



Catalog Number 5440018

CL17 Chlorine Analyzer

USER MANUAL

10/2019, Edition 14

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Section 1 Specifications

Specifications are subject to change without notice.

General	
Display	LCD, 3½-digit measurement readout and six-character alphanumeric scrolling text line.
Enclosure	IP62-rated with the gasketed door latched
Instrument description	34.3 cm (W) x 41.9 cm (H) x 19.1 (D) (13.5 x 16.5 x 7.5 in.)
Mounting	Wall mount
Instrument shipping weight	7.3 kg (16 lb)
Warranty	Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from the date of shipment unless otherwise noted in the product manual.
Certification	CE approved. Listed to UL and CSA safety standards by ETL.
Sample Requirements	
Sample flow rate to sample conditioning	200 to 500 mL/min
Inlet pressure to instrument	1 to 5 psig ; 1.5 psig is optimum. Exceeding 5 psig can cause sample tubing failure unless sample conditioning is used.
Inlet pressure to sampling conditioning	1.5 to 75 psig (with sample tube level with the bottom of the instrument—see Figure 7 on page 16.)
Sample temperature range	5 to 40 °C (41 to 104 °F)
Inlet fitting at instrument	¼-inch OD polyethylene tubing with quick-disconnect fitting
Drain fitting	½-inch hose barb
Sample conditioning	Use provided sample conditioning
Reagent/Standard Requirements	
Maximum reagent usage	One-half liter per month (each of the two reagents)
Reagent containers	High-density polyethylene (2) ½-liter bottles
Reagent containment	Reagent bottles are contained inside the analyzer enclosure and are vented externally.
Electrical	
Power requirements	100–115/230 VAC (selection switch inside instrument); 90 VA, 50/60 Hz, 2.5 Amp fuse
Power connection	Connection made by three wire barrier terminal block through a ½-inch conduit hole in the case. Wire range: 18 AWG.
Installation category	II
Polution degree	2
Protection class	I
Alarm relay outputs	Two unpowered SPDT relays each rated at 5 A resistive, 240 V ac maximum. Can function as sample set point alarms (high or low) or as a system warning indicator or a system alarm indicator. Use either high voltage (greater than 30 V RMS and 42.2 V PEAK or 60 V dc) or low voltage (less than 30 V RMS and 42.2 V PEAK or 60 V dc). Do not use a combination of high and low voltage.
Alarm connection	Connection made by a removable three wire plug through a ½-inch conduit hole in the case. Wire range: 12–18 AWG.
Recorder output	One isolated recorder output, 4–20 mA (can be adjusted to 0–20 mA). Recommended load impedance 3.6 to 500 ohms
Recorder output connections	Connection made by a removable three wire plug through a ½-inch conduit hole in the case. Wire range: 12–22 AWG.

Specifications

Optical	
Light source	Class 1 LED (light emitting diode) with a peak wavelength of 520 nm; 50,000 hours estimated minimum life
Performance	
Operating range	0–5 mg/L free or residual chlorine
Accuracy	±5% or ±0.04 ppm whichever is greater
Precision	±5% or ±0.01 ppm whichever is greater
Quantitation limit	0.09 ppm
Cycle time	2.5 minutes
Detection limit	0.03 ppm
Calibration	Uses default calibration curve
Power switch	User accessible power switch is required
Recorder	One 4-20 mA/0–20 mA
Alarm relay outputs	Two SPDT relays, 5A resistive load at 240 V ac. Can function as sample set point alarms (high or low) or as a system warning indicator or a system alarm indicator.
Environmental	
Storage temperature range	-40 to 60 °C (-40 to 140 °F)
Operating temperature range	5 to 40 °C (41 to 104 °F)
Humidity	90% at 40 °C (90% at 104 °F)
Air purge (optional)	0.1 CFM instrument quality air at 20 psig maximum, ¼-inch OD tubing
Altitude	2000 m (6561 ft)

Section 2 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.

2.1 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.

2.1.1 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.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	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 2002/96/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: <i>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 auxiliary items for proper disposal.</i>
	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.

2.2 General product information

2.2.1 Instrument description



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.

The Hach CL17 Chlorine Analyzer (Figure 1) is a microprocessor-controlled, process analyzer designed to monitor a sample stream continuously for chlorine content. Either free or total chlorine, in the range of 0 to 5 mg/L, can be monitored. The buffer and indicator solutions used determine the choice for free or total chlorine analysis.

CAUTION

Fire hazard. This analyzer is intended to be used for aqueous samples only.

The CL17 Chlorine Analyzer enclosure is environmentally rated for IP62 per IEC 529. The enclosure is dust-tight, and drip-resistant but is not designed for outdoor use.

The instrument uses a DPD Colorimetric Method which includes a N,N-Diethyl-p-phenylenediamine (DPD) indicator and a buffer. The indicator and buffer are introduced into the sample, causing a red color to form with an intensity proportional to the chlorine concentration. Chlorine concentration, measured photometrically, is displayed on the front panel, three-digit, LCD readout in mg/L Cl₂.

A recorder output (4-20 mA) is available. Recorder span minimum and maximum values in mg/L Cl₂ are programmed by the operator at the analyzer keyboard.

Programmable alarm circuits provide relay closures, both normally open and normally closed, for two selectable chlorine level set points. Set points can be programmed by the operator anywhere within the overall range. System warning and system alarm features provide automatic, self-testing diagnostics that detect a number of possible malfunctions, and provide alarm relay closures indicating a need for operator attention.

Indicator and buffer reagents (473 mL of each) are placed in the instrument case in the original factory-filled bottles. Reagents are replenished once a month.

The instrument is designed so electronic components are isolated from the hydraulic components. Windows allow the operator to observe the display indicators and reagent supply without opening the instrument enclosure.

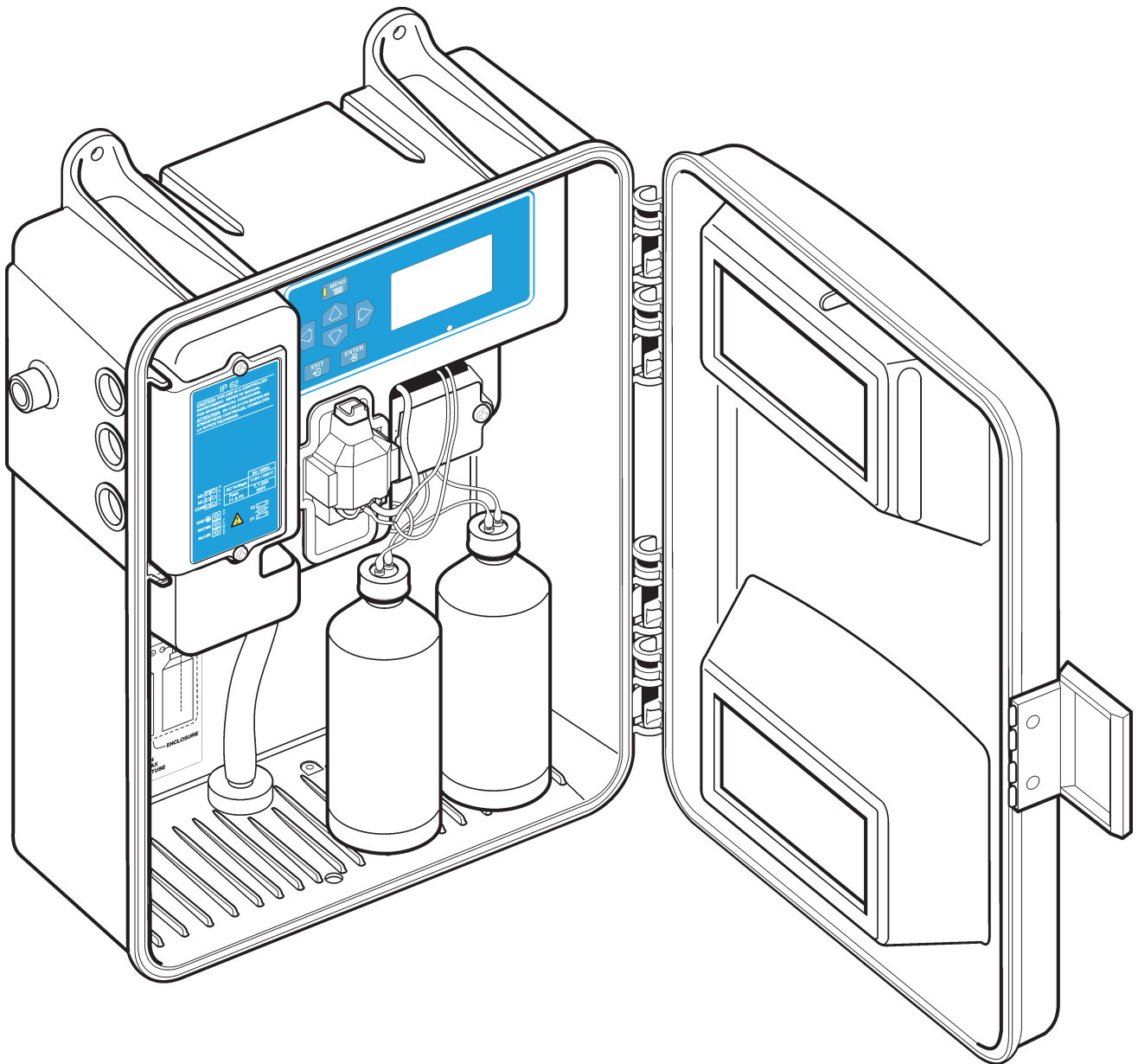


Figure 1 Chlorine analyzer

2.2.2 Method of analysis

Free available chlorine (hypochlorous acid and hypochlorite ions) oxidizes the DPD indicator reagent at a pH between 6.3 and 6.6 to form a magenta-colored compound. The depth or intensity of the resulting color is proportional to the concentration of chlorine in the sample. A buffer solution specifically for free chlorine maintains the proper pH.

Total available chlorine (free available chlorine plus combined chloramines) is determined by adding potassium iodide to the reaction. Chloramines in the sample oxidize iodide to iodine, which, along with any free available chlorine, oxidizes DPD indicator to form the magenta color at a pH of 5.1. A different buffer solution containing potassium iodide maintains reaction pH. After the chemical reaction is complete, the optical absorbance at 510 nm is compared to the absorbance measured through the sample before the reagents were added. Chlorine concentration is calculated from the difference in absorbance.

2.2.3 Theory of operation

The analyzer is designed to capture and analyze a portion of the sample every 2.5 minutes. The sample portion is captured in the colorimeter measuring cell where the blank absorbance is measured. Measurement of sample blank absorbance allows compensation for any turbidity or natural color in the sample, and provides an automatic zero reference point. Reagents are added at this point to develop the magenta color, which is measured and compared to the reference.

A linear peristaltic pump/valve module controls the flow of incoming sample and injects metered volumes of the buffer and indicator reagents in a 2.5 minute cycle. The pump/valve module uses a motor-driven cam to operate pinch blocks that squeeze special thick-walled tubing against a fixed plate. The cycle operates as follows:

1. The sample inlet line is opened, allowing sample under pressure to flush sample tubing and the colorimeter sample cell where the measurement is made.
2. The sample inlet line is closed, leaving fresh sample in the cell. Cell volume is controlled by an overflow weir.
3. As the sample inlet line closes, reagent lines open, allowing buffer and indicator solutions to fill tubing in pump/valve module.
4. A measurement of untreated sample is taken to determine an average reference measurement prior to reagent addition.
5. The reagent outlet block opens, allowing buffer and indicator to blend and enter the colorimeter cell to mix with the sample.
6. After a delay for the development of color, a measurement of treated sample is taken to determine the chlorine concentration.

This sequence is repeated every 2.5 minutes.

Section 3 Installation

DANGER

Electrocution and fire hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

WARNING

Electrocution hazard. Install a 10 A circuit breaker for mains power. Identify the circuit breaker with a label, as a local disconnect for this equipment.

3.1 Unpack the instrument

Remove the analyzer from its shipping carton and inspect it for any damage. Verify that the Installation Kit, Cat. No. 5516402, and Maintenance Kit, Cat. No. 5444300, are included along with the reagents.

If any items are missing or damaged, contact the manufacturer or distributor (outside the US).

3.2 Instrument environmental considerations

The instrument enclosure is designed for general-duty, indoor installation with a nearly constant ambient temperature between 5° and 40 °C (18° to 104 °F). The enclosure environmental rating is IP62 with the door closed and latched. Do not mount the instrument in direct sunlight; shield from dripping water.

3.3 Mount the instrument on the wall

The instrument case is designed for wall mounting. Refer to [Figure 2](#), [Figure 3](#), and [Figure 4](#) for dimensions and other installation information. Use ¼-inch screws for mounting. Mount the instrument as close to the sampling point as practical to ensure complete purging of the sample line during each cycle. Leave adequate clearance at the sides and bottom of the instrument case for plumbing and wiring connections.

