



Catalog Number 6010018

# **1720E Low Range Turbidimeter**

USER MANUAL

04/2016, Edition 8



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# Section 1 Specifications

Specifications are subject to change without notice.

**Table 1 1720E Low Range Specifications**

<b>Range</b>	0–100 nephelometric turbidity units (NTU)			
<b>Measurement Units</b>	mg/L, NTU, TE/F, FTU, Degree			
<b>Accuracy<sup>1</sup></b>	± 2% of reading or ± 0.02 NTU (whichever is greater) from 0 to 40 NTU; ± 5% of reading from 40 to 100 NTU (when calibration is performed at 20.0 NTU with the offset turned off).			
<b>Linearity<sup>1</sup></b>	Better than 1% 0–40 NTU on formazin. Allows for accurate calibration at high turbidity values.			
<b>Resolution (Displayed)</b>	0.0001 NTU up to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU; 0.01 NTU at 100.00 NTU			
<b>Repeatability</b>	Better than ±1.0% of reading or ±0.002 NTU, whichever is greater			
<b>Response Time</b>	For a full-scale step change, initial response in 1 minute, 15 seconds. Varies with flow rate, see the table below. The response time is also dependent on the signal averaging time, which is user selectable.			
	<b>% Step Change</b>	<b>Flow Rate</b>		
		<b>750</b>	<b>500</b>	<b>250</b>
	10	1¼ minutes	1½ minutes	2½ minutes
	50	2 minutes	2½ minutes	6 minutes
90	3½ minutes	3½ minutes	9 minutes	
99	4 minutes	5 minutes	12 minutes	
<b>Sample Flow Required</b>	250 to 750 mL/minute			
<b>Storage Temperature</b>	–20 to 60 °C (–4 to 140 °F)			
<b>Operating Temperature</b>	0 to 50 °C (32–122 °F) for single sensor system, 0 to 40 °C (32–104 °F) for two sensor system			
<b>Sample Temperature Range</b>	0 to 50 °C			
<b>Operating Humidity</b>	5 to 95% non-condensing			
<b>Power Requirements</b>	12 VDC ± 5%, 12.5 Watts maximum			
<b>Sample Inlet Fitting</b>	1/8 barb fitting to ¼-inch NPT male adapter			
<b>Signal Average Time</b>	no averaging, 6, 30, 60, and 90 seconds, user selectable. Default is 30 seconds.			
<b>Dimensions</b>	Turbidimeter body and cap: 25.4 x 30.5 x 40.6 cm (10 x 12 x 16 inches)			
<b>Sensor Cable Length</b>	1.8 m (5.9 ft); optional 7.62 m (25 ft)			
<b>Mounting Options</b>	Turbidimeter Body and Head Assembly: Wall; floor stand			
<b>Shipping Weight</b>	1720E Series 2 Turbidimeter and Controller: 6.31 kg (13.5 lb); 1720E Turbidimeter only: 4.71 kg (10 lb)			
<b>Calibration Methods</b>	<ol style="list-style-type: none"> <li>1. StablCal® (stabilized formazin) – primary or wet calibration of the instrument. Recommended at 20.0 NTU.</li> <li>2. Formazin – user-prepared primary or wet calibration of the instrument. Recommended at 20.0 NTU.</li> <li>3. Multi-sensor calibration – Performed with a specialized calibration procedure for up to eight sensors on a single set of fresh StablCal® standards.</li> </ol>			

**Table 1 1720E Low Range Specifications (continued)**

<b>Verification (Wet) Method</b>	<ol style="list-style-type: none"><li>1. StablCal® (stabilized formazin) – recommended for verification in the appropriate application range of measurement. For regulatory verification, standards of 0.1 to 50 NTU.</li><li>2. Formazin – fresh user-prepared standard</li></ol>
<b>Verification (Dry) Method</b>	<ol style="list-style-type: none"><li>1. ICE-PIC™ Verification Module with factory-set values of 20.0 or 1.0 ±25%. Unique value is assigned when dry verification is done immediately after calibration and is used as pass/fail criteria for subsequent verifications.</li></ol>
<b>Recommended Maintenance</b>	<ol style="list-style-type: none"><li>1. Lamp replacement: once per year.</li><li>2. Cleaning: mandatory before calibration, optional before calibration, and mandatory upon verification failure.</li></ol>
<b>Installation Environment</b>	Indoor
<b>Primary Compliance Method</b>	USEPA 180.1; Hach Method 8195; ASTM D 6698; Standard Methods 2130B
<b>Limit of Detection<sup>1</sup></b>	0.0032 NTU (according to criteria specified by ISO 15839)

<sup>1</sup> All specifications are based on a calibration with 20.0 NTU formazin and with the offset turned off.

