percentage of the TOC standard

Do a validation manually

1. Push ▼ until "Validation" is shown, then push **Enter**.

   "Standard Validation" is shown.

2. Push **Enter**.

   The results of the previous validation are shown. The display alternately shows the:

   - TOC reading in mg/L
   - TOC reading as a percentage of the TOC standard

3. Push **Enter** to do a validation.

   The TOC standard that was used for the previous validation is shown.

4. To change the TOC standard for validation:

   a. Use the arrow keys to change the value.
   b. Push **Enter** to save the value.

5. Push **Enter**.
6. Make sure that the span (TOC) standard container is plumbed to the CALIBRATION port.
7. Push **Enter**.

   The time that remains to complete the validation is shown. When the validation is complete, the display alternately shows the:

   - TOC reading in mg/L
   - TOC reading as a percentage of the TOC standard

Manual control

Use the manual control menu to:

- Start, stop or prevent an auto validation, calibration or cleaning
- Select one of the six calibrations to use as the basis for calculation of TOC (or TC)
- Reboot the analyzer
- Change the stream selected on a dual stream analyzer

1. Push ▼ until "Manual control" is shown, then push **Enter**.

   The first option in the Manual control menu is shown, "Initiate cln?".

2. Use the arrow keys to scroll through the options.

Option	Description
Initiate cln?	Starts a cleaning.
Initiate cal?	Starts an auto calibration.
Initiate val?	Starts an auto validation.
Go online?	Stops a validation, calibration or cleaning cycle that is in progress and puts the system online.
Inhibit next clean?	Prevents the occurance of the next scheduled auto cleaning, but no subsequent auto cleanings.

Option	Description
Inhibit next calibration?	Prevents the occurance of the next scheduled auto calibration, but no subsequent auto calibrations.
Inhibit next validation?	Prevents the occurance of the next scheduled auto validation, but no subsequent auto validations.
Active Cal	Sets the calibration that is used as the basis for the calculation of TOC (or TC)—Manual, Primary, Auto-cal, Segmented, TOC added or Fitted. Refer to Calibration overview and options on page 44. Push **Enter** to change the value on the screen. Use the arrow keys to change the value, then push **Enter** to save.
Reboot system	Turns the analyzer off and back on. The previous settings are kept.
Change to[1]	Sets the selected stream—Stream 1 or Stream 2. Push **Enter** to change the value on the screen. Use the arrow keys to change the value, then push **Enter** to save. The amount of time the analyzer measures the selected sample stream is in accordance with the Stream period setting. Refer to Select the amount of time for analyzer phases on page 35.

[1] Dual stream analyzer only.

3. Push **Enter** to select the option.

Measure a grab sample

The analyzer automatically goes offline when a grab sample is measured and then back online after measurement.

1. Push ▼ until "Grab Sample" is shown, then push **Enter**.

   The results of the previous grab sample measurement are shown.
   Note: *Grab sample readings are only shown on the Grab sample screen.*
2. Disconnect the tubing for the span standard container from the span standard/grab sample inlet (CALIBRATION port). Refer to Figure 9 on page 21.
3. Plumb clean tubing to the CALIBRATION port, then put the tubing in the grab sample.
4. Push **Enter**.
5. Push **Enter** again to start the measurement.

   The time to complete the measurement is shown. The time is according to the Pre span period setting.

   When the measurement is completed, the reading and the time and date of the measurement are shown on the grab sample screen for 10 seconds.
6. Disconnect the tubing from the CALIBRATION port.
7. Plumb the span standard container to the CALIBRATION port.

Maintenance

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

⚠ CAUTION

Ozone inhalation hazard. Under certain conditions, this instrument produces ozone concentrations above safe exposure limits. Plumb waste gases to a fume hood or to the building exterior in accordance with local, regional and national requirements.

If loss of liquid sample occurs and the UV lamps remain on, the interior analyzer and the waste gas line may have ozone concentrations at levels greater than 200 ppm. This ozone level is well in excess of permissible occupational exposure limits. When opening either the upper or lower cabinets, allow 60 seconds for any potential ozone gas build-up to dissipate before working on the instrument.

Note: *The manufacturer is not responsible for damage to the instrument caused by failure of the user to do recommended periodic maintenance.*

Electrostatic discharge (ESD) considerations

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Refer to the steps in this procedure to prevent ESD damage to the instrument:

- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.
- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

Maintenance schedule

Table 17 gives the maintenance schedule for the analyzer. The maintenance schedule shows the time intervals for maintenance tasks. Maintenance tasks may need to be done more frequently depending on the operating environment.

Table 17 Maintenance tasks and schedule

Maintenance task	Daily	Monthly	Quarterly	Annually
Look for alarms or events. An indicator light is illuminated or flashes when an alarm or event has occurred. Refer to User interface on page 23.	X			
Look for liquid leaks and other conditions that are not typical. Repair leaks immediately to prevent analyzer damage.	X			
Look at the flow meter reading for the UV reactor carrier gas flow. Make sure that the reading is stable and approximately the same reading that was recorded during initial start-up.	X			
Examine the GLS and sparger. Make sure that the sparge gas bubbles flow correctly. ***Note:*** *The sparger on the TC version is bypassed with the conversion.*	X			
Prepare the reagents and fill the 5-gallon containers. (Some reagents last two months).		X		
Calibrate the analyzer with fresh span standards.		X		
Make sure that the pressure of the carrier gas is sufficient. Refer to Attach a carrier gas on page 23.		X		
Examine the analyzer to see if it is dirty. Clean the exterior of the analyzer if necessary.		X		

Table 17 Maintenance tasks and schedule (continued)

Maintenance task	Daily	Monthly	Quarterly	Annually
Install new peristaltic pump tubing. Refer to Replace the pump head and pump tubing on page 53.			X	
Examine the UV lamps and make sure that the lamp surfaces are clear. If the lamp surfaces are not clear, start a cleaning cycle. Refer to Manual control on page 48. Before the analyzer is put back online, wrap standard aluminum foil around each lamp to prevent UV exposure.				X
Clean the IR sample cell and windows with an applicable solvent. Refer to Clean the IR cell on page 56.				X

Clean the analyzer

⚠ DANGER

Electrocution hazard. Remove all power from the instrument and relay connections before this maintenance task is started.

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Clean the external surfaces of the analyzer and the internal surfaces of the lower cabinet with a damp cloth and a mild detergent.

After the analyzer has been in operation for approximately one month, examine the IR cell. Make sure that the cleaning process and solution are sufficient to keep the internal system clean. Adjust the auto cleaning schedule as necessary. Refer to Schedule validations, calibrations and cleaning on page 33. Clean the internal system at least once a year.

Cleaning solutions

⚠ DANGER

Chemical exposure hazard. Gas from a chlorine compound and UV light reaction can cause death. Do not use chlorine compounds for cleaning.

⚠ DANGER

Chemical exposure hazard. UV light reacts with some solutions to form a dangerous gas. If a dangerous gas can form with the solution that is used, keep the UV lamps off.

Use a cleaning solution to clean biological films or compounds that can collect or crystallize in the plumbing. Use a cleaning solution as specified in Table 19.

The cleaning solution must not dissolve or damage the instrument components or produce harmful gases or by-products. The applicable instrument components are shown in Table 18.

If the clean cycle is not effective, adjust one or more of these options:

- Cleaning interval
- Cleaning duration
- UV lamp mode if safety is not compromised—refer to Table 19
- Cleaning solution

Table 18 Internal components

Component	Composition
Fittings	Polypropylene
Manifolds	Acrylic
O-rings	Silicone
Valve seals	Viton, Kalrez
IR cell	PVDF
Tubing	PFA/stainless steel, Norprene A-60-G, Tygon R-3603
Glassware	Quartz, borosilicate glass

Table 19 Cleaning solutions and UV lamp mode

Cleaning solution	UV lamp mode
DI water	ON or OFF
50/50 mix (by volume) of H_3PO_4 and $Na_2O_8S_2$	ON or OFF
1.0 M sodium hydroxide	OFF
10% HCl	OFF
5% acetone	OFF

Shutdown procedure

⚠ DANGER

Electrocution hazard. Remove power from the instrument before doing maintenance or service activities.

⚠ WARNING

Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current material safety data sheets (MSDS) for safety protocols.

⚠ CAUTION

Health hazard. Hazardous levels of ozone can be generated if the UV lamps are left on while only air moves through them.

NOTICE

Failure to do the correct shutdown procedure can cause damage to the instrument when the instrument is started again.

- The analyzer is designed for continuous operation. The useful life span of the UV lamps is decreased if the lamps are turned on and off when not necessary.
- Do not allow the UV lamps to stay on when liquid is not flowing through the reactor. Blockage and/or damage may occur.
- If measurement is not necessary or possible, use deionized water for sample in the analyzer.

To shut down the analyzer:

1. Replace all reagent containers with distilled or deionized water.
2. Turn off the UV lamp(s) from the Service/Relay test/lamps screen.
3. Flush the analyzer with the distilled or deionized water for 10 minutes.
4. Stop the analyzer to turn off the pumps. From the main menu, push the **DOWN** arrow, then push **ENTER**.
5. Disconnect the gas line between the GLS and the IR manifold.
6. Flow clean, dry nitrogen or purified air through the IR cell to dry and clean it.
7. Turn off the main power to the analyzer.

Replace the pump head and pump tubing

⚠ DANGER

Electrocution hazard. Remove all power from the instrument and relay connections before this maintenance task is started.

⚠ CAUTION

Pinch hazard. Remove power from the instrument before maintenance or service activities are done.

Required items:

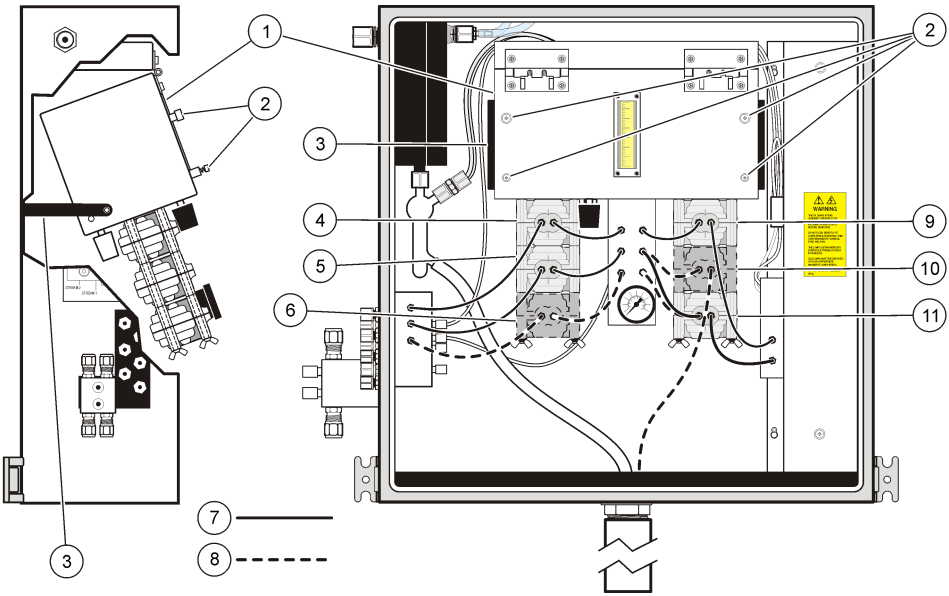
- Tube loading key
- Flat blade screwdriver

Flush the analyzer with DI water for 20 minutes before this procedure.