Installation

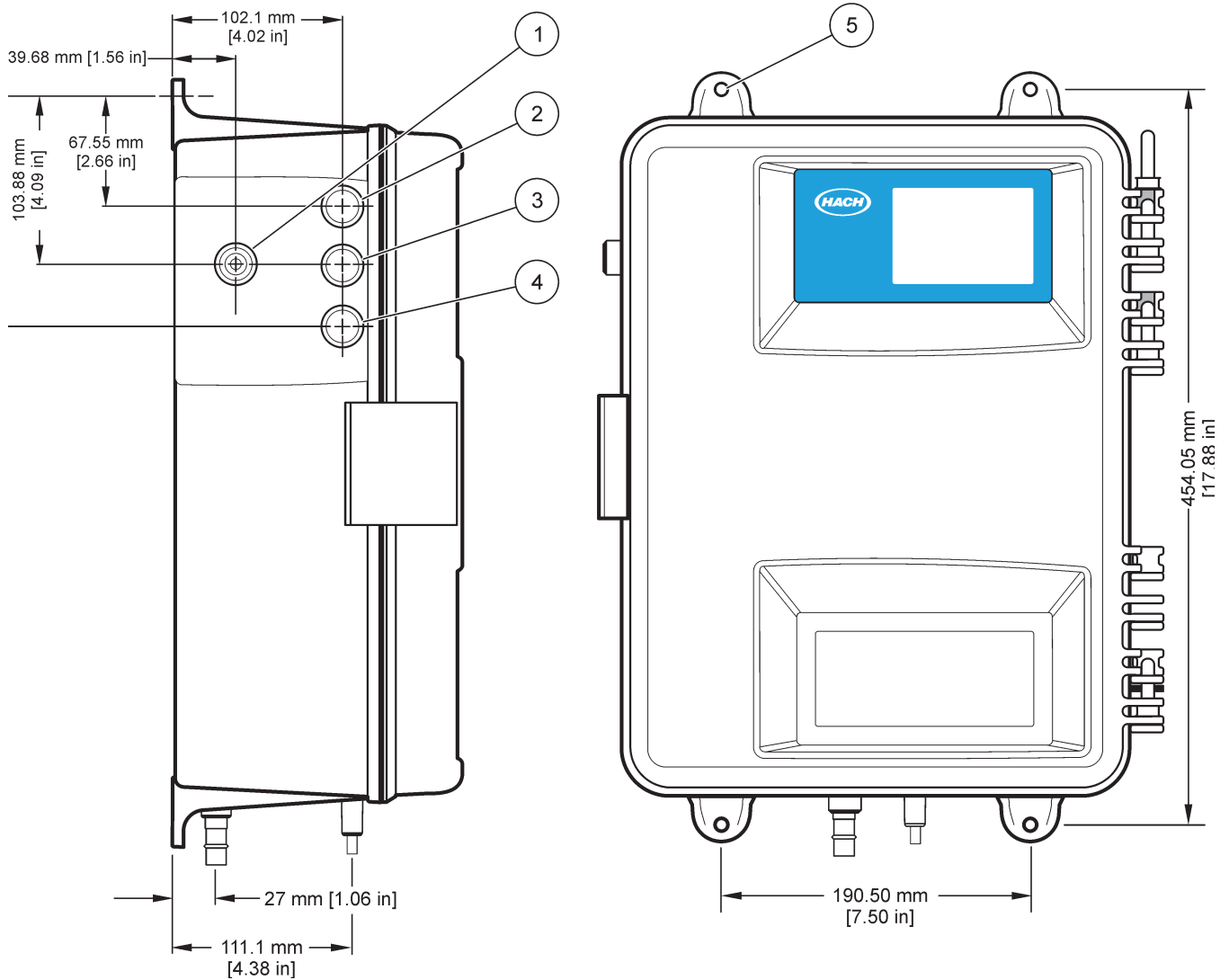


Figure 2 CL17 instrument dimensions (1 of 3)

1 Air purge quick connect .25 O.D. Polyethylene Tubing, (4743800)	4 Power connections
2 Relay / alarm contact connections	5 4 x 1/4" recommended mounting bolt
3 Network and 4-20 mA connections	

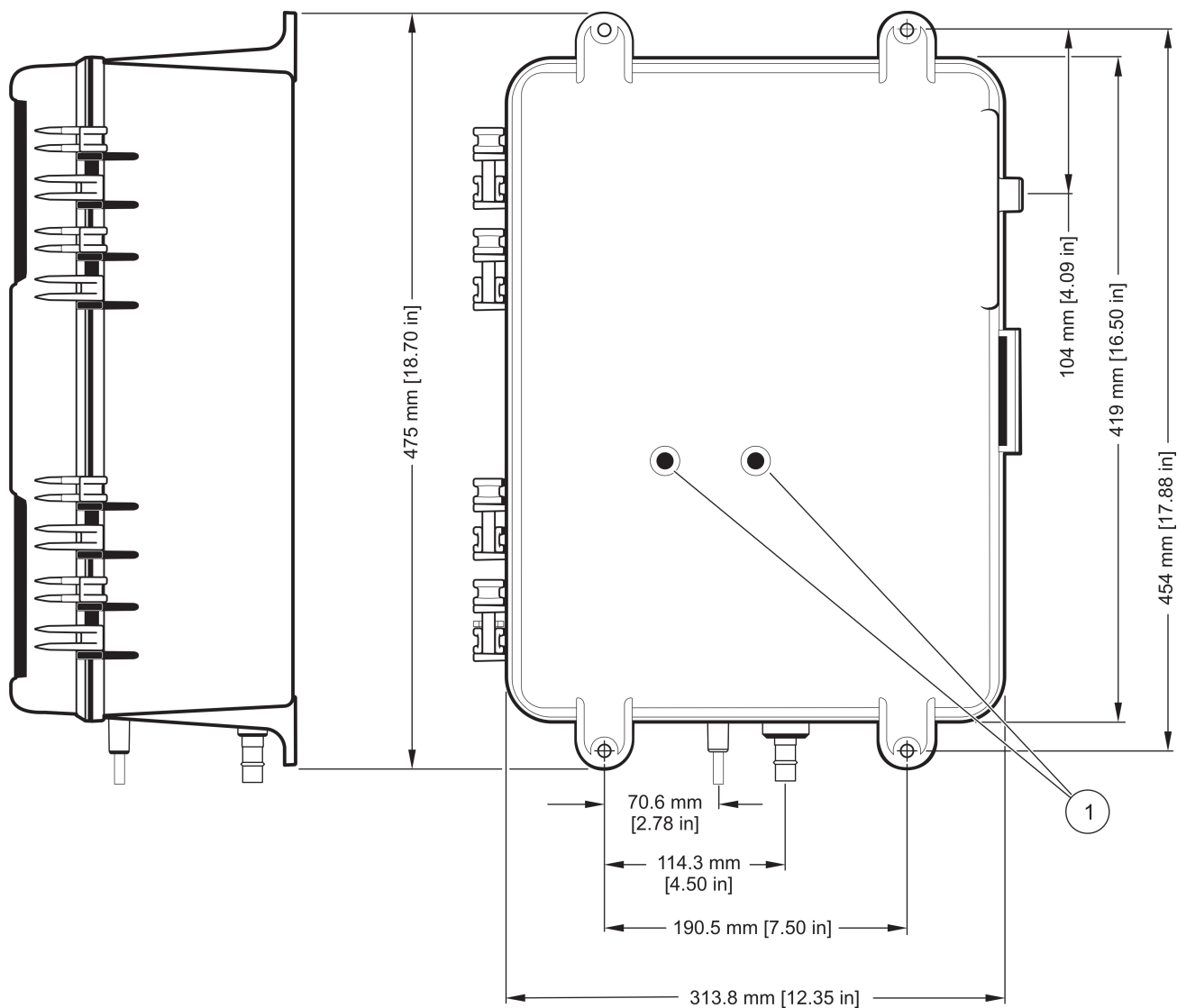


Figure 3 CL17 instrument dimensions (2 of 3)

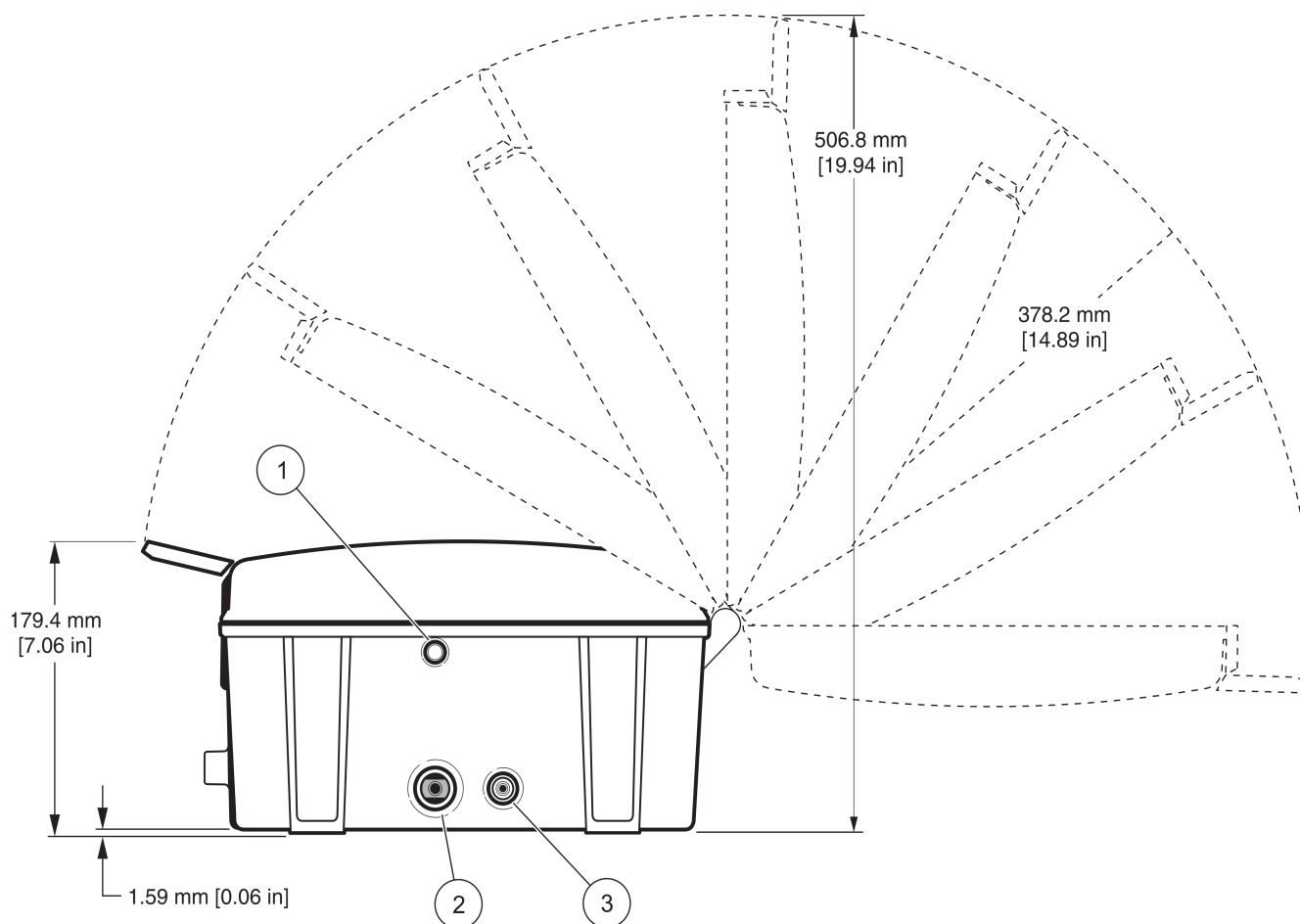


Figure 4 CL17 instrument dimensions (3 of 3)

<p>1 Overflow drain, recommended .50 I.D. tubing</p>	<p>3 Sample inlet quick connect .25 O.D. Polyethylene tubing (4743800)</p>
<p>2 .50 I.D. drain tube sample</p>	

3.4 Plumbing connections

Note: The sample drain contains analysis wastes, which include both sample and chemical reagents. The enclosure drain produces no waste under normal use. However, in the event of spills or leaks, some waste may be produced. Although the chemicals used are of low concentration, it is best to check with local authorities concerning proper disposal of waste from this product.

Sample inlet and drain connections are made on the bottom of the instrument using a quick connect fitting for ¼-inch OD tubing. Refer to Figure 5. Connect the ¼-inch O.D. poly tubing by pushing it into the fitting. Two distinct “stops” will be felt as the tubing is correctly attached. If the tubing is not properly seated, it will come loose when water pressure is applied. The sample drain fitting is sized for ½-inch ID flexible tubing (not supplied).

CAUTION

Fire hazard. This analyzer is intended to be used for water samples only.

Note: The ½-inch enclosure drain must have at least 3 feet of tubing installed to ensure the analyzer remains dust-tight. Never plug the drain. The drain must remain open to remove sample water in the event of a leak.

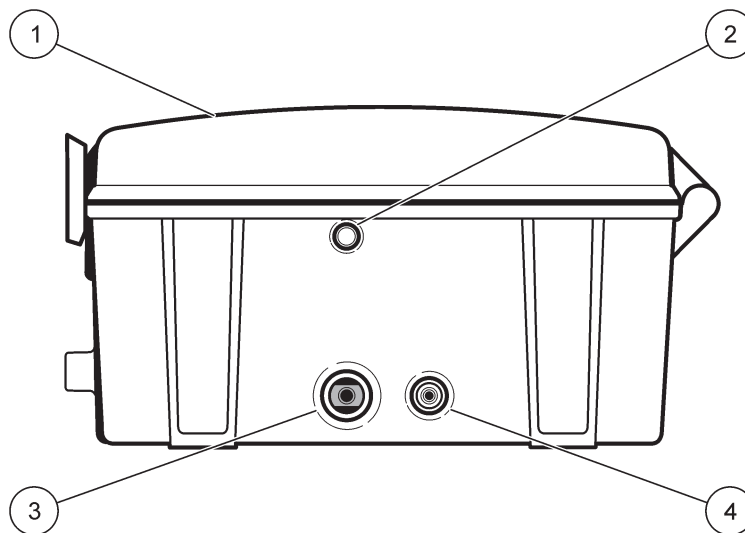


Figure 5 Plumbing connections (bottom view)

1 Front of instrument	3 Sample drain. Instrument drain fitting is sized for ½ in. ID flexible tubing
2 Enclosure drain	4 Sample inlet. Quick connect fitting for ¼ in. O.D. tubing

3.5 Installing the sample line

Selecting a good, representative sampling point is important for optimum performance of the instrument. The sample analyzed must be representative of the condition of the entire system. Erratic readings will be seen if sample is drawn from a location too close to points of chemical additions to the process stream, if mixing is inadequate, or if the chemical reaction is incomplete.

If the sample pressure into the instrument exceeds 5 psig at the analyzer inlet, flooding and instrument damage may result unless the sample conditioning kit is installed.

Install sample line taps into the side or center of larger process pipes to minimize the chance of ingesting sediment from the pipe line bottom or air bubbles from the top. A tap projecting into the center of the pipe is ideal. Refer to [Figure 6](#).

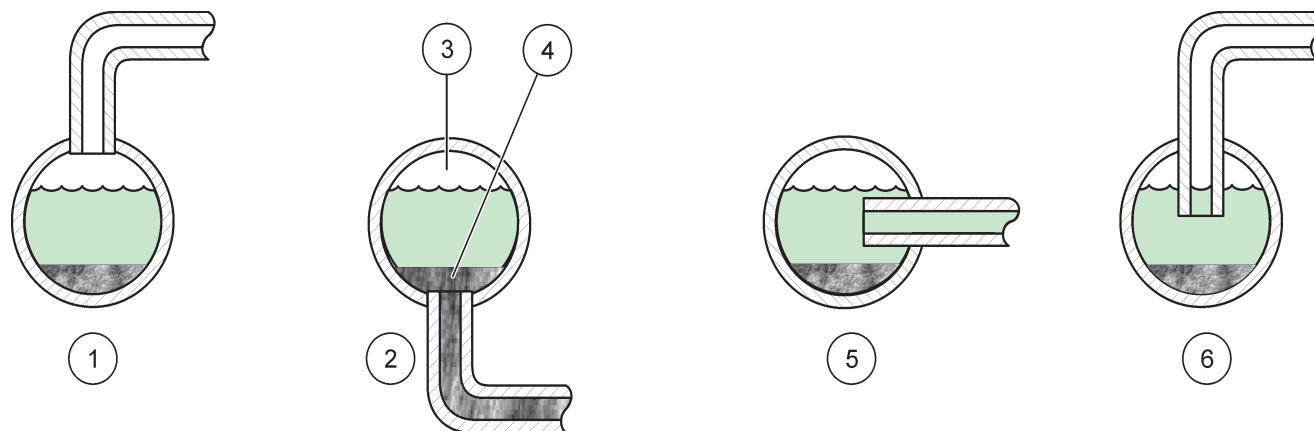


Figure 6 Sample line location in the process stream

1	Poor	4	Sediment (typical)
2	Poor	5	Good
3	Air (typical)	6	Best

3.6 Sample conditioning

All samples are “conditioned” using the single-sample, basic sample conditioning kit shipped with each analyzer. The kit eliminates large particles using a 40-mesh strainer.