Refer to Replacement pump kits on page 80 for replacement tubing and barb information. Refer to Hardware configuration on page 83 for replacement pump information. Use barb reducers to connect any reduction tubing as given in the pump kit instructions. For best operation, use only the minimum lengths of tubing necessary.

Loosen the four captive screws and swing out the pump module to make the pump accessible. Refer to Figure 16.

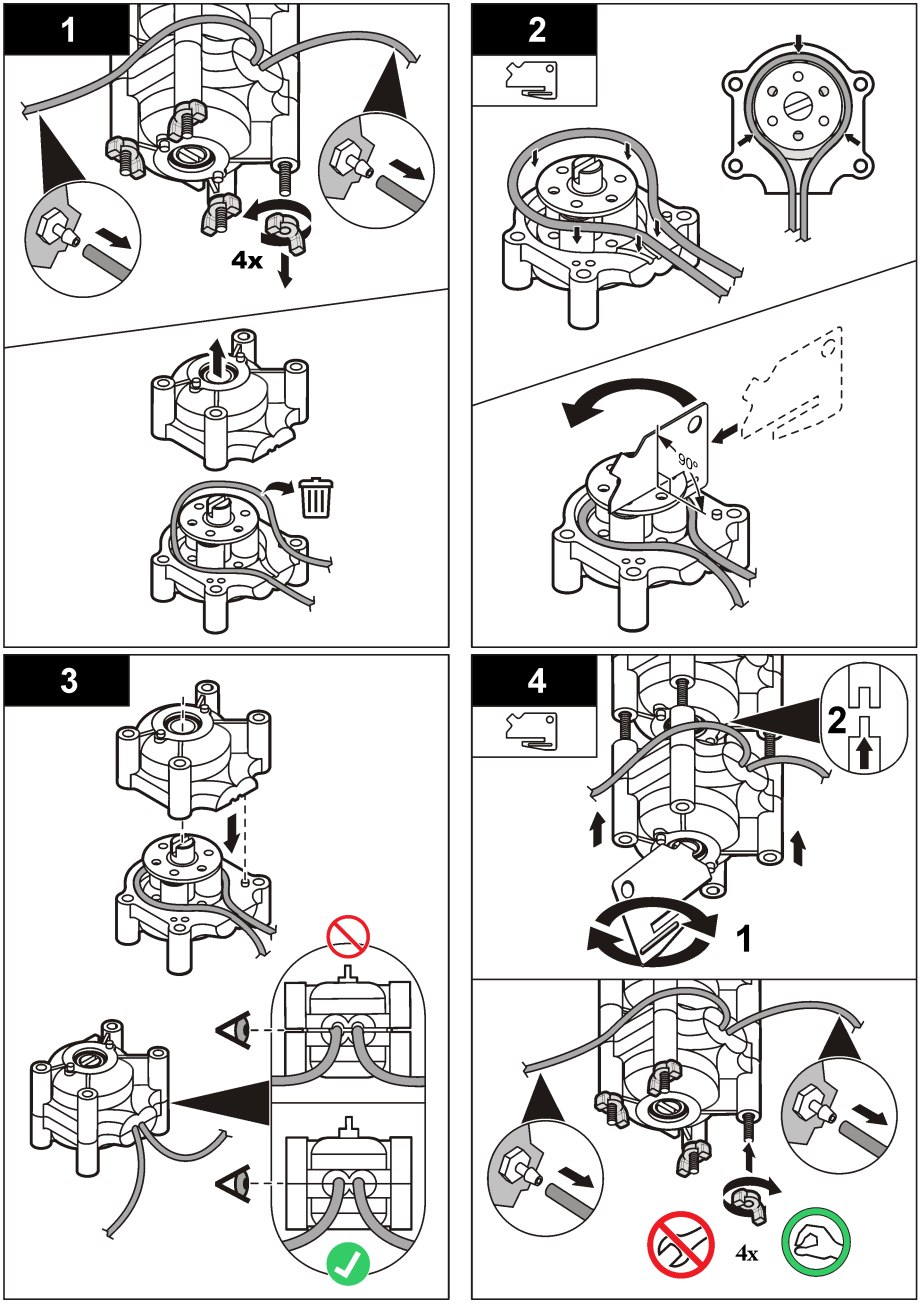
Figure 16 Pump module assembly



1 Pump module assembly	**7** Tubing route for standard pumps
2 Captive screws	**8** Tubing route for optional pumps
3 Pump module prop (2x)	**9** Persulfate pump head
4 Acid pump head	**10** Optional Sparger waste pump head (Turbo analyzers only)
5 Sample pump head	**11** Resample pump head
6 Optional dilution pump (Process analyzers only)	

1. To install the pump tubing, refer to Figure 17. Do a primary calibration of the instrument after new pump tubing has been installed.

Figure 17 Replace pump tubing



Clean the IR cell

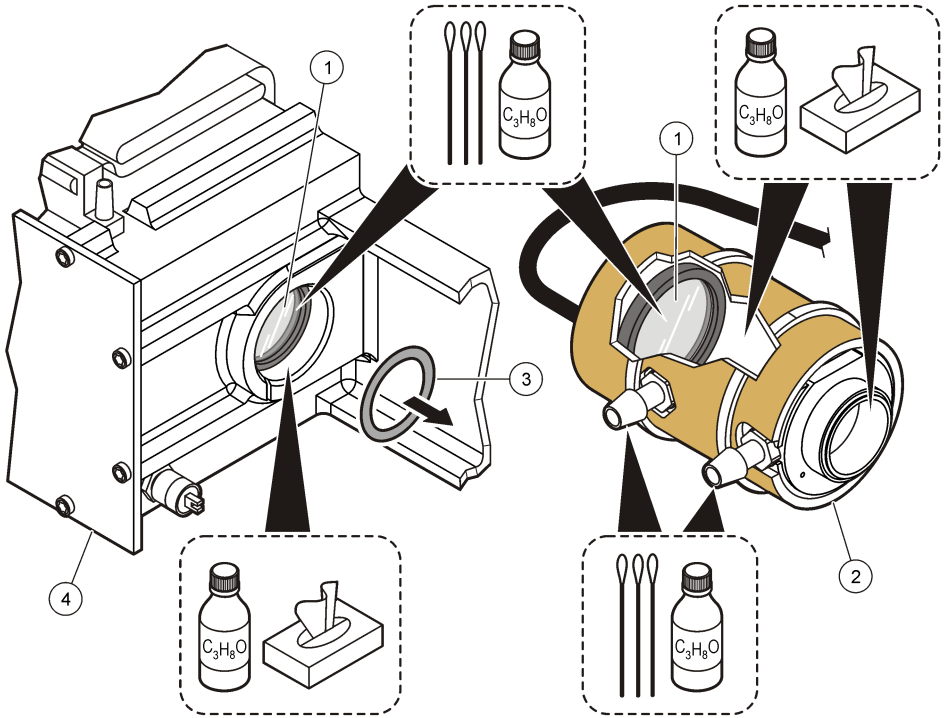
⚠ DANGER

Electrocution hazard. Remove all power from the instrument and relay connections before this maintenance task is started.

Clean the IR cell at least once a year or when results become irregular. Refer to the illustrations in this section for IR cell removal.

1. Remove the inlet and outlet tubing from the IR cell. Refer to Figure 19 on page 59.
2. Support the mirror assembly to prevent the cell assembly from falling out if the thumb latch releases unexpectedly. Refer to Figure 19 on page 59.
3. Cut the tie wrap. Refer to Figure 19 on page 59.
4. Pull the thumb latch away from the cell assembly to release it. Refer to Figure 19 on page 59.
5. Clean the interior wall of the cell assembly with lint-free tissues and isopropyl alcohol. Refer to Figure 18.
6. Use cotton swabs and isopropyl alcohol to clean the sapphire window that protects the parabolic mirror. Refer to Figure 18.
7. Do an inspection of the assembly to make certain that all debris and contamination are fully removed and that the sapphire is not scratched or cracked.
8. Make sure that the parabolic mirror is not discolored. If the mirror is discolored or the sapphire is damaged, replace the cell assembly.
9. Clean the sapphire window in the IR bench with the same procedure used to clean the cell assembly window. Refer to Figure 18.
10. Remove the O-ring between the cell and the bench assembly.
11. Do an inspection of the O-ring and look for damage, debris or deterioration. Install a new O-ring if the O-ring shows damage, debris or deterioration.
12. Do an inspection of the inlet and outlet ports for obstructions or contamination. Remove obstructions or contamination with cotton swabs and isopropyl alcohol.
13. Install the tubing and a new tie wrap.
14. Do a pressure/leak test. Refer to Pressure/leak test on page 57.

Figure 18 Clean the IR cell



1 Sapphire window	**3** O-ring (between IR bench and mirror assemblies)
2 IR mirror assembly	**4** IR bench assembly

Pressure/leak test

⚠ DANGER

Electrocution hazard. Remove all power from the instrument and relay connections before this maintenance task is started.

⚠ CAUTION

If relay contacts are connected to AC line voltage, remove the main power to the analyzer before the top enclosure door is opened.

Do a pressure/leak test to make sure that the O-rings are correctly installed and have sealed the IR cell assembly.