The ball valve on the raw sample inlet line may be used to control the amount of bypass flow that is delivered to the filter. For dirty water, high bypass will adjust it to help keep the strainer clean longer, or adjust it to any partially open position for continuous bypass. Adjust the ball valve on the instrument supply line to control the flow rate of filtered sample to the instrument.

Note: Installing the drain tee more than 2 feet above the instrument can result in excessive pressure which may cause leaks.

Mount the centerline of the bypass drain tee two feet above the instrument. Refer to [Figure 7](#). When properly mounted, the vacuum breaker design of the bypass drain tee prevents negative sample pressure and establishes the needed positive sample pressure for sample flow through the analyzer.

3.6.1 Assemble the sample conditioning kit

Refer to the complete system diagram in [Figure 7](#) and the tips in [Table 3](#) to assemble the components.

- Seal all threaded fittings with two wraps of PTFE tape (provided).
- Two stops should be felt when installing tubing into the push-in fitting. The first is when the tubing clears the gripper ring, and the second is when the tubing meets the bottom of the fitting. To prevent leaks, make sure to push the tubing all the way in.

Note: To help grip the tubing, use rubber gloves or other material that grips and forcefully push the tubing into the fitting. Two stops should be felt; otherwise the tubing will not be fully inserted and will leak.

- Be sure to cut all tubing used in the push-in fittings with a sharp knife so the ends are round, cleanly cut and not angled.
- The push-in fittings are designed for use with soft, ¼-inch OD plastic tubing as included in the kit. Tubing material such as PTFE or HDPE is recommended. The push-in fitting will not grip hard plastic or metal tubing and the tubing will slip out.

3.6.2 Use the sample conditioning kit

Assemble the head height regulator (stand-pipe) and filter as shown in [Figure 7](#). Make sure the sample pressure to the sample conditioning is between 1.5 and 75-psig for proper operation.

1. Set flow by adjusting the ball valve (item 18, in [Figure 7](#)). The valve is fully closed when the lever is perpendicular to the valve body and fully open when the lever is parallel with the valve body.
2. Observe the flow in the unfiltered sample bypass (clear tube, item 13 in [Figure 7](#)). Make sure the flow is adjusted so there is always bypass flow.
3. Use the ball valve (item 19) to turn off sample flow to the instrument.

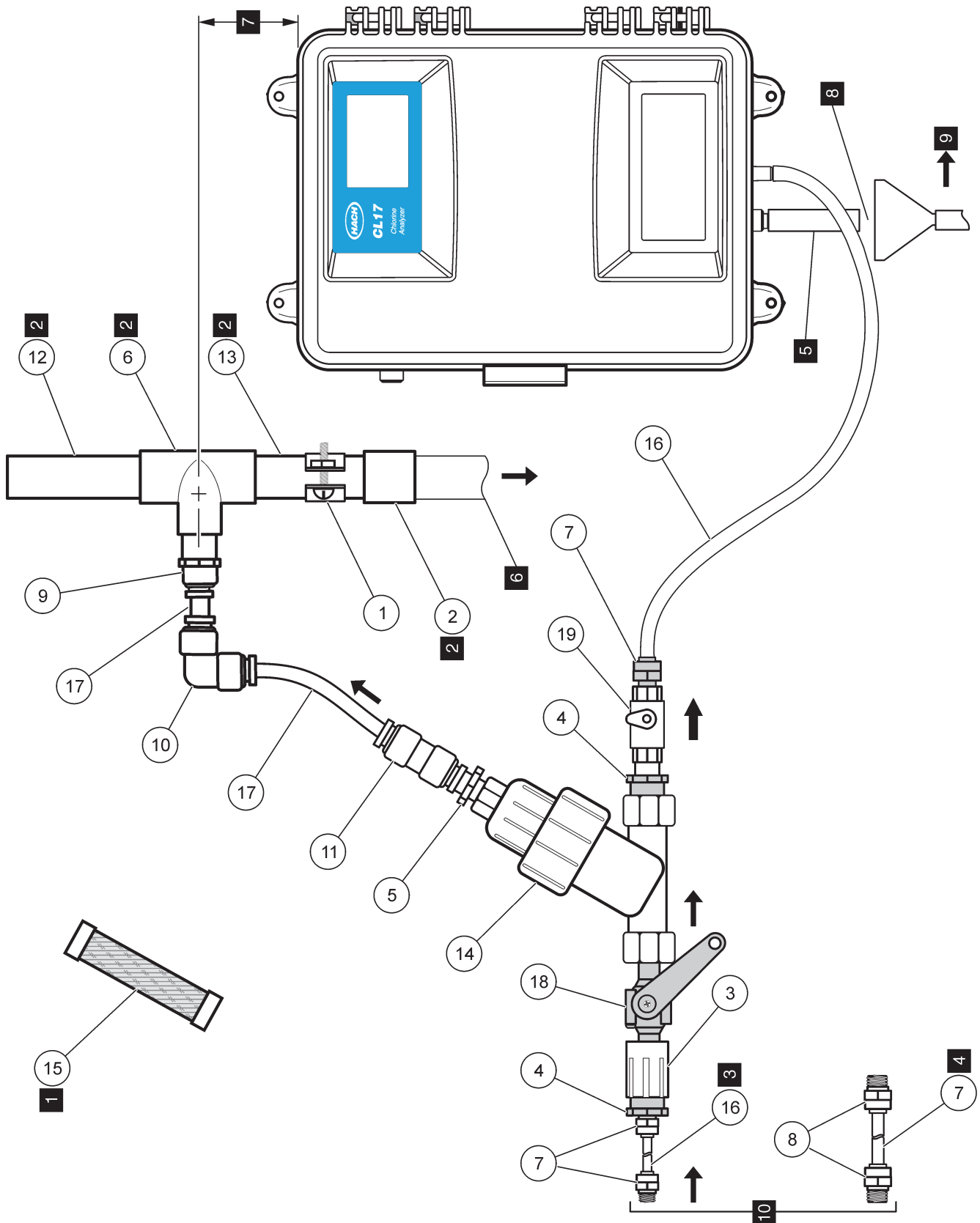


Figure 7 Sample conditioning kit

Table 1 Sample Conditioning Parts List (refer to Figure 7)

Item	Description	Qty	Catalog Number
1	Clamp, Conduit Hanger, 1-inch	4	4734900
2	Coupling, 1-inch, SCH 40, PVC pipe	1	5417500
3	Coupling, ½-inch FPT x ½ FPT PVC	1	5417600
4	Fitting, Reduce Bushing, PVC, Hex	2	2300200
5	Fitting, Stem Adapter, ½-inch O.D., ¼ NPT	1	5418000
6	Fitting, Tee, 1-inch x 1-inch	1	4662200
7	Fitting, Tube, Connector, Male (¼-inch tubing)	3	5124600
8	Fitting, Tube, Connector, Male (½-inch tubing)	2	5126200
9	Fitting, Tube, ½-inch O.D. x ½-inch Male NPT	1	5417800
10	Fitting, Tube, ½-inch O.D. Union Elbow	1	5417900
11	Fitting, Tube, ½-inch O.D., Union Straight	1	5418100
12	Pipe, Pre-cut Drain, 1-inch Diameter, PVC	1	5123900
13	Pipe, Drain, Clear	1	5417400
14	Strainer, Y-body	1	5418300
	Filter, 40-mesh Screen (provided with strainer and in Maintenance Kit)	1	5418400
15	PTFE Thread Tape, ¼-inch wide	1	7060824
16	Tubing, Polyethylene, 0.250 O.D., 0.040 W, Black	15 feet	3061600
17	Tubing, Polyethylene, 0.500 O.D., 0.062 W, Black	10 feet	5115900
18	Valve, Ball, PVC, ½ NPT, PVC	1	5417700
19	Valve, Ball, PVC, ¼ NPT, PVC	1	5139500

Table 2 Sample condition kit parts list notes for Figure 7

1	The filter element is factory installed. A spare filter is provided in the Maintenance Kit.
2	Use PVC pipe cement to assemble. Leave pipe open to the atmosphere.
3	This the “Low Flow” option.
4	This the “High Flow” option.
5	The ½ inch drain tube must have an air-break. (Must be supplied by the customer.)
6	Use the Unfiltered Sample Bypass to return to system under zero pressure, if possible, or to drain. Use customer supplied PVC pipe as required to run to drain location.
7	Install the Sample Flow Regulator (Constant Head Device) 24 inches above the instrument.
8	Air Gap
9	Drain
10	Use either 7 and 16 or 8 and 17.

3.7 Optional air purge

Air purge may be necessary if the analyzer is located in an environment with high humidity and/or caustic vapors. The goal is to maintain a slight positive pressure in the instrument with dry instrument air.

The air purge connection is located on the left side of the instrument enclosure. To connect an air supply, remove the plug in the quick connect fitting then connect ¼-inch poly tubing by pushing the tubing into the fitting. Two distinct “stops” will be felt as the tubing is correctly attached. If the tubing is not properly seated, it will come loose when air pressure is applied. Use only dry, oil-free instrument air at 15 scfh.

3.8 Electrical connections

All power connections are made through the conduit openings in the upper left side of the instrument. The instrument is shipped with plugs in all of the conduit openings. Wire the instrument for power, alarms, and relay connections using sealing-type conduit fittings, to maintain the IP62 environmental rating.

If connections are not made through a conduit opening, install a liquid-tight seal in place of the plugs to maintain the IEC 529 IP62 rating. Refer to [Parts and accessories on page 49](#).

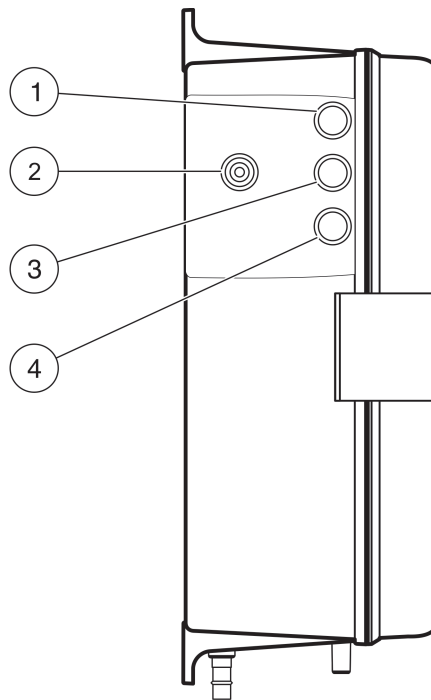


Figure 8 Location of air purge and electrical connections

<p>1 Intended for wiring relays. Use sealing type fittings.</p>	<p>3 Network and 4-20 mA connections. Use sealing type fittings. <i>Note: If relay connections are not made, a liquid-tight seal (4221000) must be installed to maintain the IEC 529 IP62 rating.</i></p>
<p>2 Optional air purge connection</p>	<p>4 Power connections. Use sealing type fittings.</p>

3.8.1 Power connections

DANGER

Electrocution hazard. Only qualified personnel should conduct the tasks described in this section of the manual. Connect equipment in accordance with national, state and local electrical codes.

Power connections are made at the terminal strip located in the left side of the electrical compartment and are accessible when the customer access cover is opened. Refer to [Figure 9](#) and [Figure 12](#).

For process or industrial applications, the national electrical codes of most countries require that AC service feeds be hard-wired and contained in conduit systems. The CL17 Chlorine Analyzer has been designed to conform to this requirement.

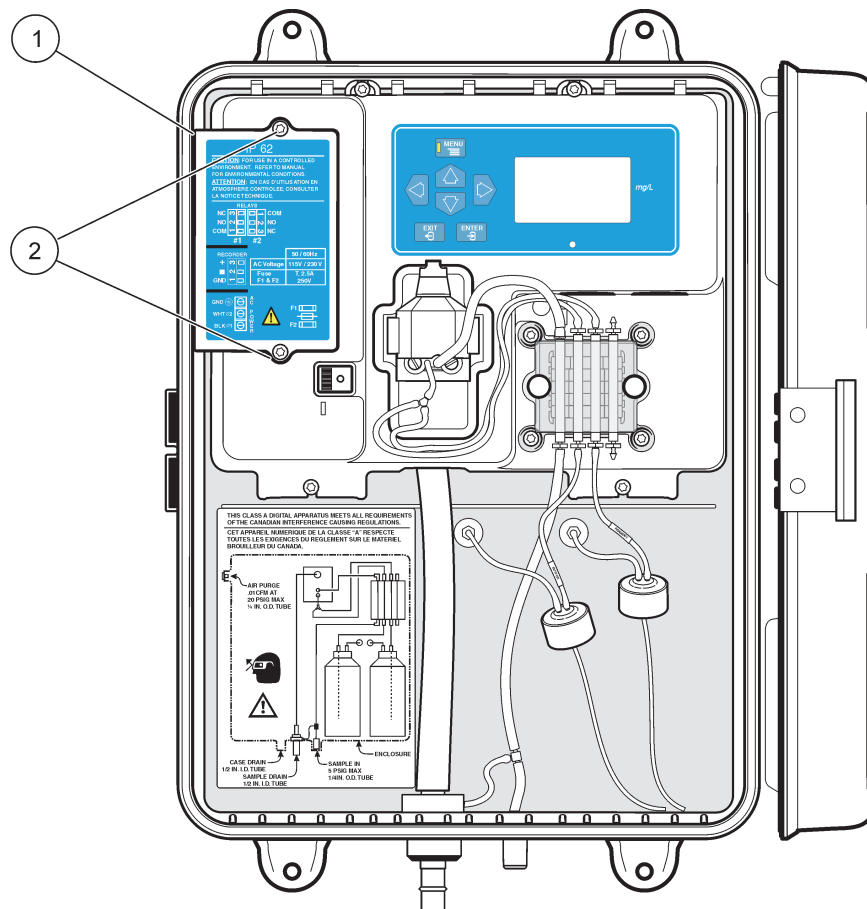


Figure 9 Locating and removing customer access cover

<p>1 Customer access cover</p>	<p>2 Use a torx-driver to remove the two screws that hold the Customer Access Cover in place. Set cover aside.</p>
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Conduit is recommended for two reasons:

1. It is generally required by most local electrical codes.
2. Use of metal conduit can improve immunity to lightning surges and AC power transients.