1. Remove the outlet tube from the IR cell assembly and plug the outlet tube.
2. Monitor the bubbles in the GLS U-tube. If the bubbles travel consistently from front to back, the cell O-rings give a sufficient seal.
   Note: *Failure of this test may also indicate a cracked condenser or leaky GLS fitting.*

Replace the IR cell

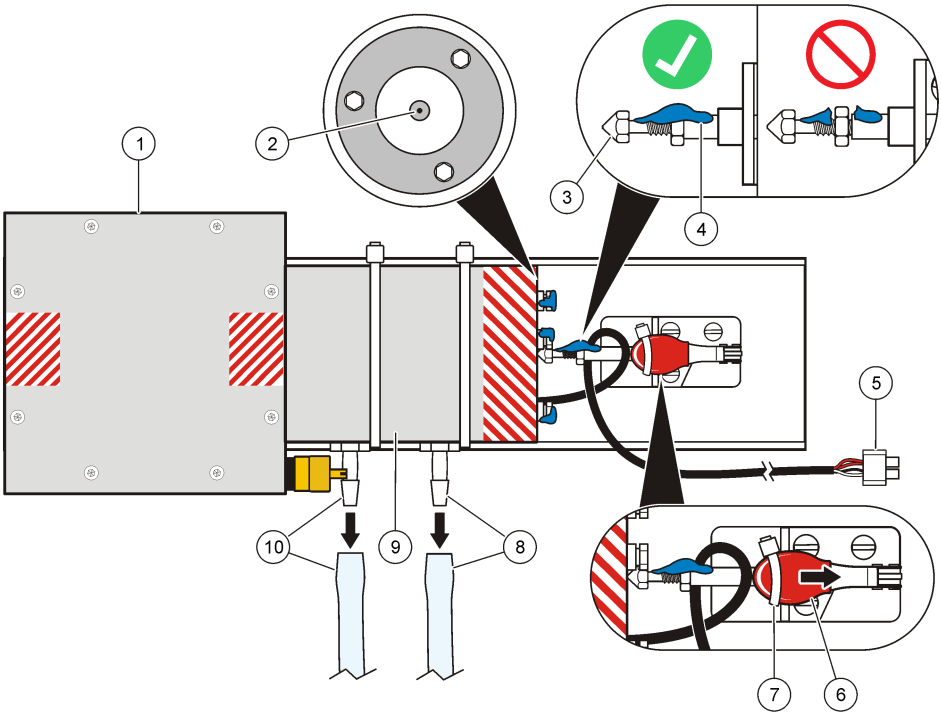
⚠ DANGER

Electrocution hazard. Remove all power from the instrument and relay connections before this maintenance task is started.

Note: *After a new IR cell is installed, the thumb latch must be adjusted. Improper adjustment of the thumb latch can damage a new IR cell assembly and make it impossible to correctly align the mirror.*

1. Remove the inlet and outlet tubing from the IR cell. Refer to Figure 19.
2. Disconnect the power connector from the I/O board.
3. Support the mirror assembly to prevent the cell assembly from falling out if the thumb latch releases unexpectedly. Refer to Figure 19.
4. Cut the tie wrap. Refer to Figure 19.
5. Pull the thumb latch away from the cell assembly to release it. Refer to Figure 19.
6. Install the new IR mirror assembly and connect the power connector to the I/O board.
7. Install a new tie wrap.
8. Restore power and do a pressure/leak test. Refer to Pressure/leak test on page 57.

Figure 19 Remove the IR cell



1 IR bench assembly	**6** Latch handle
2 Indentation for latch piston	**7** Tie wrap
3 Latch piston	**8** Inlet fitting and tubing
4 Inspector lacquer	**9** IR mirror assembly
5 Power connector	**10** Outlet fitting and tubing

Calibrate IR gas

⚠ DANGER

Electrocution hazard. If relay contacts are connected to AC line voltage, remotely disconnect the power before opening the upper enclosure door of the analyzer.

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

CO_2 span gas at 1000 ppm or 10000 ppm is necessary to do this procedure. For IR span, ppm CO_2 gas range, refer to Hardware configuration on page 83.

Zero gas can be the carrier gas. Connect the zero and span gases directly to the IR manifold.

Calibrate the IR gas when the IR is out of calibration. Make sure that the feed pressure at the carrier gas inlet is 40-90 psig.

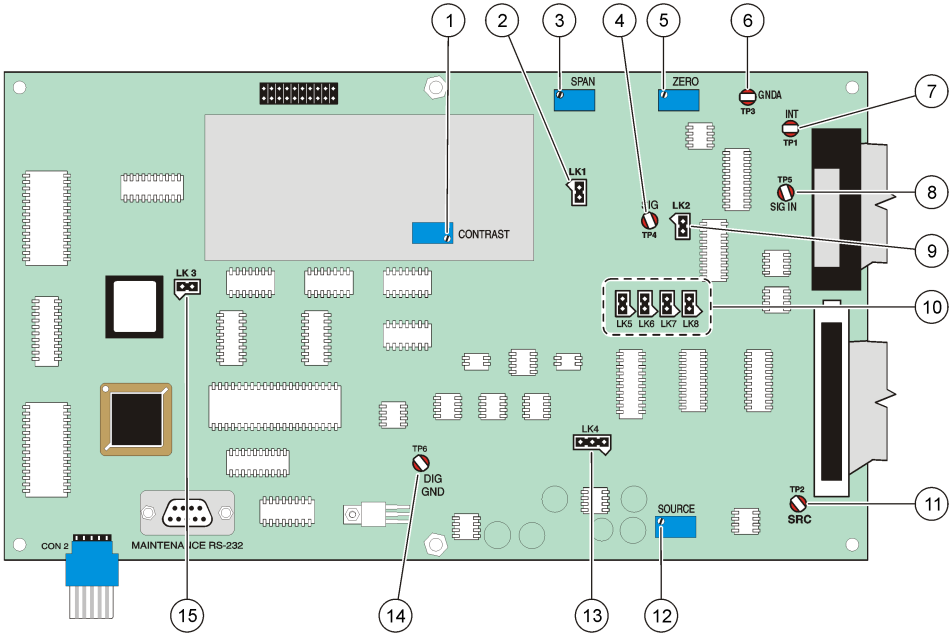
1. In the Service/Elevation menu, set the elevation to 1 m.
2. In the Service menu, push the up arrow three times.
   The display shows the IR cal screen.
3. Make sure that the temperature of the IR cell is in the range of 48 to 51 °C. Apply the zero gas directly to the cell. Let the gas flow for 10 minutes at 200 cc/minute.
4. Identify the IR span gas concentration (1000 ppm or 10000 ppm CO_2). Refer to Hardware configuration on page 83. If the span gas is 1000 ppm, LK1 must be out. If the span gas is 10000 ppm CO_2, LK1 must be in. Refer to Figure 20 on page 61.

Zero adjustment

Make the zero adjustment on the 8000 display/controller board. Refer to Figure 1 on page 8.

1. Turn the screw clockwise to increase the voltage. Turn the screw counterclockwise to decrease the voltage. Refer to Figure 20.
2. When the zero gas reading is stable, adjust the Zero potentiometer so that the voltage is between 0.26 and 0.27 V.
   0.27 V gives a CO_2 ppm reading slightly above zero. 0.25 V gives a zero reading, but the actual gas ppm reading on the display could be zero or below zero. The slight increment above zero makes sure that the gas ppm reading is in a positive range.

Figure 20 Adjust the zero potentiometer on the 8000 controller PCB



1 Contrast adjustment	**9** LK2-IN-AGC setup
2 LK1-IR range selection (OUT=0-1000 ppm, IN=0-10000 ppm)	**10** LK5-LK8-IN
3 Span adjustment	**11** TP2-Source voltage 1.7 V
4 TP4-IR voltage 0.25V-4.75 V (at sea level only)	**12** Source voltage adjustment to 1.7 V
5 Zero adjustment	**13** LK4-OUT (stepper inputs)
6 TP3 Analog ground (Ø V)	**14** TP6-Digital 0 V
7 TP1-INT output	**15** LK3-EPROM
8 TP5-SIG IN (input signal from IR bench)	

Span adjustment

1. Connect the appropriate span gas (1000 ppm or 10000 ppm) to the IR manifold and let it flow for 10 minutes at 200 cc/minute until the reading is stable.
2. When the reading is stable, adjust the span potentiometer to read the approximate CO_2 ppm (1000 or 10000 ppm).
3. After the span adjustment is completed, examine the zero adjustment again. The span and zero adjustments interact. Adjust the zero setting and the span setting back and forth as necessary to get correct last adjustments.
   Note: *Noise can cause minor fluctuations in the readings. If the fluctuations bracket the wanted values, the readings are acceptable.*
4. If the span gas does not yield 1000 ppm ±5 ppm or 10000 ppm ±50 ppm, make sure that the LK1 jumper position is correct. Refer to Hardware configuration on page 83. If necessary, contact the manufacturer.

Clean the gas liquid separator (GLS)

⚠ DANGER

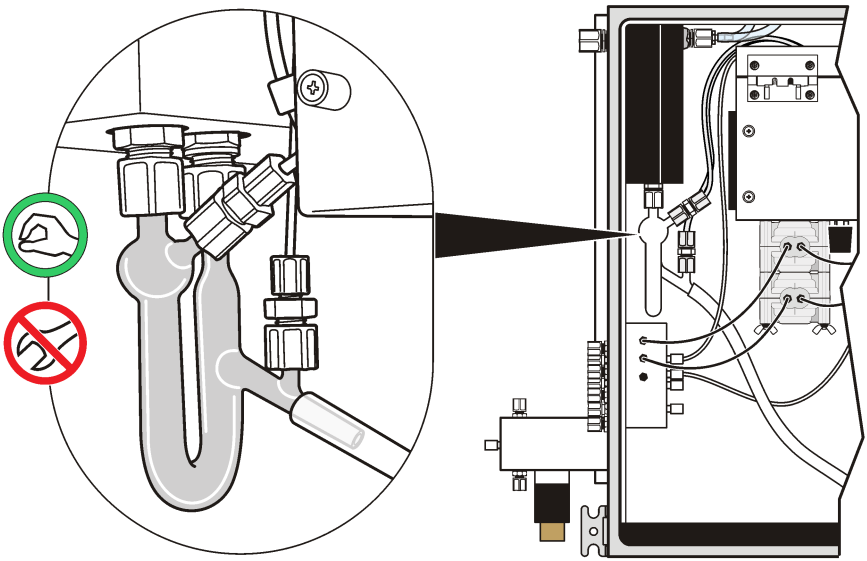
Electrocution hazard. Turn off all pumps and lamps before servicing the GLS. Disconnect power to the relays before opening the analyzer top enclosure door.

⚠ CAUTION

Personal injury hazard. If the analyzer has not been flushed with deionized water for 20 minutes, some acid and persulfate is still in the inlet tubes and the peristaltic tubes. Use caution when removing the tubes as the acid and persulfate may spray out.

1. Turn off main power to the analyzer.
2. Disconnect the four finger-tight connectors and slide the GLS down to remove the GLS from the analyzer (Figure 21).
3. Invert the GLS to remove accumulated sediment. Flush with deionized water from a squeeze bottle if necessary. Remove algae accumulations with a cotton swab and deionized water.

Figure 21 Clean the gas liquid separator (GLS)



Fuse replacement

⚠ DANGER

Electrocution hazard. Remove all power from the instrument and relay connections before this maintenance task is started.

NOTICE

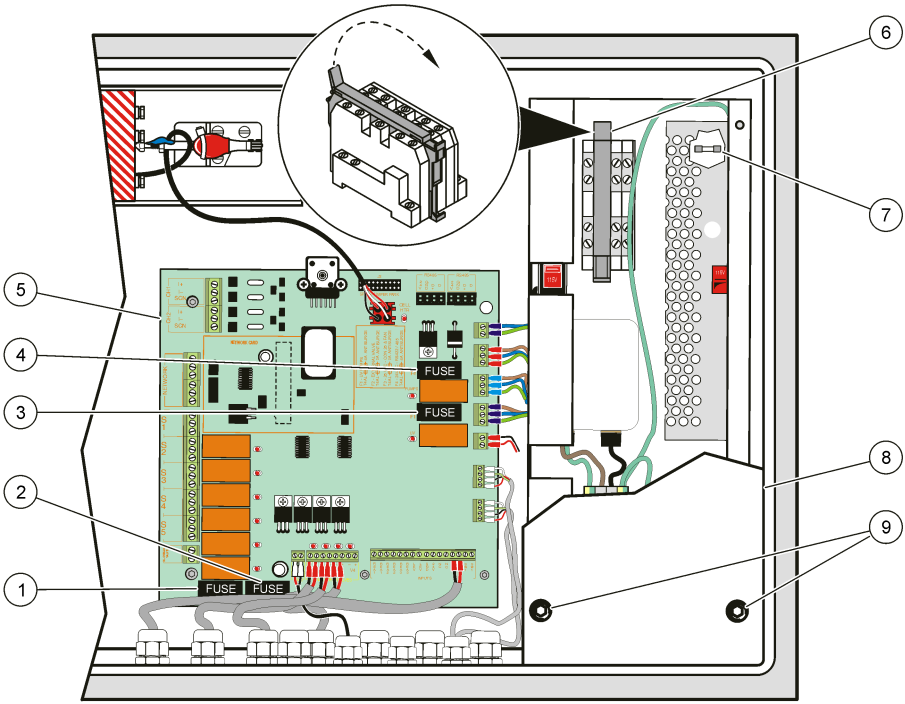
Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

⚠ DANGER

Fire hazard. Use the same type and current rating to replace fuses.

Figure 22 shows the locations and specifications of the fuses.

Figure 22 Fuse locations and descriptions



1 **F2**-External valve fuse	**6** **F5** fuse holder
2 **F3**-Con25 and fan fuse: 1 A anti-surge 250 V (IEC127 Sheet III Type 2)	**7** Power supply terminal fuse: 2 A anti-surge 250 V (IEC127 Sheet III Type 2)
3 **F1**-UV lamp fuse	**8** Power supply cover
4 **F4**-RS422/485 fuse: 4 A anti-surge 250 V (IEC127 Sheet III Type 2)	**9** Cover screws (4x)
5 Printed circuit board	

Troubleshooting

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Preliminary checks

1. Make sure that the proper electrical power is supplied to the analyzer.
2. Make sure that the fuses are good.
3. Make sure that the liquid and gas supplies are present and sufficient.
4. Make sure that all drains, sample and gas lines have no kinks, restrictions or leaks. If necessary, refer to the user instructions for TC conversion and flow diagram.

Instrument does not calibrate

Do liquid tests that require changes to the plumbing after a purge cycle so that there is no contact with samples and reagents.

1. Make sure that the sample flow is sufficient. Put a finger over the IR cell outlet (vent) and look at the GLS U-tube. Make sure that bubbles move in the U-tube from front to back.
2. Make sure that the overflow portion of the GLS is filled with water and drains correctly.
3. Look at the water level in the back-pressure gauge on the GLS and make sure that it is at the operation level.
4. If there is an increase in pressure (caused by a clog or obstruction), the U-tube liquid seal is pushed down on the right side and gas bubbles appear around the bottom of the U-tube. Remove the clog or obstruction.
5. If bubbles are forced through the drain, there is too much back pressure in the IR or vent line. Clean or replace the IR tubing.
6. Stop the analyzer, refer to Shutdown procedure on page 52.
7. Disconnect the carrier gas supply to the UV manifold. Fold the carrier supply tubing to obstruct flow or use a fitting to prevent flow. The flow meter shows the carrier flow is zero and an alarm might be generated as the reactor has been pressurized.
8. Put a plug into the sparger block manifold outlet that is connected to the resample pump.
9. Put the inlet to the resample pump in a new calibration standard.
   Note: *In dilution analyzers, it might be necessary to dilute the standard by the dilution fact, normally 10. If needed, use the tubing from the start-up kit for this procedure.*
10. Reconnect reagents and start the analyzer.
    Note: *Step 11 should not be done with acid and persulfate in the analyzer.*
11. Use water instead of acid and persulfate to make sure that the delivery rates (mL/min) of all pumps match the hardware configuration table. Use a small measuring cylinder to measure how much water is taken from the cylinders.

Instrument readings are not stable or drift

1. Make sure that electrical input wiring is correctly installed.
2. Make sure that the nitrogen flow rate is stable.
3. Make sure the carrier gas feed pressure is correct. If needed, calibrate the IR gas. Refer to Calibrate IR gas on page 59.
4. Look for pinched or incorrectly installed pump tubing.

Periodic spikes in the readout

Large particles in the sample cause periodic spikes in the readout. At elevated temperatures, persulfate bubbles can also cause dips followed by spikes in the output.

1. Look for large particles in the sample. Mix the sample sufficiently.
2. Make sure that the large particles do not go into the reactor.
3. Do not go beyond the molarity specified in Table 9 on page 26.

Identify a carrier gas leak

Do this procedure to identify and fix a carrier gas leak.

1. Make sure that the fittings, barb connections etc for the carrier gas lines are tight. Tighten any loose connections.
2. Make sure that there is an air/gas interface in the UV reactor manifold. Refer to Figure 2 on page 9.

   The air/gas interface frequently moves up and down where the carrier gas contacts the persulfate and resample solution which flows up.
3. In the top enclosure, pinch closed the right tygon tube. Refer to Figure 19 on page 59.
4. Make sure that the bubbles in the GLS U-tube consistently move from front to back. If not, a leak is present or the condenser has a crack. Refer to Figure 2 on page 9.
5. In the top enclosure, pinch closed the left tygon tube that contains flow from the IR detector. Refer to Figure 19 on page 59.
6. Make sure that the bubbles consistently move from the front to back of the GLS. If not, a leak is present at the flow cell on the IR bench.

Maintenance codes

Code	Description	Diagnosis	Corrective action
M01 (Zero stability)	Four attempts at a zero calibration have been made and failed.	During the cleaning delay, insufficient carbon is removed. This results in a significant oxidation during a baseline, and causes the CO_2 to vary.	Make sure that: • The clean period is sufficient and the cleaning solution is sufficient for the application. • The pre zero period is set to a value greater than the response time of the analyzer.
		The carrier flow rate is varying.	Make sure that the flow meter gas supply is at a constant pressure.
		The purity of the DI water varies or there is not enough water.	Make sure that: • The purity of the zero standard is sufficient and replace if necessary. • The peristaltic pumps operate correctly. • The calibration valves are fully open.
		The persulfate has carbon impurities.	Use carbon free persulfate only.
		Fluid or gas system leaks.	Fix all leaks.
		Poor IR cell heater control.	Make sure that the cell temperature is constant 49 °C ±1 °C.
		Faulty IR	Contact technical support.

Code	Description	Diagnosis	Corrective action
M02 (Zero standard level)	The zero standard produces a CO_2 level that is too high.	High CO_2 level	Calibrate the IR again. Use carrier gas in the IR input and make sure that IR reads zero.
		The purity of the DI water varies or there is not enough water.	Make sure that: • The purity of zero standard and replace if necessary. • The peristaltic pumps operate correctly. • The calibration valves are fully open.
		The persulfate has carbon impurities.	Use carbon free persulfate only.
		Fluid or gas system leaks.	Fix all leaks.
		The carrier gas has a high CO_2 content.	Increase purity of carrier gas.
M03 (Span stability)	Four attempts at a span calibration have been made and failed.	The purity of the standard solution is bad, there is not enough solution, or solution has not been introduced for long time.	• Make sure that there is a constant flow of standard. • Make sure that the calibration valves are fully open. • Increase the Pre span delay to make sure that the analyzer has a stable IR CO_2 reading before a span is performed.
		The persulfate has carbon impurities or it is not delivered constantly.	Make sure that the persulfate delivery system is in good condition.
		The TIC extraction/acid mix is not constant. This can be because of no TIC extraction or an irregular supply of acid. If there is no TIC in the standard, the acid is a small diluent to the sample that gets into the reactor.	Make sure that the acid delivery system is constant and that there are no impurities in the acid. Use fresh TIC free calibration standard.
		Leaking fluid or gas system	Fix all leaks.
		Poor IR cell heater control	• Make sure that the cell temperature is constant 49 °C ±1 °C. • Increase span size.

Code	Description	Diagnosis	Corrective action
M04 (Span standard level)	In order to pass an auto calibration, it is necessary to get 65% of the theoretical CO_2 for the applied standard. For example, if the analyzer is calibrated with 10000 ppm CO_2 and the analyzer is a 1000 mg/L analyzer, and if the single point standard is 1000 mg/L, it is expected that the gas produced will be at least 6500 ppm CO_2. Expected CO_2 = 0.65 x FSD gas x CAL STD ÷ Analyzer FSD Expected CO_2 = 0.65 x 10000 x 1000 ÷ 1000 = 6500 ppm CO_2	Oxidation is not sufficient, caused by insufficient persulfate (supply or strength) or weak or bad UV lamps.	• Make sure that the condition of the persulfate delivery system is good. • Make sure that the concentration of persulfate is correct. • Look for a broken lamp.
		Bad standard.	Mix a new standard and make sure that it matches the value entered in the Single cal std menu.
		Fluid leak.	Fix all leaks.
M05 (Maintenance %)	The difference between the current calibration and the primary calibration is more than the Maint % Primary setting. Refer to Change the tolerance settings (not recommended) on page 42.	—	• Increase the Maintenance % in the Setup\Tolerance \Maintenance % Screen. • Replace peristaltic pump tubing and perform a primary and calibration.
M06 (Validation %)	The validation result (%) is different by more than the validation tolerance setting. Refer to Select validation, calibration and cleaning options on page 34.	—	• Make sure that the standard is the correct mg/L. • Calibrate the analyzer again. • Increase the validation %. • Make sure that the standard concentration that is selected is correct.
M07 (Calibration failure)	The difference between the current calibration and the primary calibration is more than the Fault % Primary setting. Refer to Change the tolerance settings (not recommended) on page 42.	—	• Replace peristaltic pump tubing and perform a primary calibration. • Edit the entry in the Setup/Tolerance/Fault % Pri Screen.
M08 (Reactor flow)	The UV reactor pressure is greater than the Maint Pressure setting. Refer to Change the tolerance settings (not recommended) on page 42.	The UV reactor flow is restricted.	• UV manifold crystal buildup in the UV block. Clean the UV manifold. • Blocked UV reactor. Disassemble the reactor and flush with water to remove this blockage.
M09 (Low reagents)	One of the level detectors for the reagents has detected a low reagent level. To disable this feature, refer to Change the input status on page 70.	—	• Refill the bottles. • Make sure that the jumper settings are correct.