Installation

Additionally, electrical and instrumentation standards require a local means of removing power from the product. **The instrument is supplied with a power on/off switch that is located inside the instrument enclosure. To remove relay power from the instrument, an external customer-supplied 5A fused switch or a 5A breaker is required.**

In hard-wired electrical applications, the power and safety ground service drops for the instrument should be no longer than 6 meters (20 feet) unless metal conduit is used to shield the AC power wiring. The wire should be 18 AWG.

In applications where power cords are allowed by local electrical codes and power surges and transients are not a great concern, a sealing-type strain relief and power cord with three 18 gauge conductors (including a safety ground wire) can be used. Refer to [Figure 10](#) for strain relief assembly. The length of the power cord must not exceed 3 meters (10 feet).

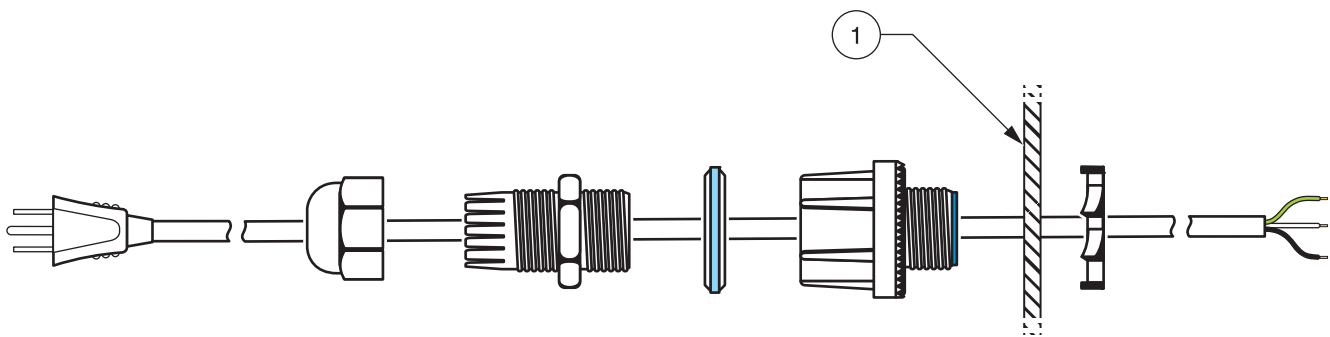


Figure 10 Assembling the optional power cord hardware

1 Wall section of the instrument closure

Description	Item number
115V Power cord with strain relief	5448800
230V Power cord with strain relief	5448900

3.8.2 Wiring the instrument

Connect the unpowered wires to the instrument power terminal as follows:

1. Strip the outside insulation of each wire back ¼-inch. Refer to [Figure 14 on page 23](#).
2. Connect the three wires to the terminal using the information in [Table 3](#) and [Figure 11 on page 21](#).
3. Ensure the voltage setting is correct and supply power to the instrument.

Table 3 Terminal wiring information

Wire color code for:	Protective earth ground	Hot or Ø1	Neutral or Ø2
North America	Green	Black	White
IEC	Green with yellow tracer	Brown	Blue

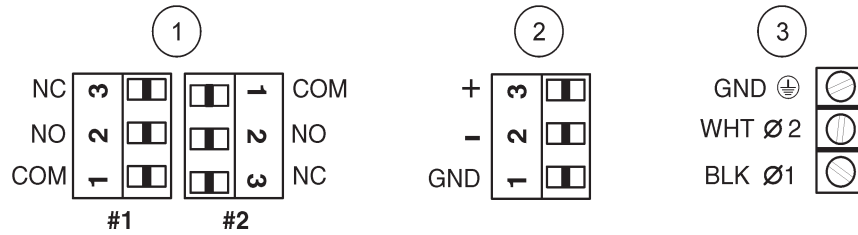


Figure 11 Customer connections to analyzer

1 Relays	3 AC power: 100-115/230 VAC, 50/60 Hz, 90 VA fused at 2.50A
2 Recorder	

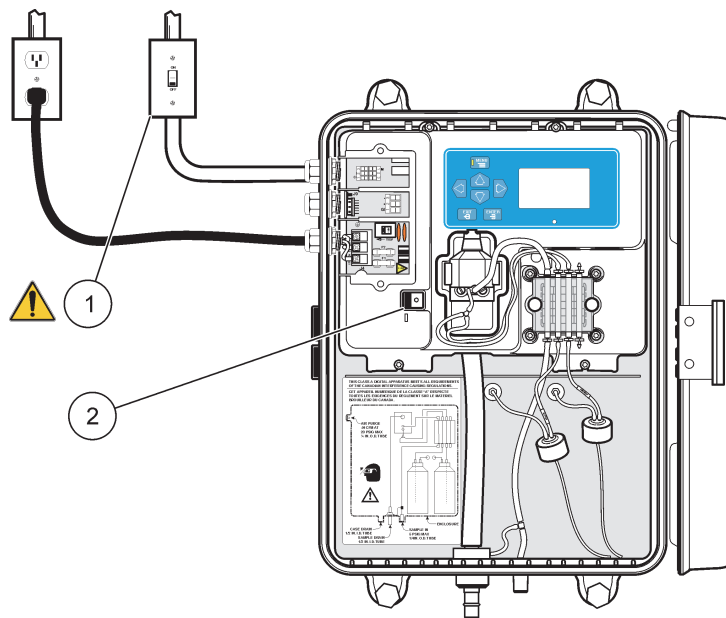


Figure 12 Power connections

1 A method to remove power from the relays locally must be available in case of an emergency or for servicing the instrument.	2 Since the ON/OFF switch can be accessed without the use of a tool an external switch is not required for instrument power.
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3.8.3 Voltage selection for alternate voltage operation

Note: The voltage selector switch must be set properly for the line voltage to be used. An improper setting can result in serious damage to the instrument when power is applied. Refer to [Figure 13](#).

The instrument is switched for 115-volt operation when it leaves the factory. To convert the instrument for 230-volt operation, slide the AC line conversion switch (shown in [Figure 13](#)) to the 230V position. The fuses used in this product are 5 mm x 20 mm. The fuses used are approved for both North American and European use; they do not need to be changed when voltage is converted.

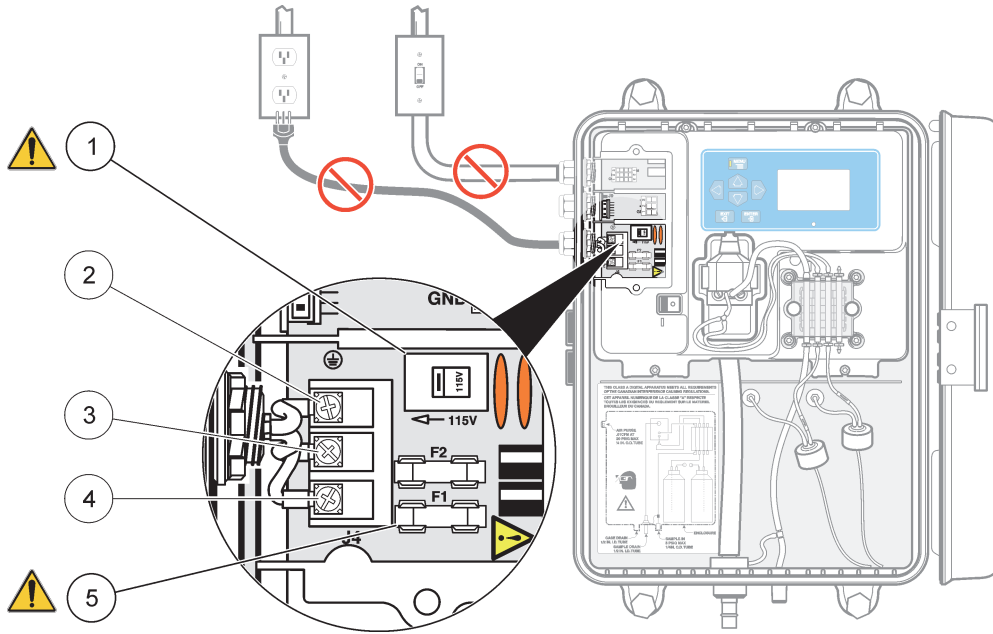


Figure 13 Voltage selector switch and fuse replacement

1	Voltage selection switch (SW1). Factory set at 115V.	4	Hot / Black Ø1
2	GND	5	Fuses (F1, F2) (T, 2.5A, 250V)
3	Neutral / White Ø2		

3.8.4 Alarm connections

CAUTION

Fire hazard. Current to the relay contacts must be limited to 5 amps resistive. A method to remove power from the relays locally must be available in case of an emergency or for servicing the product. Power removal can be accomplished with an external switch and a 5-amp fuse or with a switched 5-amp circuit breaker.

The analyzer contains two alarm relays designed for use with either high voltage (greater than 30V-RMS and 42.2V-PEAK or 60 VDC) or low voltage (less than 30V-RMS and 42.2V-PEAK, or less than 60 VDC), but not a combination of both high and low voltage. Refer to 3.8.5, Figure 11, and Figure 15 along with the instructions below for connection information.

The Normally Open and Common relay contacts will be connected when an alarm condition is active.

The relay connector accepts 18-12 AWG wire. Wire gauge should be determined by load application. Wire gauge less than 18 AWG is not recommended.

1. Make sure no power is supplied to the instrument.
2. Strip the insulation on each wire back ¼-inch. Refer to Figure 14.
3. Remove the connector from the instrument if desired.
4. Insert the wire ends into the connector until the insulation seats against the connector. Refer to Figure 14. (Do not seat the insulation under the terminal pinch plates.)
5. Replace the connector if necessary and supply power to the instrument.

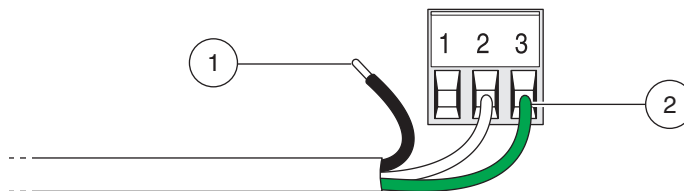


Figure 14 Proper wire preparation and insertion

<p>1 Strip ¼ in. of insulation</p>	<p>2 Seat insulation against connector with no bare wire exposed.</p>
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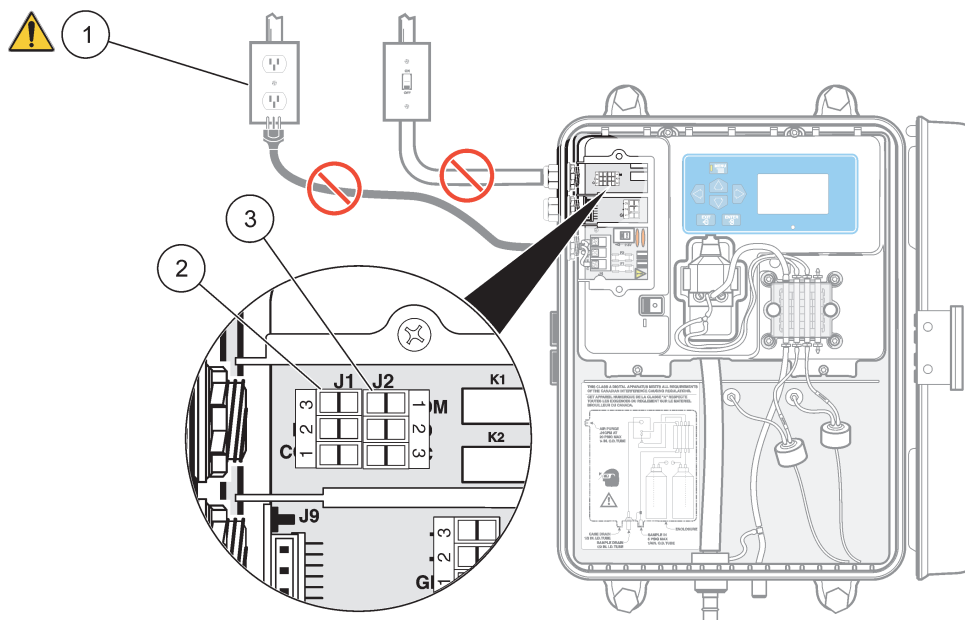


Figure 15 Alarm connections

<p>1 Current to the relay contacts must be limited to 5 amps. Note: Make sure no power is supplied to the instrument.</p>	<p>3 J2 alarm connections terminal block: Terminal 1 = COM; Terminal 2 = NO; Terminal 3 = NC</p>
<p>2 J1 alarm connections terminal block: Terminal 1 = COM; Terminal 2 = NO; Terminal 3 = NC</p>	

3.8.5 Recorder output connections

The recorder output is a 4–20 mA current-source output. Make recorder connections with twisted-pair shielded wire and connect the shield at the recorder, controlled component end or at the analyzer end. Do not connect the shield at both ends of the cable.

Make wiring connections at the analyzer end as follows:

1. Make sure no power is supplied to the instrument.
2. Remove the Customer Access Cover (refer to [Figure 9](#) in the manual).
3. Strip the insulation on each wire back ¼-inch. Refer to [Figure 14](#).

Note: Use a twisted-pair, shielded cable. Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than allowed.

4. Route the wire through an available strain relief.

5. Remove the connector from the instrument. Refer to [Figure 16 on page 24](#) for connector position.
6. Insert the wire ends into the connector (refer to the table below) until the insulation seats against the connector as shown in [Figure 14](#). (Do not seat the insulation under the terminal pinch plates.)

Recorder Wires	Circuit Board Markings
Recorder +	+
Recorder -	-
Shield	GND

7. Replace the connector and supply power to the instrument.

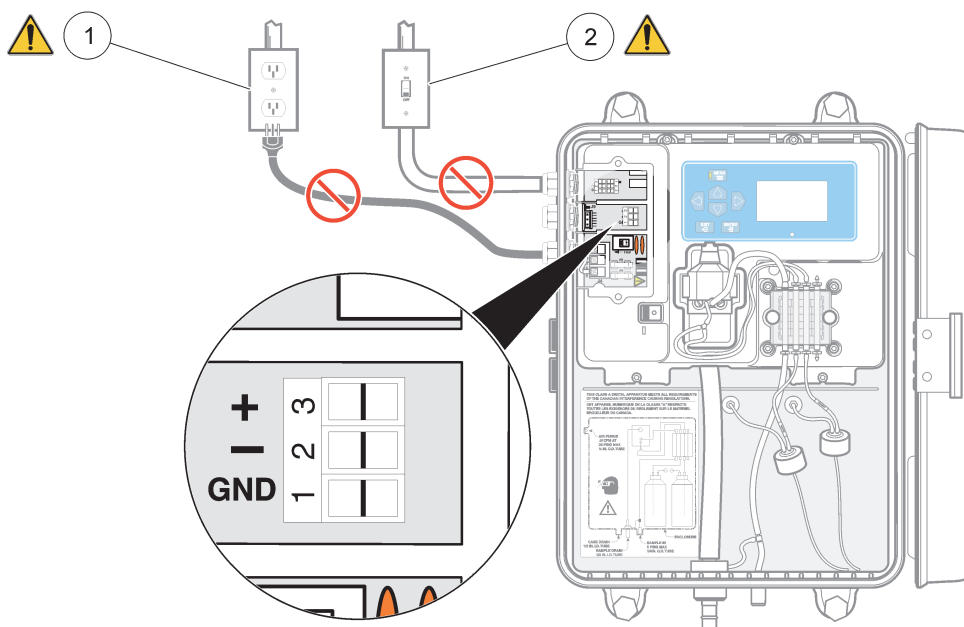


Figure 16 Recorder connections

1 Make sure no power is supplied to the instrument	2 Make sure no power is supplied to the relay
--	---

3.9 Install the pump/valve pinch plate

To eliminate the effects of constant pressure on the pump tubes during shipment and storage, the pinch plate and screws for the pump/valve module are shipped in the installation kit and the pump tubes are held in place with tape.

Reagent flow through the pump/valve module must be from bottom to top. If reversed, fluid mixture will be pumped from the colorimeter sample cell, causing reagent bottles to overflow.

Complete the assembly of the pump/valve module as follows:

1. Remove the tape.
2. Make sure the individual pinch blocks are positioned as shown in [Figure 17](#), with the dissimilar-shaped block on top.
3. Align the pinch plate on the pump/valve module (refer to [Figure 18](#)).

- Install the two screws through the pinch plate and into the pump/valve module. Secure the pinch plate by turning the screws in small increments moving from one screw to the other so that the plate is drawn down evenly. Tighten until the plate is seated against the pump/valve module.

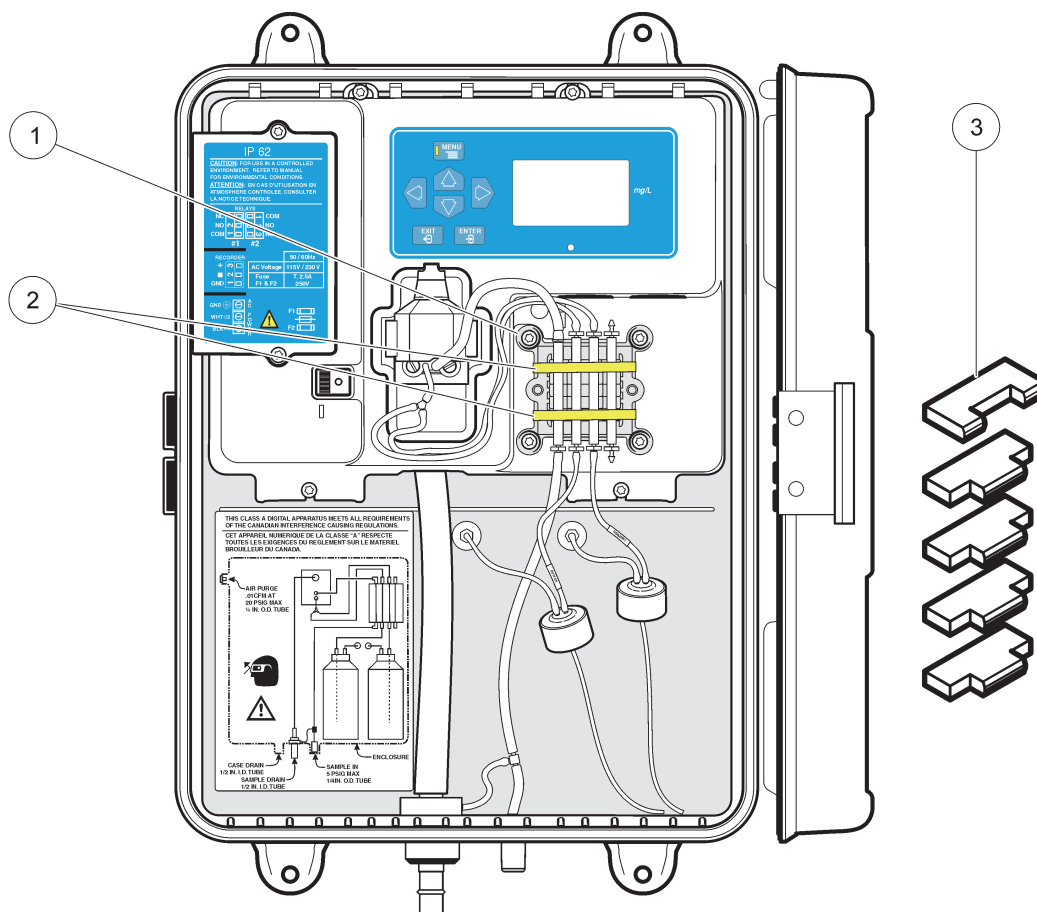


Figure 17 Installing pump/valve module pinch blocks

1 Pump/Valve module	3 The dissimilar-shaped block should be on top
2 Remove tape from tubes	

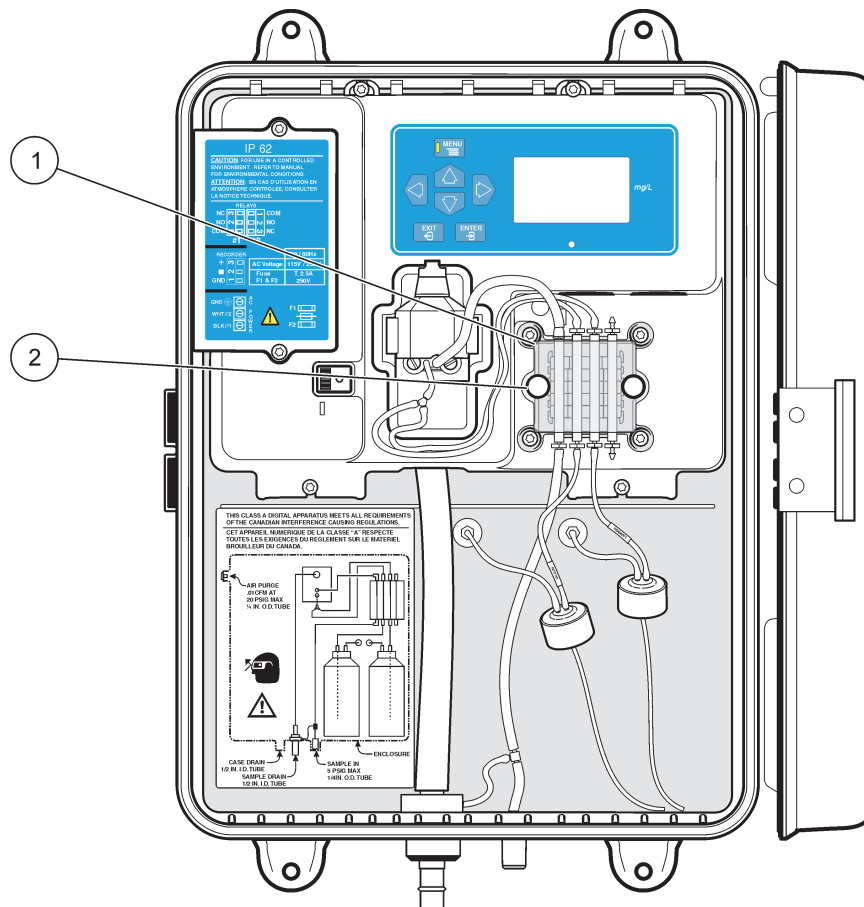


Figure 18 Aligning the pump/valve module pinch plate

1 Align pinch plate with pump/valve module

2 Install screws. (Advance the screws in small increments moving from one screw to the other so that the plate is drawn down evenly.)

Section 4 System Startup



CAUTION

Chemical exposure hazard. To familiarize yourself with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards. Protective eye wear is always recommended when contact with chemicals is possible.

Preliminary tasks necessary for placing the instrument in operation are defined below in their recommended sequence. Once these preliminary steps are performed, the instrument will be operational.

4.1 Install the reagents

The analyzer requires two reagents, a buffer solution and an indicator (Table 4). Space is provided in the instrument enclosure for a 500-mL bottle of each of the reagents. Two reagents used in the chlorine analysis are installed in the analyzer hydraulic section and replenished at monthly intervals. One is the buffer solution, Free Chlorine Buffer, Cat. No. 8867711, used to determine free available chlorine, or Total Chlorine Buffer, Cat. No. 2263511, used for total chlorine analysis. The buffer solutions are completely formulated at the factory and are ready to install. Remove the cap and seal from the buffer solution bottle and install the cap and tubing labeled *BUFFER* to the buffer solution bottle.

Note: It is normal for the reagent tubing to become discolored over time.

The second reagent, the indicator solution, must be prepared.

The indicator solution and indicator powder must be mixed just before use to ensure the best instrument performance. Using the powder funnel provided in the maintenance kit, add the contents of one bottle of DPD High Range Powder, Cat. No. 2297255, to a bottle of Total Chlorine Indicator Solution, Cat. No. 2263411, or a bottle of Free Chlorine Indicator Solution, Cat. No. 2314011. Stir or shake until the powder is dissolved completely. Remove the cap from the reagent bottle and install the cap and tubing labeled *INDICATOR* to the reagent bottle. Tubing should be inserted to the bottoms of the bottles to prevent air from being drawn in when the level in the bottle drops.

Table 4 Buffer and indicator solutions

Test Type	Required Reagent	Item No.	Reagent Set Item No.
Free Chlorine	Free Chlorine Buffer Solution	2314111	2556900
	Free Chlorine Indicator Solution	2314011	
	DPD Indicator Powder	2297255	
Total Chlorine	Total Chlorine Buffer Solution	2263511	2557000
	Total Chlorine Indicator Solution	2263411	
	DPD Indicator Powder	2297255	

Remove each reagent bottle cap and replace it with the special two-part bottle cap that is connected to the delivery tube inside the instrument.

4.2 Install the stir bar

A small stir bar for the sample cell in the colorimeter assembly is included in the installation kit furnished with the instrument. The stir bar must be installed for the instrument to operate properly.

Install the stir bar as follows:

Note: Make sure the stir bar drops down into the colorimeter and remains in the colorimeter.

1. Remove the plug in the top of the colorimeter.
2. Drop the stir bar into the hole. Refer to [Figure 19](#). The bar should rest on the bottom of the vertical bore.
3. Replace the plug.

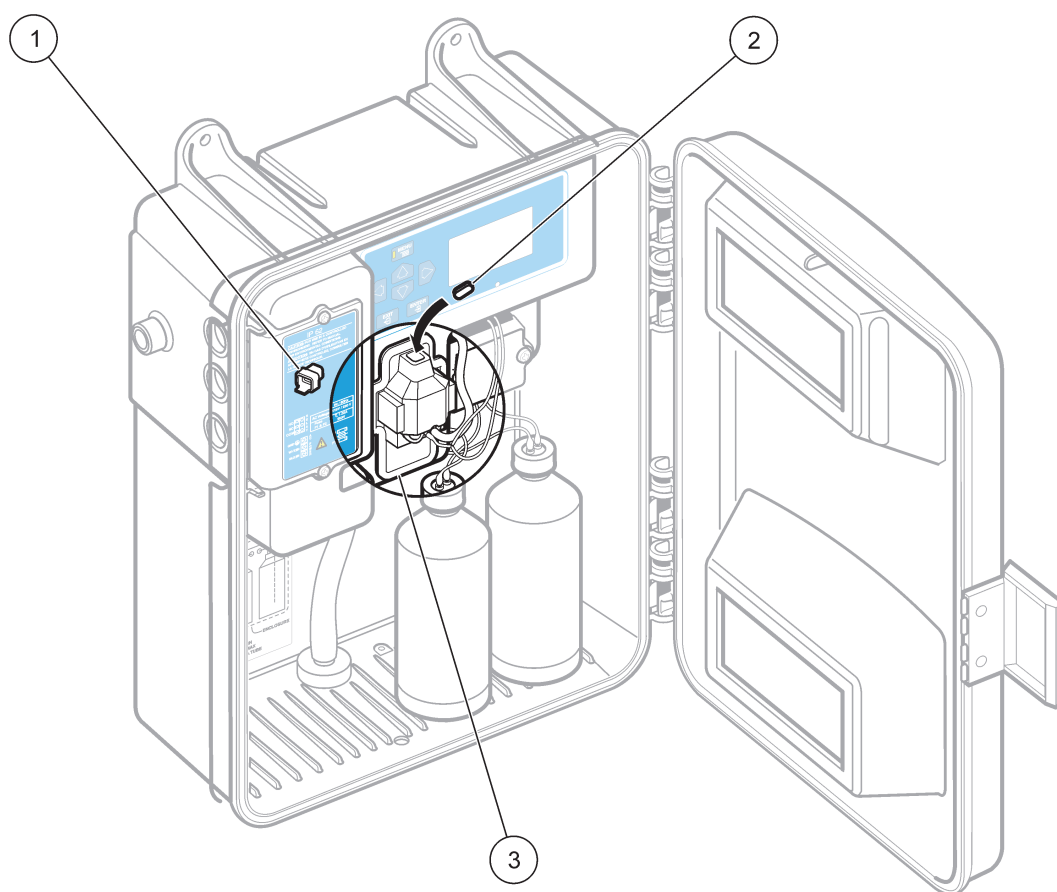


Figure 19 Installing the stir bar

1 Remove the plug from the top hole of the colorimeter	3 Colorimeter assembly
2 Drop the stir bar into the hole and replace the plug. (The stir bar is shown larger than actual size.)	

4.3 Supply the sample

Note: Make sure the pressure plate is securely attached to avoid backflow of the sample into the reagents.

Start sample flow through the instrument by opening the supply valve (item 19 in [Figure 7 on page 16](#)). Allow the pressure in the tubing to stabilize and check for leaks.

Until the surface of the sample cell becomes completely wetted, bubbles may cling to the sample cell and cause erratic readings. This condition is temporary. Its duration depends on the sample properties.

4.4 Supply power to the analyzer

The power switch is located inside the enclosure door in the recessed area to the left of the colorimeter block. Set the POWER (-/O) switch to ON (-) and allow the analyzer to operate for approximately two hours to ensure the system is completely wetted with reagents and sample.

Section 5 Operation

5.1 Keypad and display information

The instrument display defaults to normal Concentration Measurement Mode unless keys are pressed to change it. [Table 5](#) shows the functions for each key.