Code	Description	Diagnosis	Corrective action
M10 (Low cell temperature)	The temperature of the flow cell in the IR detector is too low.	Cell heater plug not connected to 8001 I/O PCB assembly.	Connect IR cell heater. Determine if IR cell is warm to touch.
		Cell heater faulty. Indicator light repeatedly turns on and off.	Replace the cell heater.
		Erratic cell temperature	Stop the analyzer. If the cell temperature becomes stable: • Replace any failed UV lamps. • Replace the UV power supply.
M11 (Spill detection)	The TOC level is greater than the spill threshold. A cleaning cycle is done for the spill recovery time. Refer to Select validation, calibration and cleaning options on page 34. To disable this feature, increase the spill threshold setting.	—	—
M12-M16 (Not allocated)	—	—	—

Fault codes

Code and fault message	Diagnosis	Corrective action
F01 (No sparger flow)	Loss of sample ***Note:*** *To disable this feature, refer to* Change the input status *on page 70*.	• Disable the flow sensing in the Service\Input status screens. In later firmware versions, the flow failure thresholds must be set to zero. • Make sure that there are no leaks in the acid line from the tubing or fittings. • Make sure that sample flows to the analyzer.
F02 (No UV lamp flow)	False trigger	Disable the flow sensing in the Service\Input status screens. In later firmware versions, this might require the setting for flow failure thresholds be set to zero.
	Loss of persulfate	Make sure that there is persulfate supply.
	Loss of resample	Make sure that there are no leaks in resample.
F03 (No carrier gas)	The pressure switch has detected low carrier pressure.	• Make sure that there is carrier gas. • Replace the pressure switch.

Code and fault message	Diagnosis	Corrective action
F04 (Drain level)	The analyzer has detected that the level sensor in the drain pan has been actuated.	—
	The analyzer has a leak and the drain has a blockage.	Make sure that the drain is clear.
	The level sensor is installed with the wrong orientation.	Invert level sensor.
F05 (Not allocated)	—	—
F06 (Reactor flow)	The pressure in the UV reactor is greater than the specified value in the Fault Pressure Threshold in Setup/Tolerances. The reactor flow is restricted.	• UV manifold crystal buildup in the UV block. Clean the UV manifold. • Blocked UV reactor. Disassemble the reactor and flush with water to remove this blockage.
F07-F08 (Not allocated)	—	—
F09 (IR detector)	The Automatic Gain Control level on the IR has reached an unacceptable level.	Examine and clean the optics in the IR cell. Refer to Clean the IR cell on page 56.
F10-F16 (Not allocated)	—	—

Service menu

Use the Service menu to find if there is a hardware problem. The analyzer shows an offline status when a service menu other than input status screen is used.

1. Push **Ctrl + Down** arrow to access the Service menu from the main operating screens. The screen shows "Service."
2. Push **ENTER**. The relay test menu is shown.

Test the relays

NOTICE

Possible instrument damage. If the carrier loss input is disabled, the pumps run when the carrier is not present. This can result in damage to the carrier gas system due to liquids that flow back through the carrier gas components.

Use the Relay test menu to toggle the status of the S1-S5 relays, the blowback valve, lamps and pumps. The screen shows "Relay test."
Note: *If a relay is activated, an alarm system connected to the relay might be activated.*

1. Push **ENTER**.
2. When prompted, type the pass code (1953) and push **ENTER** again. The S1 relay status screen shows "S1 relay ON."
3. Push **ENTER** to toggle the relays between ON and OFF. Push the up arrow to access the S2 relay and enter the status of the S1 relay (ON or OFF) into memory. The S2 relay status screen is displayed. The Blowback screen, the Lamp screen and the Pumps screen show "ON."
4. Use the up and down arrows to move through the screens.
   Note: *In these screens, HI/LO only allows a change to be seen for the logical level of the input. It does not refer to the High or Low nature of the parameter that is monitored.*
5. To enable or disable a function, push **ENTER**. Asterisks flash on either side of Enable or Disable. Push the up and down arrows to toggle between Enable and Disable. Push **ENTER** to save and store your selection.

6. Push the up and down arrows to continue to the next screen.
7. To exit the input status function, push **Ctrl** and then **ENTER**.

Test the valves

⚠ DANGER

Explosion hazard. Do not connect or disconnect electrical components or circuits to the equipment unless power has been removed or the area is known to be non-hazardous.

These menus turn on the streams, clean and calibration valves. The standard analyzer does not have a connection to V4 terminals.

1. Push the up arrow in the Relay test menu to access the Valve test menu. The screen shows "Valve Test."
2. Push **ENTER**.
3. When prompted, type the pass code (1953) and push **ENTER** again. The Online valve V1 status screen is displayed.
4. Push **ENTER** to toggle between ON/OFF status. This displayed selection is saved when the screen is exited.
   Each time the up arrow is pushed, the Clean valve V2, STD valve V3 and Valve V4 screens are shown in succession. Push **ENTER** to toggle between ON/OFF status.
   Note: *In normal operation, the stream valve V4 is temporarily disabled when V1 is switched on.*

Change the input status

NOTICE

Possible instrument damage. If the carrier loss input is disabled, the pumps run when the carrier is not present. This can result in damage to the carrier gas system due to liquids that flow back through the carrier gas components.

The Input Status menus allow the level of the logical input to be measured and allow the action of the input to be enabled. The actual logical input levels (HI and LO) are not significant as long as they change when the actuator state is changed. If an input is disabled, it will not cause an event warning or fault to occur.

1. Push the up arrow from the Valve test menus to access the Input status menus. The screen shows "Input status."
2. Push the up or down arrow. When prompted, type the pass code then push **ENTER** again.
3. Push the up or down arrow to move through the screens.
   Note: *In these screens, HI/LO only allows a change to be seen for the logical level of the input. It does not refer to the High or Low nature of the parameter that is monitored.*
4. Push **ENTER** to enable/disable a function. Asterisks will flash on either side of Enable or Disable.
5. Push the up or down arrow to select Enable or Disable.
6. Push **ENTER** to save and store the selection.
7. Push the up or down arrow to go to the next screen.
8. Push **Ctrl + ENTER** to exit the Input status function and return to the Input status menu.

Calibrate the analog outputs

Before the analog outputs are calibrated, connect two analog circuits to the circuit loop which operates the analyzer for at least 5 minutes. The circuit loop must not be broken (open-circuited) during the adjustment of zero and span while the DCS loop load resistor is in position.
Note: *The analog outputs can be calibrated to be the same as the input of a DCS system to get accurate repeating of signalled values.*

1. Push **Ctrl** ▼.

The Service screen is shown.

2. Push **ENTER**.

   The first option in the Service screen is shown, "Relay Test".

3. Push ▲ until "Output Adjust" is shown, then push **ENTER**.

   "CH1" (analog output 1) is shown.

4. Push **ENTER**.

   The first option in the CH1 screen is shown, "CH1 Zero".

5. Use the arrow keys select an option.

Option	Description
CH1 Zero	Sets the digital count for the zero value (4 mA output)—0 to 1024 counts. Make sure that on the multimeter 4 mA is measured at CH1 or that 0 is shown continuously on a DCS.
CH1 Span	Sets the digital count for the span value (20 mA output)—1025 to 4095 counts. Make sure that on the multimeter 20 mA is measured at CH1 or the appropriate TOC value is shown continuously on the DCS.
CH1 Test	Lets the user make sure that the analog output is linear over the 4-20 mA range. Use the arrow keys to scroll. Make sure that on the multimeter: • 4 mA is measured when 0% is shown • 12 mA is measured when 50% is shown • 20 mA is measured when 100% is shown

6. Push **ENTER** to change the value on the screen.

   Asterisks flash on both sides of the value.

7. Use the arrow keys to change the value, then push **ENTER** to save.

8. Push **Ctrl ENTER**.

   "CH1" is shown.

9. Push ▲ until "CH2" is shown, then push **ENTER**.

10. Do steps 5–7 to calibrate the other analog output (CH2).

Set the elevation

The IR can be calibrated at different elevations and atmospheric pressures. The elevation is normally set to 1 m for locations that are at or close to sea level. If the analyzer is operated at substantial elevations with the factory calibrated IR, set the menu to the local elevation. If the analyzer is gas calibrated on site with the instructions in this manual, it is not necessary to enter the local elevation. Set the elevation to 1 m.

Adjust the UV block

To get the correct default bubble threshold constants for each analyzer range, use the Service/UV Block menu. This menu lets the block to be selected by part number. All of the original acrylic blocks can be treated as the part number 011664. The default selection in this release of firmware is the old block (011664).

To be effective, the UV Block menu must be selected after the analyzer is selected. The default values can be overridden with the Sparger Flow and UV Flow menus.

Replacement parts and accessories

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Table 20 Replacement parts

Description	Item no.
Block, Angled Input, Sample/DI, TOC Analyzers	011604
Block, Orifice, TOC Analyzers	011588
Cable, Ribbon, 8000/8001	110152
Cable, Ribbon, IR, TOC analyzer	110153
Cell Assembly, Kynar, Integral Mirror	120191-01
Condenser Assembly UV (Process UV only)	120210
Condenser Assembly (Turbo UV only)	120239
Condenser Pre-Cooler (SS Coil) (Turbo UV only)	020592
Fan, 2.36-in., 24 V	020011
Flow Controller, Silver/ Green	014726
Flow Element, 465, Black/ Silver	021045
Flow Meter, 0–200 cc, 65 mm	020589
Flow Meter, 300 cc, 65 mm, w/o Valve	021127
GLS, TOC Analyzer (Process UV only)	020585
GLS, TOC Analyzer Bypass Drain (Turbo UV only)	020590
Hardware, Pump Mounting 3-head SS	010178
Hardware, Pump Mounting 2-head SS	010333
Lamp Assembly, UV, TOC Analyzers	110131
Manifold, Top, Sparger, TOC Analyzers	011581
Manifold, Valve, TOC Analyzers	011582
Manifold, Bottom, Sparger, TOC Analyzers	011583
Manifold, UV TOC Analyzers	011664
Mixer Assembly TOC UV	120228
Motor, Pump, 2 RPM, TOC Analyzers (Process UV only)	024102-01
Motor, Pump, 6 RPM, TOC Analyzers	024102-02
PCB, Display, 8000, Assembly	130135
PCB, Flow, Assembly	130137
PCB, Termination, 8001, Assembly	130143
PSU Assembly, TOC Analyzers	110142
PSU, UV, 30 mA, Absopulse (For replacement of older obsolete models, refer to the kit tables below.)	5885700
Power Supply, 150 W, Switchable 1	025020
Regulator, Pressure, 0–30 PSI	014699
Surge Suppressor, 240 V ac	58444-00
Switch, Pressure, 15–60 PSI	016183
Tubing PFA, $^{1}/_{8}$-in. OD x 0.062-in. ID (per ft)	026009

Table 20 Replacement parts (continued)