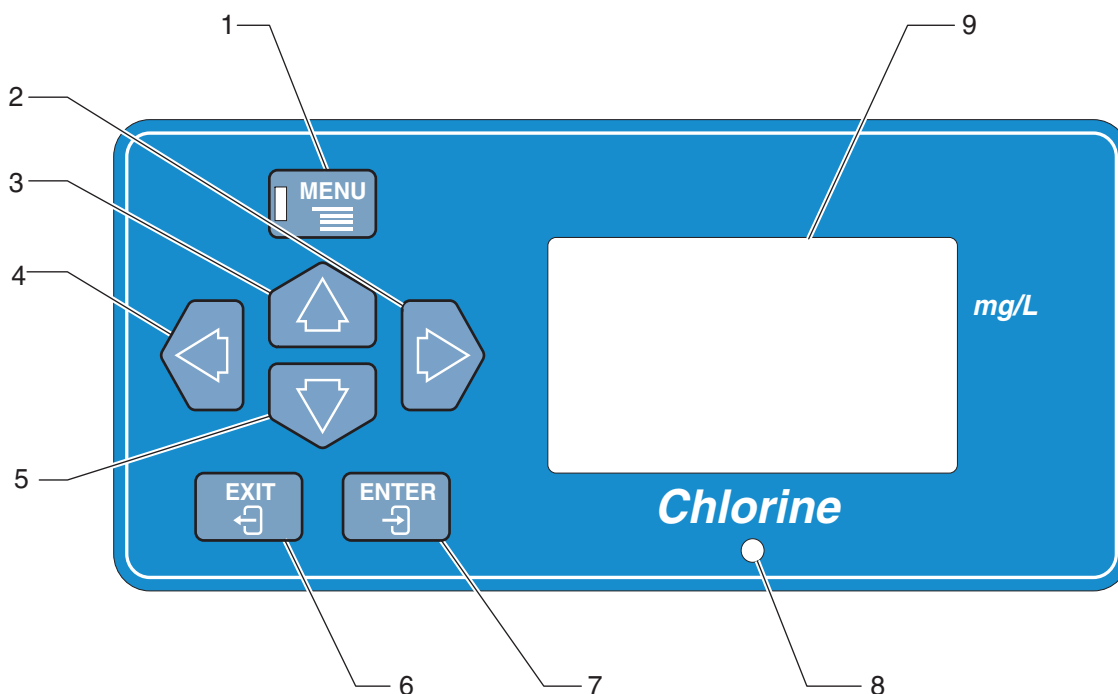


Figure 20 Analyzer keypad and display

Table 5 Keypad Description

Number	Key	Description
1	MENU	In measurement mode, pressing the MENU key allows access to ALARM , RECORDER , MAINTENANCE and SETUP menus.
2	RIGHT ARROW	Allows movement so different components of the display can be edited. Active when the right arrow icon is shown on the display.
3	UP ARROW	Use to scroll through menu options or edit display components. Active when the up / down arrow icons are shown on the display.
4	LEFT ARROW	Allows movement so different components of the display can be edited. Active when the left arrow icon is shown on the display.
5	DOWN ARROW	Use to scroll through menu options or edit display components. Active when the up / down arrow icons are shown on the display.
6	EXIT	Rejects an edited value or backs out of the menu structure.
7	ENTER	Accepts an edited value, moves deeper into the menu structure, or accepts a menu option.
8	Alarm LED	Indicates an active alarm.
9	Display Screen	Display area for measurement and menu information.

5.2 Instrument menu structure

The major menus in the CL17 Analyzer consist of **ALARMS**, **RECRDR**, **MAINT**, and **SETUP**. Press the **UP** or **DOWN ARROW** keys to access the menus. The sections below give information on the functions of each of the menus and the submenus within them.

5.2.1 Setup menu

Day-to-day analyzer functions are accessed from the **SETUP** menu. To enter the **SETUP** menu, press the **MENU** key, then use the **UP ARROW** key to scroll to the **SETUP** option. Press **ENTER**.

Scroll through the **SETUP** menu options using the **UP** and **DOWN ARROW** keys. Press **ENTER** to select the displayed menu option. Arrow icons are displayed if the display is editable. Press the **EXIT** key to back out of a menu and return to **SETUP**. The menu information in [Table 6](#) is in the order it appears in the **SETUP** menu.

Table 6 Setup menu options

Menu option	Description
SIGAVG	The SIGAVG feature is used to average readings and prevent erratic recorder output signals. Press ENTER , use the UP and DOWN ARROW keys to select 1, 2, 3, or 4, then press ENTER to accept the displayed selection. Depending on the value selected, the last 1, 2, or 3 measurements are averages and the reported concentration is the averaged values. Option 4 is a special filter, which only reports the maximum value between the current reading and the last. This feature reduces negative spikes due to bubbles and other abnormalities in the sample. The factory default is 1. Press EXIT to return to the SETUP menu. <i>Note: A properly maintained instrument in good working condition will read within the accuracy specifications presented in Specifications on page 3. The calibration function should never be used to force an analyzer that is not working correctly to display a correct reading. Calibrations are intended for very small adjustments only.</i>
CAL ZERO	This feature is used to offset the instrument zero using a prepared zero standard. If the offset is too large, a marginal zero (MARG Z) warning will occur. Refer to Calibration on page 36 .
CAL STD	This feature is used to adjust the analyzer slope using a prepared standard. If the adjustment is too large, the analyzer will not accept it and a marginal gain (MARG G) warning will occur. The new standard will not be accepted and it will have to be checked again using another method to establish a more exact reading. Refer to Calibration on page 36 .
CAL DEFAULTS	(Calibration Default Settings) Press ENTER to return the calibration settings back to factory defaults and set the Gain to 1.0 and the Offset to 0. Use this feature to remove calibrations that are causing a MARG G or MARG Z to be displayed.
OFFSET	Press ENTER to momentarily display the current Zero correction factor. The factory default is 0.
GAIN	Press ENTER to momentarily display the current Gain correction factor. The factory default for gain is 1, however, readings of 0.8 to 1.25 are acceptable.
DISPLAY TEST	Press ENTER to momentarily display all LCD segments to visually check that the complete display is functioning.
RECMIN	Recorder signal test. Press ENTER to drive the Recorder output to its minimum (normally 4 mA) and hold it there until the next analysis is complete.
RECMAX	Recorder signal test. Press ENTER to drive the Recorder output to its maximum (normally 20 mA) and will hold it there until the next analysis is complete. <i>Note: To hold the signal longer, press the MENU key then the DOWN ARROW key to scroll to MAINTENANCE. Press ENTER then scroll down to HOLD OUTPUTS and press ENTER again.</i>
REC ADJUST	Press ENTER to modify the Recorder Minimum and Recorder Maximum values. Use this feature to offset the 4 or 20 mA output signal to force a chart recorder to read zero or full scale in case of a small discrepancy. Use the RIGHT and LEFT ARROW keys to select RECMIN or RECMAX then use the UP and DOWN ARROW keys to adjust the value. Press ENTER to select. Press EXIT to accept changes and return to SETUP . <i>Note: The numbers on the display are A/D counts and cannot be used to determine the recorder setting.</i>

Table 6 Setup menu options

Menu option	Description
RELAY TEST	Press ENTER to momentarily turn the relays off, then sequentially turn on ALARM1 and ALARM 2. Automatically clears both alarms to complete the test.
REF¹	Momentarily displays the last Reference A/D counts.
SAMPLE¹	Momentarily displays the last Sample A/D counts.
ZERO¹	Momentarily displays the last Zero A/D counts.
CYCLE TIME¹	Momentarily displays the Motor On time (in seconds).
POWER FAIL WARNING	Sets the power fail warning to ON or OFF . Press ENTER then use the ARROW keys to toggle between ON and OFF . Press ENTER to select. Press EXIT to accept changes and return to SETUP . If the power fail warning is turned on and the power is interrupted, a system warning will be generated when power is restored. The factory default is off.
DIAG OUTPUT	Pressing ENTER will momentarily indicate ON at the display and any optional LonWorks® interfaces present will receive diagnostic data.
KEYBOARD LOCKOUT	Press ENTER then use the ARROW keys to toggle between ON and OFF . Press ENTER to select the displayed option. Press EXIT to return to the SETUP menu. If the keyboard is locked out, no editing functions are allowed and all diagnostics are disabled except this one. The factory default is OFF .
LANGUAGE	English language is the factory default. Spanish, French, and German can be enabled. Press ENTER then use the ARROW keys to move between the available options. Press the ENTER key when the language of choice is displayed. Press the EXIT key to accept changes and return to SETUP .
DEFAULT SETUP	Cold Start—Press ENTER to reset the instrument to factory defaults. All user-specified settings will be lost. The display will show the software version number (V 1.2 for example) until the next analysis is complete.

¹ These functions are used by service technicians to troubleshoot the instrument.

5.2.2 Alarm setup

This menu accesses two unpowered alarm relays (**AL1** and **AL2**), **RECALL WARNINGS**, and **CLEAR WARNINGS**. The alarm relays may be assigned to one of the alarm functions listed below. Only one function can be assigned to each relay.

- **LO**—Alarm is triggered if concentration is less than or equal to the trip point. (0.0 mg/L to 5.0 mg/L limits)
- **HI**— Alarm is triggered if concentration is greater than or equal to the trip point. (0.0 mg/L to 5.0 mg/L limits)
- **SYSTEM ALARM (SA)**—Activates an alarm when a system alarm occurs.
- **SYSTEM WARNING (SW)**—Activates an alarm when a system warning occurs.

In addition, alarm status can be obtained and alarms can be cleared using this menu.

The relay is activated when an alarm condition occurs. Either relay may be activated on a high chlorine alarm, a low chlorine alarm or when a System Warning or System Alarm occurs. Alarm relays can be used to control chemical feeds as an on/off control, by using them as a high or low alarm set point.

The two alarm relays can also be used to bracket a specific control range by adding a double-pole double-throw auxiliary relay and wiring it to electrically latch. This allows the pump to be turned on at a low level and off at a higher level—with the concentration dropping down in between.

Perform the procedure below to assign functions to AL1 or AL2:

1. Press the **MENU** key. **ALARMS** will be displayed.
2. Press **ENTER** to select **ALARMS**. The screen will display AL1 (or AL2), and either the alarm set point (HI or LO), SA (System Alarm), or SW (System Warning).
3. To change the AL1 (or AL2) assignment, press **ENTER** again. The item to be changed will flash. The arrow icons indicate active arrow keys. Scroll through the available assignments. Press the **RIGHT ARROW** key to change the value of the high or low alarm.
4. Press **ENTER** to select the displayed assignment.
5. Repeat the procedure to customize the other alarm relay.

In addition, a selection to recall or clear warnings is available. Access as follows:

1. Press the **MENU** key. **ALARMS** will be displayed.
 - a. Press **ENTER** to select **ALARMS**. The resulting screen will display AL1 (or AL2) along with the alarm set point (HI or LO), SA (System Alarm), or SW (System Warning).
2. Scroll through the options. When the appropriate option is displayed, press **ENTER**.
 - **RECALL WARNINGS**—Momentarily shows all active warnings then displays **DONE**.
 - **CLEAR WARNINGS**—Clears all resolved warnings then momentarily displays **OK**.
3. Press **EXIT** twice when done.

5.2.3 Set the recorder output span

This menu allows the Recorder Output High and Low limits to be set and also offers the capability to use the ON SYSTEM ALARM option to communicate an alarm condition. Use ON SYSTEM ALARM to send a signal to the control room using the recorder output, to drive any device being controlled to full off, or to maintain the present level if the analyzer goes into System Alarm status and shuts off.

The CL17 is supplied with the recorder output set at maximum range. At maximum range, a chlorine concentration of 0 mg/L provides an output of 4 mA and a concentration of 5 mg/L gives an output of 20 mA. The output span can be adjusted to bracket any portion of the 0–5 mg/L range with the 4–20mA signal. For instance, this function can be used to bracket a lower range for increased recorder resolution.

For example: if chlorine concentration of your sample is normally 0.5–0.7 mg/L, the recorder output span can be set for 0–1 mg/L (where 4 mA equals 0 mg/L and 20 mA equals 1 mg/L).

Alternatively, the output can be bracketed between 2–4 mg/L to control chemical feeds, or the signal can be inverted by assigning a higher mg/L reading for REC LO and a lower mg/L reading to REC HI.

Initially, select an output span that will cover the expected range of chlorine concentration in the sample. Determine the correct minimum and maximum values by monitoring chlorine values in your sample over time. Adjust the minimum and maximum values if necessary, to obtain the best span for your specific application.

Adjust the recorder output minimum and maximum values using the analyzer keypad:

1. Press the **MENU** key.
2. Scroll to **RECR DR** menu and press **ENTER**. The display will show **REC LO** and a mg/L reading. Move to **REC HI** or **ON SYSTEM ALARM**.
3. Press **ENTER** to change the displayed mg/L reading for **REC LO** or **REC HI**. The digit to be changed will flash.
4. Change the digit or move to another digit. Appropriate values and selections are shown below. When the value is correct, press **ENTER** to accept.
 - **REC LO**—0.0 mg/L to 5.0 mg/L limits.
 - **REC HI**— 0.0 mg/L to 5.0 mg/L limits.
 - **ON SYSTEM ALARM**—Select minimum, maximum, or hold to define the recorder output when a system alarm is initiated.
5. Press **EXIT** to return to the main menu. Press **EXIT** again to return to normal operation.

5.2.3.1 Change to 0 to 20 mA output range

Set the lower end of the output range to 0 mA instead of 4 mA as follows:

1. Press the **MENU** key then scroll to the **SETUP** menu. Press **ENTER**.
2. Scroll to **REC ADJUST** and press **ENTER**.

Note: A large number may be displayed for the minimum value, this number refers to counts, not milliamps. Proceed with step 4.

3. Adjust the displayed value to 0. Press **ENTER** to accept the value. Press **EXIT** twice to return to normal operation.

5.2.4 Maintenance menus

The following selections allow the user to perform standard maintenance tasks. Use the **ARROW** keys to scroll through the menu selections, then press **ENTER** to select the displayed menu option.

- **PRIME**—This feature causes the analyzer to make 39 concurrent accelerated cycles to prime the reagent lines. Press **ENTER** to activate. At the end of 39 cycles, the analyzer will return to normal operation. To terminate the prime cycle before all 39 cycles are complete, press **EXIT**. The analyzer will return to normal operation.
- **CLEAN**—This feature stops the analyzer in the last portion of the measurement cycle. Sample and reagents are left in the sample cell for cleaning purposes. The analyzer remains in the clean mode for 60 minutes. To terminate the cycle earlier, press the **EXIT** key. The analyzer will return to normal operation.
- **HOLD OUTPUTS**—This feature allows the alarms to be locked out and the recorder output to be held at its present level for maintenance purposes. Activate this feature as follows:
 - a. Press **ENTER** then the **UP ARROW** key to activate for 60 minutes. The alarm LED will be flashing.
 - b. To deactivate the feature, and return to normal operation, press the **MENU** key then the **DOWN ARROW** key until **HOLD OUTPUTS** is displayed.
 - c. Press **ENTER**.
 - d. Select **OFF** and press **ENTER** again.

5.3 Calibration

The CL17 Chlorine Analyzer is factory calibrated. A built-in electronic curve is preprogrammed into the instrument. **This instrument does not require recalibration unless specified by your regulatory agency for compliance reporting purposes.**

If you are required to do a two-point calibration or if your sample stream chlorine concentration is typically less than 0.5 mg/L, follow the instructions in [section 5.3.1](#). If your sample stream chlorine concentration is typically greater than 0.5 mg/L, you can perform a Calibration by Comparison as detailed in [section 5.3.2](#).

If the calibration you perform requires you to adjust the CAL ZERO by more than 0.2 mg/L, a SYSTEM WARNING caused by a MARGINAL ZERO error will appear. Similarly, adjusting the CAL STD by more than 10% (up or down) will produce a MARGINAL GAIN ERROR.

If either of these errors occur, reset the instrument to the default calibration (refer to [section 5.2](#)), check the standards, and repeat the calibration. If the error messages persist, contact the Customer Service department.

5.3.1 Calibration on known standards



CAUTION

Chemical exposure hazard. To familiarize yourself with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards. Protective eye wear is always recommended when contact with chemicals is possible.

This procedure provides the best over all accuracy by establishing the zero mg/L reference and the span setting. Perform the calibration as follows:

1. Prepare a zero chlorine reference solution by adding approximately 4 mL of Ferrous Ammonium Sulfate, Cat. No. 181133NC, to approximately 2 liters of the normal sample or chlorine-free demineralized water.

Note: Enter the zero value before the chlorine standard value.

2. Place a container of zero reference water above the analyzer with at least two feet of head. Plumb the system to enable the sample flow to be shut off so the zero reference water can enter the analyzer in its place. Allow the analyzer to run on zero reference water for approximately 10 minutes.
3. When the readings are stable, set the zero reference.
 - a. Enter the **SETUP** menu.
 - b. Press the **DOWN ARROW** key until **CAL ZERO** is displayed.
 - c. Press **ENTER** to display the current measured value.
 - d. Press **ENTER** to force the value to zero.
4. Prepare a chlorine standard solution with a value between 3 and 5 mg/L. Determine the value of the standard to the nearest 0.01 mg/L.
5. Remove the container of zero reference water and substitute the chlorine standard solution. Allow the analyzer to run on the standard solution for approximately 10 minutes.
6. When the readings are stable, enter the **SETUP** menu.
7. Press **ENTER** when **CAL STD** is displayed. The current measured value is displayed.

8. Press **ENTER** and edit the value. Press **ENTER** again to accept the value. The measured value will be forced to the entered value. Press the **EXIT** key three times to return to normal display mode.
9. Remove the standard and restore sample flow to the analyzer. The instrument is now calibrated.

5.3.2 Calibration by comparison

Note: Make sure sample chlorine concentration is relatively stable before taking a grab sample for laboratory analysis. Perform the laboratory analysis as quickly as possible.

Calibration by comparison involves analyzing the sample stream with a reliable, accurate laboratory method, such as a DPD spectrophotometric or amperometric titration method then setting the analyzer to match. Accuracy specifications over the full 0 to 5 mg/L range cannot be assured unless the sample chlorine concentration used for calibration is greater than 3.0 mg/L. Setting the calibration at a lower concentration may provide accuracy at that point but can cause large errors in other portions of the span.

Perform a calibration by comparison as follows:

1. When the sample chlorine concentration is relatively stable, obtain a grab sample for analysis.
2. Perform a laboratory analysis (DPD spectrophotometric or amperometric titration method) on the grab sample and record the value.
3. Enter the **SETUP**.
4. Press **ENTER** when **CAL STD** is displayed. The current measured value is displayed.
5. Press **ENTER** and edit the value to match the value from the laboratory analysis. Press **ENTER** again to accept the value. The measured value will be forced to the entered value.
6. Press the **EXIT** key three times to return to normal display mode.



DANGER

Multiple hazards. Only qualified personnel should conduct the tasks described in this section of the manual.



CAUTION

Chemical exposure hazard. To familiarize yourself with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs, and delivery systems that contain chemical reagents and standards. Protective eye wear is always recommended when contact with chemicals is possible.



6.1 Scheduled maintenance

6.1.1 Replenish the reagents

One 500-mL bottle each of buffer and indicator solution lasts approximately one month. Discard the old containers with any unused contents and install the new bottles as described in [section 4.1 on page 27](#).

6.1.2 Replace the pump tubing

Over a period of time, the clamping action of the pump/valve module will soften the tubing and cause it to collapse and obstruct liquid flow. This breakdown is accelerated at high temperatures. The following replacement schedules, based on ambient operating temperature, are recommended:

- Below 27 °C (80 °F), replace at six-month intervals.
- Above 27 °C, replace at three-month intervals.

Pump tube replacement procedure:

1. Shut off sample flow to the instrument and set the POWER (I/O) switch to OFF (O).
2. Remove the screws securing the pinch plate to the pump/valve module. Refer to [section 3.9 on page 24](#). Loosen in small increments, moving from one screw to the other to allow tension to be relieved evenly. Remove the plate.
3. Disconnect the pump tubes from the inlet and outlet fittings and discard the tube assemblies.
4. Cut four 2-inch lengths of 1/16-inch ID tubing (white). Install one 1/16-to 1/8-barb elbow fittings in one of the 1/16-inch ID tubes (white) and 1/16-inch barb union fittings in the three remaining tubes. Although one of the pump tubes is not used for fluid flow, it must be included to provide even compression on all four tubes.
5. Install the two screws through the pinch plate and into the pump/valve module. When securing the pinch plate, advance the screws in small increments moving from one screw to the other so that the plate is drawn down evenly. Tighten until snug, do not overtighten.
6. Set the POWER (I/O) switch to ON (I) and restore sample flow through the instrument. Allow the instrument to run for approximately one hour to fill the reagent lines.

6.1.3 Replace the analyzer tubing

Remaining tubing in the analyzer should be replaced annually.

The maintenance kit is available with the tubing harnesses assembled (5444301) or unassembled (5444300) If you have ordered the unassembled maintenance kit, use [Figure 21](#) and [Table 7](#) on page 41 to determine the tubing lengths and positions. When installing new tubing it is helpful to dip the ends in hot water before making the connections. It also is recommended that one tube at a time be removed and replaced.

Numbers on the illustration correspond to the item numbers listed in the legend where the size, catalog number, and quantity also are given. The length given in [Table 7](#) tells how long that particular tubing segment at a time should be; the operator must cut a piece to that length from a coil of the proper tubing.

The catalog number given for the tubing in the legend identifies the coil of tubing to cut the segment from and not the number of the segment itself.

DPD Reagent tubing may darken before the scheduled replacement time but that will not affect the performance of the instrument.

[Table 8](#) gives information about the air purge, case drain, sample drain, and sample-in specifications and locations. Refer to [Figure 21](#).

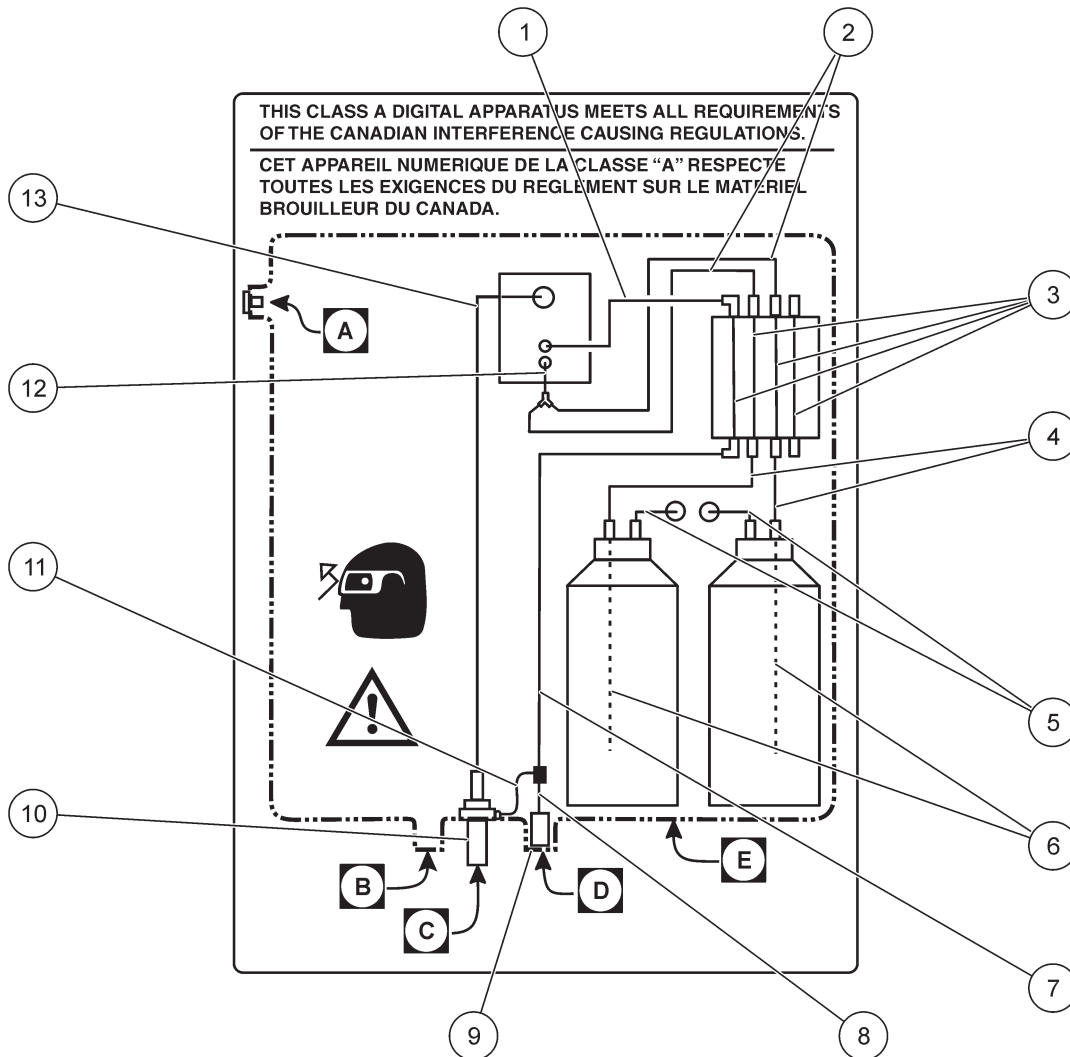


Figure 21 Plumbing diagram

Table 7 Replacement Tubing Lengths for Figure 21

Item	Description	Length (Qty)	From...	To...	Item Number
1	1/8" ID, 1/4" OD	4.5 inches (1)	Pump Body Out	Colorimeter	4329300
2	0.031" ID, 0.193" OD	7.0 inches (2)	Pump Body Out	Y-Fitting	4425300
3	1/16" ID, 3/32" OD	2.0 inches (4)	Pump Body In	Pump Body Out	4271700
4	0.062 ID, 0.125" OD	6.0 inches (2)	Reagent Bottle Cap	Pump Body In	4207600
5	0.062" ID, 0.125" OD	6.0 inches (2)	Reagent Bottle Cap	Reagent Vent Fitting	4207600
6	0.062" ID, 0.125" OD	7.0 inches (2)	Reagent Bottle Bottom	Reagent Bottle Cap	4552400
7	1/8" ID, 1/4" OD	7.0 inches (1)	Sample Bypass Tee	Pump Body In	4329300
8	1/8" ID, 1/4" OD	1.5 inches	Sample Bypass Tee	Sample Inlet Fitting	4329300
9	1/4" OD x 0.04 W, Black	varies (1)	Sample Conditioning Out	Case Fitting	3061600
10	1/2" ID	varies (1)	Instrument Drain	Customer Drain	(not supplied)
11	0.031" ID, 0.193" OD	3 inches	Sample Bypass Tee	Drain fitting	4425300
12	0.031" ID, 0.193" OD	1.0 inch (1)	Y-Fitting	Colorimeter	4425300
13	1/2" ID, 11/16" OD	12 inches	Colorimeter	Drain Fitting	5410800

Table 8 Drain, air purge, sample-in, and enclosure locations

A	Air purge, 0.01 CFM at 20 PSIG max, ¼ in. O.D. tube
B	Case drain, ½ in. I.D. tube
C	Sample drain, ½ in. I.D. tube
D	Sample in, 5 PSIG max, ¼ in. O.D. tube
E	Enclosure

6.2 Unscheduled maintenance

6.2.1 Fuse replacement

The T, 2.5A, 250V fuse used in this instrument is used for both 115V and 230V operation.

DANGER

Electrocution hazard. Remove power from the instrument when removing or installing a fuse.

DANGER

Fire hazard. For continued protection against fire, replace the fuse only with a fuse of the same type and rating.

Fuse replacement procedure:

1. Make sure there is no power supplied to the instrument. the instrument power switch does not remove power from the fuses, Power must be disconnected remotely to remove power from the fuses.
2. Remove the customer access cover.
3. Locate the fuse holders (near the terminal strip in the customer wiring compartment). Refer to [Figure 13 on page 22](#).
4. Remove the two fuses (F1 and F2) and replace them with two new fuses with the same specifications (T, 2.5A, 250V). Refer to [Parts and accessories on page 49](#).
5. Reinstall the customer access cover and resupply power.

6.2.2 Clean the instrument enclosure

With the enclosure securely latched, use a soft cloth and a mild detergent to wipe the outside of the enclosure. Do not allow moisture to enter the enclosure.

6.2.3 Clean the colorimeter

The colorimeter measuring cell may collect sediment or develop a film growth on the inside walls. Cleaning with an acid solution and a cotton swab on a monthly basis is recommended. Depending on sample conditions, it may be necessary to clean the cell more often.



CAUTION

Chemical exposure hazard. The chemicals used in this procedure may be hazardous if inappropriately handled or accidentally misused. Please read all warnings on the reagent labels. Protective eye wear is always recommended when contact with chemicals is possible.

Colorimeter cell cleaning procedure:

1. Press the **MENU** key, then press the down **ARROW** key until the **MAINT** menu appears. Press **ENTER**.
2. Press the down **ARROW** key to scroll to the **CLEAN** option. Press **ENTER**.
3. Refer to [Figure 22](#) and locate the colorimeter.
4. Remove the rubber plug on the top of the colorimeter assembly.
5. Remove the magnetic stir bar using a bent steel paper clip as a retrieval tool. Refer to [Figure 22](#).
6. Wait until **CLEAN** flashes on the status line of the display, then fill the colorimeter with 19.2 N Sulfuric Acid Standard Solution (203832).

Note: Lower normality sulfuric acid will NOT be sufficient for cleaning the colorimeter.

7. Allow the sulfuric acid to stand in the colorimeter for 15 minutes.
8. Insert a wooden or paper cotton-tipped swab* into the opening and move it up and down with a gentle scrubbing action, cleaning the interior surfaces of the colorimeter cell. Clean the stir bar with the cotton swab ([Figure 23](#)).
9. Install the stir bar.
10. Replace the rubber plug on the top of the colorimeter assembly and make sure the cover is on the viewing port of the colorimeter.
11. Press the **EXIT** key to immediately return to normal operation; the instrument will return to normal operation automatically after 60 minutes.