Description	Item no.
Tubing Tygon 7016 (per ft, 50 ft min.)	026014
Tubing Tygon 7017 (per ft, 50 ft min.)	026015
Tubing Tygon $^{3}/_{8}$-in. ID x 1/2-in. OD (per ft)	026017
Tubing Kit, acid and persulfate tubing, 6 each (Turbo UV only)	200143
Tubing Norprene 7013 (per ft, 50 ft min.)	026043
Tubing Norprene 7014 (per ft, 50 ft min.)	026044
Tubing Norprene 7015 (per ft, 50 ft min.)	026045
Tubing Norprene 7016 (per ft, 50 ft min.)	026046
Tubing, PFTE, $^{1}/_{8}$-in. OD x 0.030" ID (per ft)	026067
Tubing Norprene 7024 (per ft, 50 ft min.)	026071
Valve, 3-way, Burkert, 125 MAN	014458
Valve, 3-way, Burkert, 125 MAN, Class 1, Div 2 UL for Dual Stream Operation	6023700
Valve, 3-way, Burkert, 127 MAN	014459
Valve, 3-way, Burkert FM (for Blowback Filter)	024105
Valve, Manifold Assembly (Complete with valves)	120214
Weight, Reagent, PVC, $^{1}/_{8}$-in. NPT	011622
Weight, Reagent, SST, $^{1}/_{8}$-in. NPT	54838-00

Table 21 Reagents and calibration standards

Description	Qty	Item no.
Phosphoric Acid Solution, 0.1 Molar	20 Liter	58458-00
Phosphoric Acid Solution, 0.3 Molar	20 Liter	58459-00
Phosphoric Acid Solution, 0.6 Molar	20 Liter	58460-00
Phosphoric Acid Solution, 1.0 Molar	20 Liter	58461-00
Sodium Persulfate Kit, 4-Jar Case (sold in North America only)	1	040005
Sodium Persulfate Solution, 0.2 Molar	20 Liter	58451-00
Sodium Persulfate Solution, 0.4 Molar	20 Liter	58452-00
Sodium Persulfate Solution, 0.6 Molar	20 Liter	58453-00
Sodium Persulfate Solution, 0.8 Molar	20 Liter	58454-00
Sodium Persulfate Solution, 1.0 Molar	20 Liter	58455-00
Sodium Persulfate Solution, 1.2 Molar	20 Liter	58456-00
Sodium Persulfate Solution, 1.5 Molar	20 Liter	58457-00
TOC Standard, 2.0 mg/L	4 Liter	58462-00
TOC Standard, 5.0 mg/L	4 Liter	58471-00
TOC Standard, 10.0 mg/L	4 Liter	58467-00
TOC Standard, 25.0 mg/L	4 Liter	58463-00

Table 21 Reagents and calibration standards (continued)

Description	Qty	Item no.
TOC Standard, 50.0 mg/L	4 Liter	58472-00
TOC Standard, 100.0 mg/L	4 Liter	58468-00
TOC Standard, 200.0 mg/L	4 Liter	58464-00
TOC Standard, 500 mg/L	4 Liter	58473-00
TOC Standard, 1000 mg/L	4 Liter	58469-00
TOC Standard, 2000 mg/L	4 Liter	58465-00
TOC Standard, 5000 mg/L	4 Liter	58474-00
TOC Standard, 10000 mg/L	4 Liter	58470-00
TOC Standard, 20000 mg/L	4 Liter	58466-00
ZERO Solution, <0.05 mg/L TOC	4 Liter	58477-00
TOC Standard, 5 mg/L, Benzoquinone	1 Liter	58476-00
ZERO Solution, <0.05 mg/L TOC	4 Liter	58477-00

Table 22 Pump kits

Description	Item no.
Kit, 7013 Pump (Process UV only)	200117
Kit, 7014 Pump (Process UV only)	200118
Kit, 7015 Pump (Process UV only)	200119
Kit, 7016 Pump (Process UV only)	200120
Kit, 7024 Pump (Process UV only)	200138
Kit, 7014 Pump, T/T LH (Turbo UV only)	200139
Kit, 7024 Pump, Barb Reduced (Turbo UV only)	200140
Kit, 7014 Pump, T/T RH (Turbo UV only)	200141
Kit, 7015 Pump, Barb Reduced (Turbo UV only)	200142
Kit, 7016 Pump, Barb Reduced (Turbo UV only)	54147-00
Kit, 7016 Pump (Turbo UV only)	200120

Table 23 Start-up kits

Description	Qty	Item no.
Start-up Kit, TOC UV analyzers (Process UV only), includes:	1	200122
Start-up Kit, TOC UV Turbo analyzers (Turbo UV only), includes:	1	200148
Barb adapter ¼–28 x 0.08 (Turbo UV only)	2	013830H
Barb adapter ¼–28 x 0.102 (13)	2	013829
Barb adapter ¼–28 x 0.129 (14)	2	013828
Barb adapter ¼–28 x 0.164 (16)	2	013827

Table 23 Start-up kits (continued)

Description	Qty	Item no.
Hex Ballend Driver, 2.5 mm	1	018402
Hex Ballend Driver, $^{3}/_{32}$	1	018405
Hex Ballend Driver, 16, 3 mm	1	018403
Hex Ballend Drive, 4 mm	1	018404
Nut Driver, $^{5}/_{16}$ AF	1	018401
Bottle kit 2 x 5 gal, 2 x 4 L, tube weights, reagent bottle tray (Turbo UV only)	1	200129
Brush, Sparger	1	018400
Case Assembly, HC6	1	46606-10
Ferrule, $^{1}/_{8}$ SF, ETFE YEL	6	013849
Filter, hydro., dual Luer L	2	018248
Fitting, 0.470 Cable, H20	2	013946
Fitting, ¼ T x $^{1}/_{8}$ NPT MA	5	013857
Fitting, ¼ x $^{1}/_{8}$ T, PP	3	013861
Fitting, $^{1}/_{8}$ NPT x $^{1}/_{8}$T, BL	2	013858
Fuse, 1 A, 5 x 20, Antisurge	2	015804
Fuse, 4 A, 5 x 20, Antisurge	4	015806
Kit, Bottle		200129
Label, 115 V, 60 HZ	2	013221
Label. 230 V, 50 HZ	2	013219
Membrane, Hydrophobic, 0.6	2	021049
Nut, Fitting, $^{1}/_{8}$ T, White	3	013842
Nut, Flangeless, $^{1}/_{8}$” (ET)	6	013848
O-ring; #009 Silicone, 70	2	020141
O-ring, #013 Silicone, 70	2	019507
O-ring,#012 Silicone, 70	2	020123
Plug, 1/4–28	4	014659
Reagent Storage Tray, Clear (Process UV only)	1	54131-00
Rubber Disc	1	019509
Tailpipe, Drain, SS, 1-$^{1}/_{2}$”	1	013839
Tube-in-tube assembly, acid, TOC analyzers (Turbo UV only)	2	120240-02
Tube-in-tube assembly, persulfate (Turbo UV only)	2	120240-01
Tubing Norprene 7013 (Process UV only)	5	026043
Tubing Norprene 7014	5	026044
Tubing Norprene 7015	5	026045
Tubing Norprene 7016	5	026046
Tubing Norprene 7024	5	026071

Table 23 Start-up kits (continued)

Description	Qty	Item no.
Tubing PFA, 1/8" OD x 0.062	12	026009
Tubing, PFTE, 1/8 OD x 0.03	12	026067
Union, 1/8 MPT x 1/8 T	5	014016

Table 24 One-year spare parts kit

Description	Qty	Item no.
One-year Spare Parts Kit, TOC UV Analyzers, includes:	1	200123
Barb Adaptor ¼–28 x 0.08	4	013830H
Barb Adaptor ¼–28 x 0.102 (13)	4	013829
Barb Adaptor ¼–28 x 0.129 (14)	6	013828
Barb Adaptor ¼–28 x 0.164 (16)	6	013827
Barb, Reducer 1/8-in. x ¼-in. (16 x 24)	5	013831
Barb, Reducer 1/8-in. x 3/16-in. (16 x 15)	5	014038
Breather, Gelman, 0.2 µm	1	018248
Fitting, Male Luer to 1/8-in. Barb, PP	2	58492-00
Fitting, Male Luer to 1/8-in. NPT thread	1	58442-00
Fitting, Tee Female Luer	1	58441-00
Elbow, 1/8-in. T x 1/8-in. MP	5	014084
Ferrule, 1/8-in. SF, ETFE YEL P359X	10	013849
Fitting, 1/8-in. NPT male plug	3	013836
Fuse, 1A, 5 x 20, Antisurge	1	015804
Fuse, 4A, 5 x 20, Antisurge	2	015806
GLS, TOC Analyzers Bypass drain	1	020590
Membrane, Hydrophobic, 0.063 x 0.087	2	021049
Nut, Flangeless, 1/8-in. ETFE P354	5	013848
O Ring; #009, Silicon, 70 DURO	2	020141
O-Ring, #013,Silicone, 70 DURO	2	019507
O-Ring,#012, Silicon, 70 DURO	2	020123
Plug, ¼–28	4	014659
Switch, Pressure, 15–60 PSI, Manifold	1	016183
Tubing PFA,1/8-in. OD x 0.062-in. ID	12 feet	026009
Tubing, PFTE, 1/8-in. OD x 0.030-in. ID	12 feet	026067
Union, 1/8-in. MPT x 1/8-in. T	5	014016
Valve, 3-way, Burkert, 125 MAN	1	014458
Valve, 3-way, Burkert, 127 MAN	1	014459

Table 25 Two-year spare parts kit

Description	Qty	Item no.
Two-year Spare Parts Kit, TOC UV Analyzers, includes:	1	200124
Barb Adaptor ¼–28 x 0.08	8	013830H
Barb Adaptor ¼–28 x 0.102 (13)	8	013829
Barb Adaptor ¼–28 x 0.129 (14)	12	013828
Barb Adaptor ¼–28 x 0.164 (16)	12	013827
Barb, Reducer $^{1}/_{8}$-in. x ¼-in. (16 x 24)	10	013831
Barb, Reducer $^{1}/_{8}$-in. x $^{3}/_{16}$-in. (16 x 15)	10	014038
Breather, Gelman, 0.2 µm	2	018248
Fitting, Male Luer to $^{1}/_{8}$-in. Barb, PP	4	58492-00
Fitting, male Luer to $^{1}/_{8}$-in. MPT thread	1	58442-00
Fitting, Tee, Female Luer	1	58441-00
Ferrule, $^{1}/_{8}$-in. SF, ETFE YEL P359X	10	013849
Elbow, Compression	2	013861
Elbow, Compression	2	013860H
Flowmeter, 0–200 CC. 65 mm	1	020589
Fuse, 1A, 5 x 20, Antisurge	1	015804
Fuse, 4A, 5 x 20, Antisurge	2	015806
GLS, TOC Analyzers Bypass drain	1	020590
Lamp Assembly, UV, TOC series	1	110131
Membrane, Hydrophobic, 0.063 x 0.087	4	021049
Nut, Flangeless, $^{1}/_{8}$-in. ETFE P354	10	013848
O Ring; #009 Silicon, 70 DURO	2	020141
O-Ring, #013 Silicone, 70 DURO	2	019507
O-Ring,#012, Silicon, 70 DURO	2	020123
Plug, ¼–28	4	014659
Switch, Pressure, 15–60 PSI, Manifold	1	016183
Tubing PFA,$^{1}/_{8}$-in. OD x 0.062-in. ID	12 feet	026009
Tubing, PFTE, $^{1}/_{8}$-in. OD x 0.030-in. ID	12 feet	026067
Union, $^{1}/_{8}$-in. MPT x $^{1}/_{8}$-in. T	5	014016
Valve, 3-way, Burkert, 125 MAN	1	014458
Valve, 3-way, Burkert, 127 MAN	1	014459

Table 26 Fittings and O-ring kit

Description	Qty	Item no.
Fittings and O-Rings Kit, TOC UV Analyzers, includes:	1	200132
Barb Adaptor ¼–28 x 0.08	4	013830H

Table 26 Fittings and O-ring kit (continued)

Description	Qty	Item no.
Barb Adaptor ¼–28 x 0.102 (13)	4	013829
Barb Adaptor ¼–28 x 0.129 (14)	10	013828
Barb Adaptor ¼–28x 0.164 (16)	10	013827
Barb, Reducer $^{1}/_{8}$-in. x ¼-in. (16 x 24 mm)	5	013831
Barb, Reducer $^{1}/_{8}$-in. x $^{3}/_{16}$-in. (16 x 15 mm)	5	014038
Clamp, ½-in. NYL	10	010817
Elbow, $^{1}/_{8}$-in. T x $^{1}/_{8}$-in. MP	4	014084
Elbow, Compression	4	013861
Elbow, Compression	4	013860H
Ferrule, $^{1}/_{8}$-in. SF, ETFE YEL P359X	10	013849
Fitting 0.470 cable, water tight	2	013946
Fitting, ¼-in. cable, water tight	2	013949
Fitting, ¼-in. NPT male x ¼ barb	5	013832
Fitting, ¼-in. T x ¼-in. NPT female	4	013834
Fitting, $^{1}/_{8}$-in. NPT x $^{1}/_{8}$-in. T, Blank PP	5	013858
Fitting, $^{5}/_{16}$-in. Cable, water tight	2	013948
Fitting, Male Luer to $^{1}/_{8}$-in. Barb, PP	2	58492-00
Fitting, Male Luer to $^{1}/_{8}$-in. NPT thread	1	58442-00
Fitting, Tee Female Luer	1	58441-00
Nut, Flangeless, $^{1}/_{8}$-in. (ETFE) P354	10	013848
O Ring; #009 Silicon, 70 Duro	5	020141
O-Ring, #013 Silicone, 70 Duro	5	019507
O-Ring, 2-012,Silicon Rubber	2	57857-00
O-Ring, #012,Silicon, 70 Duro	5	020123
Plug, ¼–28	5	014659
Rubber Disc	2	019509
Union, $^{1}/_{8}$-in. MPT x $^{1}/_{8}$-in. T	10	014016

Table 27 Kalrez O-ring kit

Description	Qty	Item no.
Kit, Kalrez O-ring, includes:	1	6948600
Diaphragm, Simriz, Burkert	1	6019100
O-Ring, 009, Kalrez - 4079	5	6019200
O-Ring, 013, Kalrez - 4079	1	6019500
O-Ring, 6.1 mm x 1.6 mm X-S	3	6019800

Table 28 Bottle kit

Description	Qty	Item no.
Bottle Kit, includes:	1	200129
Carboy, 19 liter	2	030501
Tubing, PFTE, $^1/_8$-in. OD x 0.03	12	026067
Union, $^1/_8$-in. MPT x $^1/_8$-in. T	4	014016
Bottle, one gallon	2	030506
Weight, Reagent, PVC, $^1/_8$-in. NPT	2	011622
Tubing PFA, $^1/_8$-in. OD x 0.062	12	026009
Installation Drawing	1	090201
Ferrule, $^1/_8$-in. SF, ETFE YEL P359X	4	013849
Weight, Reagent, SST, $^1/_8$-in. NPT	2	54838-00
Nut, Flangeless, $^1/_8$-in. ETFE P354	4	013848
Reagent Storage Tray	1	54131-00

Table 29 Miscellaneous kits

Description	Item no.
Lamp Kit, Additional Retrofit	200127
Level Detector Kit, Reagent and Enclosure Spill	200128
Kit, Dual Stream Valve Assembly, TOC Analyzers	200136
Kit, Dual Stream Valve Assembly, TOC Analyzers Retrofit	200137
Kit, Retrofit, UV Power Supply	5004300
Kit, Threaded Plug	54137-00
Kit, UV, Firmware upgrade HACH, Eng	5463200
Kit, Power Cord, TOC Analyzers	58479-00
Kit, Network Interface Card, RS232	59200-00
Kit, Network Interface Card, RS485/RS422	59200-01

Table 30 Accessories

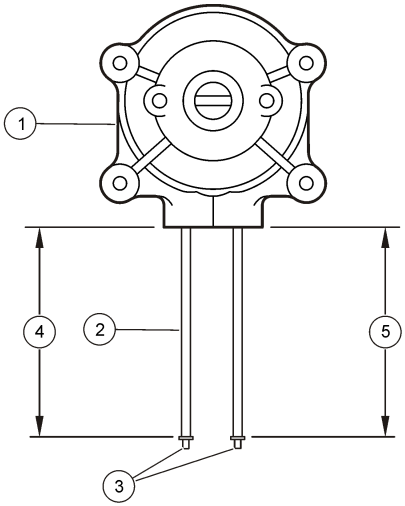
Description	Item no.
Rack Assy, TOC	120161
Gas Generator, TOC, 230/115V (requires clean dry instrument air)	4300-0005
Gas Generator, TOC, with 115V compressor	4300-0006
PS200, Blowback Filter, FM with 100 µm element	4200-1001
PS200, Blowback Filter, FM with 50 µm element	4200-1002
PS200, Blowback Filter, FM with 300 µm element	4200-1003
PS200, Blowback Filter, FM with 25 µm element	4200-1004

Table 30 Accessories (continued)

Description	Item no.
Purge Gas generator Pneumatic AAS300	4300-0003
Kit, Dual Stream, FM	6023800
Z-PURGE, Analyzer left, CL1 DIV2, (requires 200130)	4000-0011
Z-PURGE, Analyzer top, CL1 DIV2, (requires 200130)	4000-0006
Z-PURGE, Wall Mount, CL1 DIV2, (requires 200130)	4000-0008
Kit, Pneumatic condenser cooler	200130
Block, angled input, (Kynar) TOC Sample, DI	011604-01
Manifold, valve (Kynar), TOC	11582-01
Manifold top sparger (Kynar), TOC	11581-01
Manifold bottom sparger (Kynar), TOC	11583-01
Manifold, UV,1950PLUS, Kynar	11663

Replacement pump kits

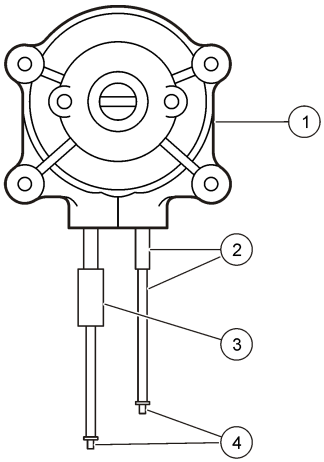
Pump kit 200117, 200118, 200120 and 5787000



Kit	1 (head)	2 (tube)	3 (barbs)	4 (length)	5 (length)
200117, left side of the analyzer (Item no.)	#13 (024505)	#13 (026043)	0.102 in. (013829)	254 mm (10 in.)	152.4 (6 in.)
200117, right side of the analyzer (Item no.)				152.4 (6 in.)	254 mm (10 in.)
200118, left side of the analyzer (Item no.)	#14 (024506)	#14 (026044)	0.129 in. (013828)	152.4 mm (6 in.)	152.4 (6 in.)
200118, right side of the analyzer (Item no.)				152.4 (6 in.)	177.8 mm (7 in.)

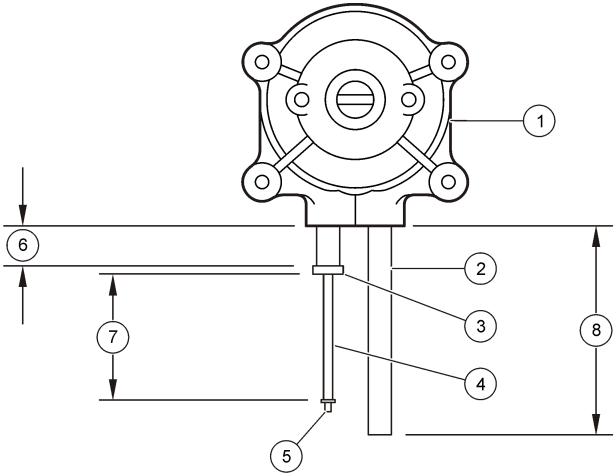
Kit	1 (head)	2 (tube)	3 (barbs)	4 (length)	5 (length)
200120, left side of the analyzer (Item no.)	#16 (024508)	#16 (026046)	0.164 in. (013827)	254 mm (10 in.)	152.4 (6 in.)
200120, right side of the analyzer (Item no.)				152.4 (6 in.)	177.8 mm (7 in.)
200120, sparger waste pump installation (Item no.)				152.4 (6 in.)	406.4 mm (16 in.)
5787000, right side of the analyzer (Item no.)	#13 (024505)	0.160 (5742600)	0.102 in. (013829)	152.4 (6 in.)	152.4 (6 in.)

Pump kits 200139 and 200141



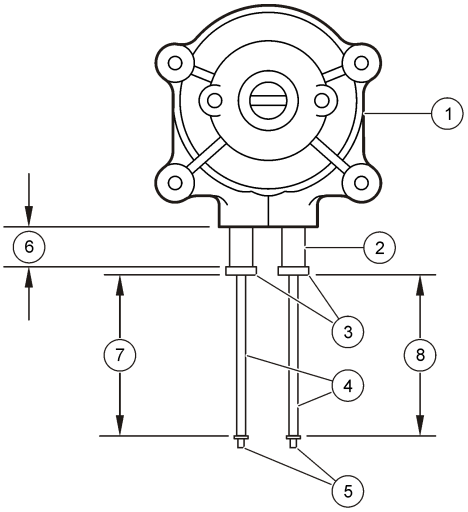
Kit	1 (head)	2 (tube)	3 (retainer)	4 (barbs)
200139, left side of the analyzer (Item no.)	#14 (024506)	Tube in Tube (120240-02)	0.75 in. (026076)	0.08 in. (013830H)
200141, right side of the analyzer (Item no.)	#14 (024506)	Tube in Tube (120240-02)	0.75 in. (026076)	0.08 in. (013830H)

Pump kit 5786700



Kit	1 (head)	2 (tube)	3 (barb)	4 (tube)	5 (barbs)	6 (length)	7 (length)	8 (length)
5786700, right side of the analyzer (Item no.)	#24 (024538)	#24 (026071)	$^{1}/_{8}$ x ¼ in. (013831)	#14 (026044)	0.129 in. (013828)	25.4 mm (1 in.)	127 mm (5 in.)	279.4 mm (11 in.)