*Do not use a plastic swab when cleaning the colorimeter with sulfuric acid. The acid will dissolve the plastic.

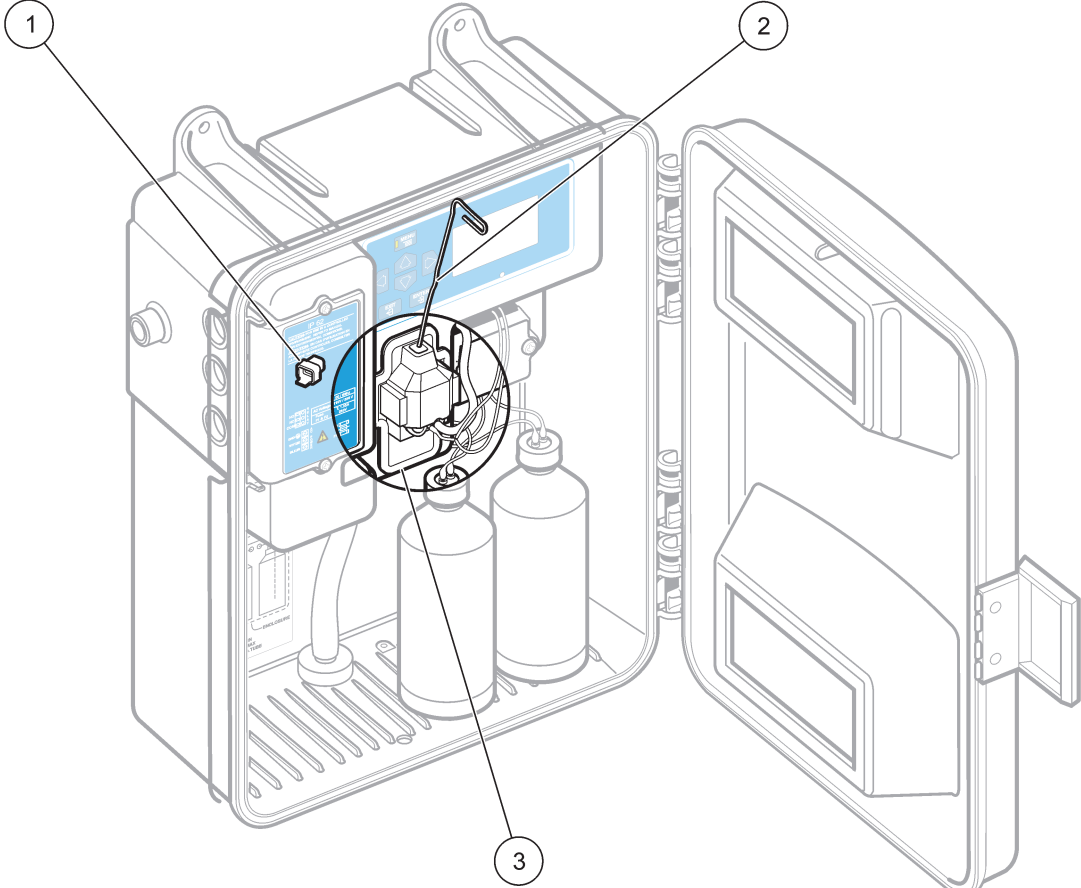


Figure 22 Removing the stir bar

1 Remove the plug from the top hole of the colorimeter.	3 Colorimeter assembly
2 Gently insert a straightened paper clip into the hole at the top of the colorimeter and slowly pull out the stir bar.	

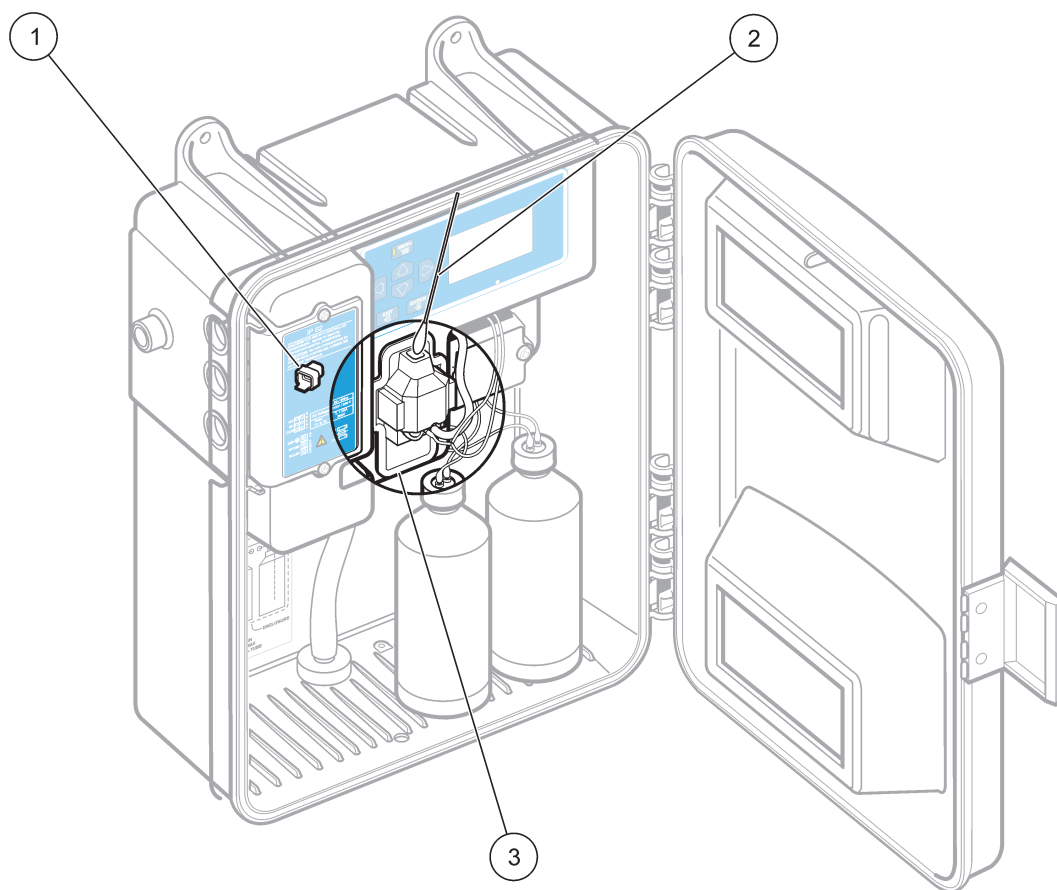


Figure 23 Cleaning the colorimeter

1 Remove the plug from the top hole of the colorimeter	3 Colorimeter assembly
2 Gently scrub the inside of the colorimeter with a cotton-tipped swab	

6.2.4 Replace the sample conditioning filter

To insert the filter into the housing:

1. Isolate the filter by turning the valves on each side to OFF.
2. Unscrew the top of the filter housing. Refer to [Figure 7 on page 16](#).
3. Insert the filter element and push until it stays in place.
4. Replace the filter housing top.

6.2.5 Reagent spill clean up

Wipe up spills with a clean, disposable wipe and discard according to applicable Federal, State, and Local regulations.

Section 7 Troubleshooting

In the event the instrument should malfunction, the following troubleshooting guide may be used to help isolate the problem. Please contact the nearest Service Center for assistance or shipping instructions if the instrument must be returned.

7.1 Troubleshooting guide

Table 9 supplies troubleshooting information for the instrument. After determining the symptom and probable cause, perform the corrective action steps in the order given.

Table 9 Troubleshooting guide

Symptom	Probable Cause	Corrective Action
Display does not light and the pump motor is not operating	No operating power	Check power switch position, fuses, and power cord connections.
Display does not light and the pump motor operates.	Problem with power supply	Replace the main circuit board.
Display lights and the pump motor does not operate.	Low operating power	Verify the line voltage is within specifications.
	Incorrect line voltage selector switch setting	Check the line voltage selector switch position.
	Motor cable not connected to the circuit board	Check the motor cable connection.
	Defective motor	Replace motor.
Zero reading	No Stir Bar	Place Stir Bar into Colorimeter
	Pinch Plate thumb screws are not fully tightened.	Tighten the thumb screws.
	Sample is not flowing to the instrument.	Check the sample conditioning and other sample supply lines.
	More than one stir bar	Remove the plug from the top of the colorimeter and use a flashlight to illuminate the inside of the cell. Look into the colorimeter to determine if more than one stir bar is inside. Remove excess stir bars.
Sample is overflowing from the colorimeter	Drain line clogged or air lock in drain line	Clean drain line and/or eliminate air lock from drain plumbing.
Excessive moisture is condensing on the colorimeter	Temperature differential between sample and analyzer environment is too large.	When practical, allow the sample temperature to warm to room temperature before it enters the analyzer.
Low reading	Clogged tubing	Replace the tubing

7.2 System alarms

An alarm message is displayed and the instrument ceases to function normally when a System Alarm is activated. Resolve the alarm to resume normal operation.

Table 10 System alarms

Alarm	What the Alarm Indicates	Alarm Display and Instrument Indication	Resolution
EE Error	Inability to write to the EE ROM	EE ERROR	Press the EXIT key to restart the instrument. If the problem recurs, the main circuit board may need to be replaced. Call Hach Service.
A2D Error	Reference measurement = 0 A/D counts Indicates that the colorimeter is reading zero light throughput. So it is likely the photo detector/analog to digital converter is faulty.	A/D ERROR - EXIT TO RESTART Alarm LED is lit	Press the EXIT key to restart the instrument. If the problem recurs, there is a problem with the colorimeter. The connector between the instrument and the colorimeter may not be making a proper connection. Remove the colorimeter, inspect the connector pins and straighten the pins if necessary. Reinstall the colorimeter. If the problem remains, replace the colorimeter.
LED Failure	The colorimeter's photo detector is reading an extremely low level of light for the reference reading (less than 100 A/D counts).	LED ERROR - EXIT TO RESTART Alarm LED is lit	Press the EXIT key to restart the instrument. If the problem recurs clean the sample cell. If the problem is not yet resolved, remove the plug from the colorimeter's sample viewing port. You should be able to observe a white light. (You must wait several minutes from instrument turn on for the light to come on.) It will remain on continuously thereafter. If the light does not come on and the colorimeter has just been removed and re-inserted, the colorimeter connector is not making a proper connection. Remove the colorimeter and inspect the connector pins. If the pins are bent, straighten them and reinsert the colorimeter. If the problem still remains, replace the colorimeter. Contact Hach Service.
Motor Failure	Indicates that the pump motor's home position flag was not detected.	MOTOR ERROR - EXIT TO RESTART Alarm LED is lit	Press the EXIT key to restart the instrument. If the problem recurs, check the following. If the motor does not turn when the instrument is turned on, try the following: <ol style="list-style-type: none"> 1 Check that the motor is plugged into the main circuit board. 2 Replace the motor. 3 Replace the main circuit board. If the motor does run and the motor coupler is turning, try the following: <ol style="list-style-type: none"> 1 Check that the optical switch is properly plugged into the main circuit board and the switch is properly located in the chassis. 2 Replace the optical switch. 3 Replace the main circuit board.
SCR Error	The Cycle Motor does not turn off at the appropriate time, resulting in a short total cycle time.	SCR ERROR - EXIT TO RESTART Alarm LED is lit	Press the EXIT key to restart the instrument. If the problem recurs, replace the main circuit board.

7.3 Sensor warnings

To view the sensor warnings, use the **RECALL WARNINGS** function in the alarm menu. To clear the warnings use the **CLEAR WARNINGS** function in the alarm menu.

Table 11 Sensor warnings

Warning	What the Alarm Indicates	Alarm Display and Instrument Indication	Resolution
POWER	Power failed. In default condition, this warning is disabled.	POWER	Inspect wiring and circuit breakers that deliver power to the CL17.
Low Signal	Reference measurement is less than 2000 A/D counts.	LOWSIG	Clean sample cell Replace sample cell
Marginal Gain	A calibration resulted in a gain correction factor greater than 1.1 or less than 0.9. The calibration standard and the value that the operator is attempting to input do not match. Re-test the calibration standard and perform a new calibration on the CL17.	MARG G	Set CAL Defaults. Verify standard value. Recalibrate the instrument.
Marginal Zero	A calibration resulted in an offset correction factor greater than 0.2 and less than 0.5.	MARG Z	Set CAL Defaults. Verify zero value. Recalibrate the instrument.
Marginal Offset	A high offset count was measured with the LED off. Usually caused by light leaks.	MARG 0	Verify the colorimeter end caps are firmly screwed in place. Check for light leaks.

Section 8 Parts and accessories

Description	Quantity	Item Number
Circuit Board Assembly, main	each	5440400
Colorimeter Module	each	6867000
Colorimeter Plug	each	6868500
Connector for Alarm or Recorder	each	4458200
Cam/Coupler Assembly	each	5445200
Follower Block, Reagent	each	4274100
Follower Block Sample	each	4274200
Fuse, (T, 2.5 A, 250V) UL/CSA/CE accepted, 2 needed	each	4952600
Installation Kit	each	5516400
Maintenance Kit	each	5444300
Maintenance Kit, preassembled	each	5444301
Motor Assembly	each	5444600
Optical switch assembly	1	5410700
Pressure Plate	each	5411800
Screen, 40-mesh, Replacement for Sample Conditioning	each	5418400
Stir Bar, Micro	each	6865600
Thumb Screw, to hold Pressure Plate	2	5410100
Optional Accessories		
Flow Meter with 1/4-inch OD tubing	each	4643600
Power Cord kit with strain relief, 115V, North American Operation	each	5448800
Power Cord Kit with strain relief, 240V, European Operation	each	5448900
Reagents		
Sulfuric Acid, 19.2 N	100 mL	203832
Ferrous Ammonium Sulfate, 0.250 N	29 mL	181133NC
Reagent Kit for Free Chlorine Testing	each	2556900
Includes:		
Free Chlorine Buffer Solution	—	8867711
Free Chlorine Indicator Solution	—	2314011
DPD Indicator Powder	—	2297255
Reagent Kit for Total Chlorine Testing	each	2557000
Includes:		
Total Chlorine Buffer Solution	—	2263511
Total Chlorine Indicator Solution	—	2263411
DPD Indicator Powder	—	2297255
6" cotton cleaning swabs	pkg	2554300

Section 9 Certification

9.1 FCC PART 15, Class "A" Limits

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the CL17 Chlorine Analyzer from its power source to verify that it is or is not the source of the interference.
2. If the CL17 Chlorine Analyzer is connected into the same outlet as the device with which it is interfering, try another outlet.
3. Move the CL17 Chlorine Analyzer away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

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