Pump kits 200119, 200138, 200140, 200142 and 5414700



Kit	1 (head)	2 (tube)	3 (barb)	4 (tube)	5 (barbs)	6 (length)	7 (length)	8 (length)
200119, left side of the analyzer (Item no.)	#15 (024507)	#15 (026045)	1/8 x 3/16 in. (014038)	#14 (026044)	0.129 in. (013828)	25.4 mm (1 in.)	228.6 mm (9 in.)	152.4 mm (6 in.)
200119, right side of the analyzer (Item no.)							152.4 mm (6 in.)	127 mm (5 in.)
200138, left side of the analyzer (Item no.)	#24 (024538)	#24 (026071)	1/8 x ¼ in. (013831)	#14 (026044)	0.129 in. (013828)	25.4 mm (1 in.)	228.6 mm (9 in.)	152.4 mm (6 in.)
200138, right side of the analyzer (Item no.)							152.4 mm (6 in.)	127 mm (5 in.)
200140, left side of the analyzer (Item no.)	#24 (024538)	#24 (026071)	1/8 x ¼ in. (013831)	#14 (026044)	0.129 in. (013828)	25.4 mm (1 in.)	215.9 mm (8.5 in.)	127 mm (5 in.)
200142, right side of the analyzer (Item no.)	#15 (024507)	#15 (026045)	1/8 x 3/16 in. (014038)	#14 (026044)	0.129 in. (013828)	25.4 mm (1 in.)	127 mm (5 in.)	139.7 mm (5.5 in.)
5414700, right side of the analyzer (Item no.)	#16 (024508)	#16 (026046)	1/16 x 1/8 in. (5410600)	#14 (026044)	0.129 in. (013828)	25.4 mm (1 in.)	152.4 mm (6 in.)	127 mm (5 in.)

Appendix

Hardware configuration

Table 31 shows the hardware configuration of each analyzer, the replacement pump kits and the IR ranges and flow rates. Pump flow rates are all calculated for 60 Hz. Refer to Prepare the acid solution on page 26 and Prepare the persulfate solution on page 27 for the molarity values for the acid and persulfate pump.

Table 31 Hardware configuration

4195- and 6195-	1010/ 3010	1020/ 3020	1030/ 3030	1040/ 3040	1050/ 3050	1060/ 3060	1070/ 3070	2000/ 4000
TOC range, mg/L	5	10	25	50	100	200	500	100
					dilution	dilution	dilution	
Number of reactors	1[1]	1[1]	1[1]	1[1]	1[1]	1	1	2
IR span, ppm CO_2	1000	1000	1000	1000	1000	1000	1000	10000
IR, ppm CO_2 maximum	950	950	950	950	950	950	950	9500
Sample pump size (Item no.)	15 (200119)	15 (200119)	15 (200119)	16 (200120)	14 (200118)	14 (200118)	14 (200118)	15 (200119)
Flow, mL/minute	10.2	10.2	10.2	4.8	1.26	1.26	1.26	10.2

Table 31 Hardware configuration (continued)

4195- and 6195-	1010/ 3010	1020/ 3020	1030/ 3030	1040/ 3040	1050/ 3050	1060/ 3060	1070/ 3070	2000/ 4000
Acid pump size (Item no.)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)
Flow, mL/minute	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Dilution pump size (Item no.)	—	—	—	—	15 (200119)	15 (200119)	15 (200119)	—
Flow, mL/minute	—	—	—	—	10.2	10.2	10.2	—
RPM	6	6	6	6	6	6	6	6
Resample pump size (Item no.)	24 (200138)	24 (200138)	15 (200119)	16 (200120)	24 (200138)	15 (200119)	16 (200120)	15 (200119)
Flow, mL/minute	5.6	5.6	3.4	1.6	5.6	3.4	1.6	3.4
Persulfate pump size (Item no.)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	14 (200118)
Flow, mL/minute	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.42
RPM	2	2	2	2	2	2	2	2

[1] H-6195-xxxx analyzers all have two reactors.

4195-	2010/ 4010	2020/ 4020	2030/ 4030	2040/ 4040	2050/ 4050	2060/ 4060	2070/ 4070	2080/ 4080
TOC range, mg/L	200	500	1000	1000	2000	5000	10000	20000
				dilution	dilution	dilution	dilution	dilution
Number of reactors	2	2	2	2	2	2	2	2
IR span, ppm CO_2	10000	10000	10000	10000	10000	10000	10000	10000
IR, ppm CO_2 maximum	9500	9500	9500	9500	9500	9500	9500	9500
Sample pump size (Item no.)	15 (200119)	16 (200120)	16 (200120)	14 (200118)	14 (200118)	14 (200118)	14 (200118)	14 (200118)
Flow, mL/minute	10.2	4.8	4.8	1.26	1.26	1.26	1.26	1.26
Acid pump size (Item no.)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)	13 (200117)
Flow, mL/minute	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Dilution pump size (Item no.)	—	—	—	15 (200119)	15 (200119)	24 (200138)	15 (200119)	24 (200138)
Flow, mL/minute	—	—	—	10.2	10.2	16.8	10.2	16.8
RPM	6	6	6	6	6	6	6	6
Resample pump size (Item no.)	15 (200119)	16 (200120)	14 (200118)	15 (200119)	15 (200119)	16 (200120)	14 (200118)	14 (200118)
Flow, mL/minute	3.4	1.6	0.42	3.4	3.4	1.6	0.42	0.42
Persulfate pump size (Item no.)	14 (200118)	14 (200118)	14 (200118)	14 (200118)	14 (200118)	14 (200118)	14 (200118)	14 (200118)

4195-	2010/ 4010	2020/ 4020	2030/ 4030	2040/ 4040	2050/ 4050	2060/ 4060	2070/ 4070	2080/ 4080
Flow, mL/minute	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
RPM	2	2	2	2	2	2	2	2

4195-	1002/3002	1005/3005	1006/3006	1007/3007	1008/3008
TOC range, ug/L	2000[1]	5000[1]	10000[1]	25000[1]	50000[1]
Number of reactors	2	2	2	2	2
IR span, ppm CO_2	1000	1000	1000	10000	10000
Sample pump size (Item no.)	24[2] (200140)	24[2] (200140)	24[2] (200140)	24[2] (200140)	24[2] (200140)
Flow, mL/minute	20	20	20	20	20
Acid pump size (Item no.)	14[3] (200139)	14[3] (200139)	14[3] (200139)	14[3] (200139)	14[3] (200139)
Flow, mL/minute	0.18	0.18	0.18	0.18	0.18
Resample pump size (Item no.)	15 (200142)	15 (200142)	16[2] (5414700)	16[2] (5414700)	16[2] (5414700)
Flow, mL/minute	11.7	11.7	4.8	4.8	4.8
Persulfate pump size (Item no.)	14[3] (200141)	14[3] (200141)	14[3] (200141)	14[3] (200141)	14[3] (200141)
Flow, mL/minute	0.18	0.18	0.18	0.18	0.18
Sparger waste pump size (replacement kit)	—	—	16 (200120)	16 (200120)	16 (200120)
Flow, mL/minute	0	0	4.8	4.8	4.8
RPM	6	6	6	6	6
Response time T90 at 60 Hz	< 5	< 5	< 5	< 5	< 5

[1] If a different TOC range is selected, the same range may result even if shown in different units (i.e., 2.000 mg/L can be shown as 2000 µg/L).
[2] Represents the size of the pump head and pump tube. Use a barb adapter outside the pump head body to decrease to 14 to get the published response time.
[3] Tube-in-tube assembly used, not 14 tubing.

CSV output

Note: *(CH1) and (CH2) are shown in Table 32 to show how the analog channels (CH1 and CH2) are set. In the table, CH1 is set to a TOC reading (latched, zeroed or live) and CH2 is set to Fault ID.*

Table 32 CSV data format

Date	Time	Stream	CO_2 ppm	Rate of change	TOC (CH1)	Fault ID (CH2)	Status	Fault ID	Faults	EOL
MM/DD/YY[1]	00:00:00	0	0000	± 00000	0000.000	0	0	0	00	LFCR

[1] The date format depends on the user settings.

Table 33 Status values in the CSV output

Value	Description	Value	Description	Value	Description
1	Online	9	Pre zero period	16	Span determination
2	Online	10	Pre zero period	17	Span determination
3	Online	11	Baseline determination	18	Span determination
4	Offline	12	Baseline determination	19	Purging
5	Offline	13	Baseline determination	20	Purging
6	Cleaning	14	Pre span period	21	Purging
7	Cleaning	15	Pre span period	22	Purging
8	Cleaning				

Table 34 Fault ID codes in the CSV output

ID	Description
5	Online
6	Offline, purge cycle, cleaning, calibration, or in the Service screens
7	Maintenance event
8	Fault event

Table 35 Fault/Maintenance event codes

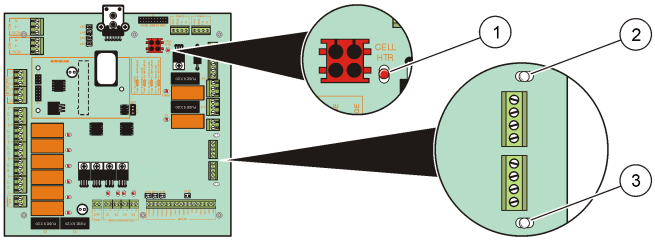
ID in the CSV output	Description	ID on the main screen
1	Zero stability	M01
2	Zero standard level	M02
3	Span stability	M03
4	Span standard level	M04
5	Maintenance %	M05
6	Validation %	M06
7	Calibration failure	M07
8	Reactor flow	M08
9	Low reagents	M09
10	Low cell temperature	M10
11	Spill detection	M11
12–16	Not used	M12–M16
17	No sparger flow	F01
18	No UV lamp flow	F02
19	No carrier gas	F03
20	Drain level	F04
21	Not used	F05
22	Reactor flow	F06

Table 35 Fault/Maintenance event codes (continued)

ID in the CSV output	Description	ID on the main screen
23	Not used	F07
24	Not used	F08
25	IR detector	F09
26–32	Not used	F10–F16

I/O board components

Figure 23 8001 I/O board components



1 NDIR cell heater light	**3** UV flow bubble detector light
2 Sparger flow bubble detector light	

Table 36 Internal indicator lights

Light	Description
NDIR cell heater light	Flashes during a heat cycle.
Sparger flow bubble detector light	Flashes when the sparger flow bubble detector senses bubbles at the sparger inlet.
UV flow bubble detector light	Flashes when the UV flow bubble detector senses bubbles at the UV block.

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