# Section 2 General Information

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## 2.1 Safety Information

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.

To ensure 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, could result in death or serious injury.*

**CAUTION**

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

**Important Note:** *Information that requires special emphasis.*

**Note:** *Information that supplements points in the main text.*

### 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.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).

### 2.1.3 General Product Information

The 1720E Turbidimeter is a continuous-reading nephelometric turbidimeter designed for low-range turbidity monitoring. This process turbidimeter is capable of measuring turbidity from 0.001 to 100.0 NTU. Calibration is based on formazin, the primary turbidity reference standard adopted by the APHA *Standard Methods for the Examination of Water and Wastewater* and the U.S. Environmental Protection Agency (EPA) and on StablCal® which is also recognized as a primary standard.

The 1720E Turbidimeter can be operated using an sc controller. Refer to the Operation section ([Section 5 on page 15](#)) for more information.

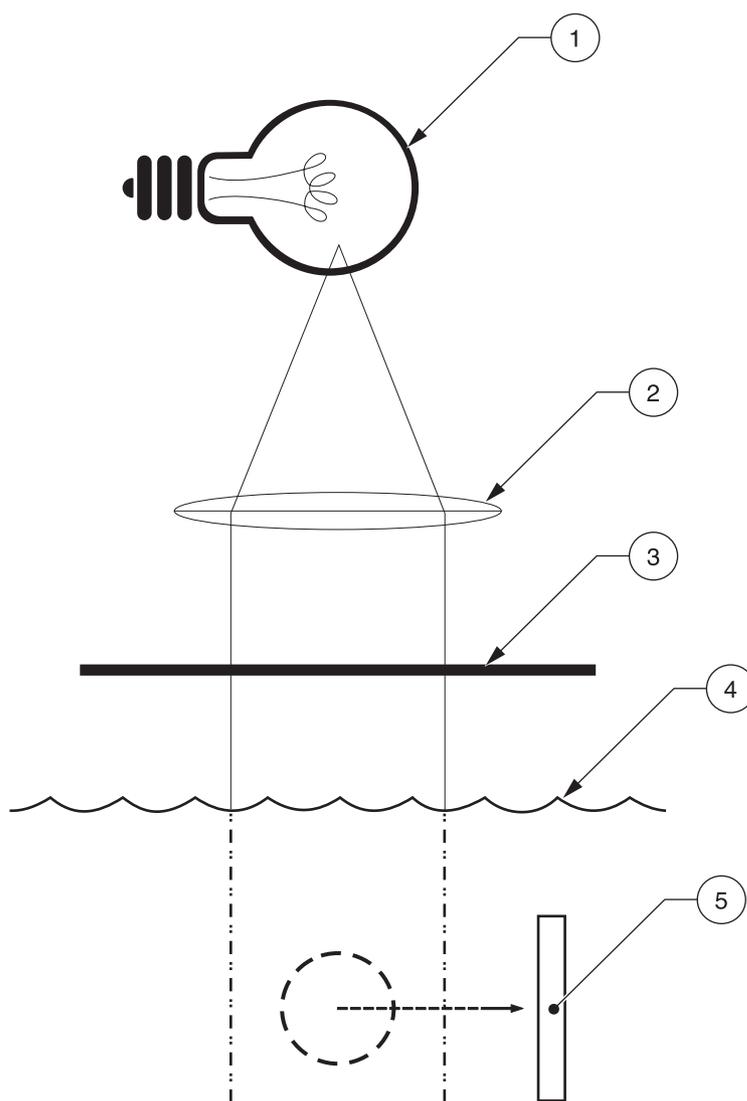
## 2.2 Theory of Operation

The 1720E Turbidimeter measures turbidity by directing a strong beam of collimated light from the sensor head assembly down into the sample in the turbidimeter body. Light scattered at 90° relative to the center line of incident light by suspended particles in the sample is detected by the submerged photocell (Figure 1).

The amount of light scattered is proportional to the turbidity of the sample. If the turbidity of the sample is negligible, little light will be scattered and detected by the photocell and the turbidity reading will be low. High turbidity, on the other hand, will cause a high level of light scattering and result in a high reading.

Sample enters the turbidimeter body and flows through the baffle network of the bubble trap. The flow allows bubbles to either cling to surfaces of the baffle system or rise to the surface and vent to atmosphere. After traveling through the bubble trap, sample enters the center column of the turbidimeter body, rises into the measuring chamber and spills over the weir into the drain port. A reading is taken once per second.

Figure 1 90 Degree Detector



1. Lamp	3. Aperture	5. 90° Detector
2. Lens	4. Water Level	

## Section 3 Installation

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### **DANGER**

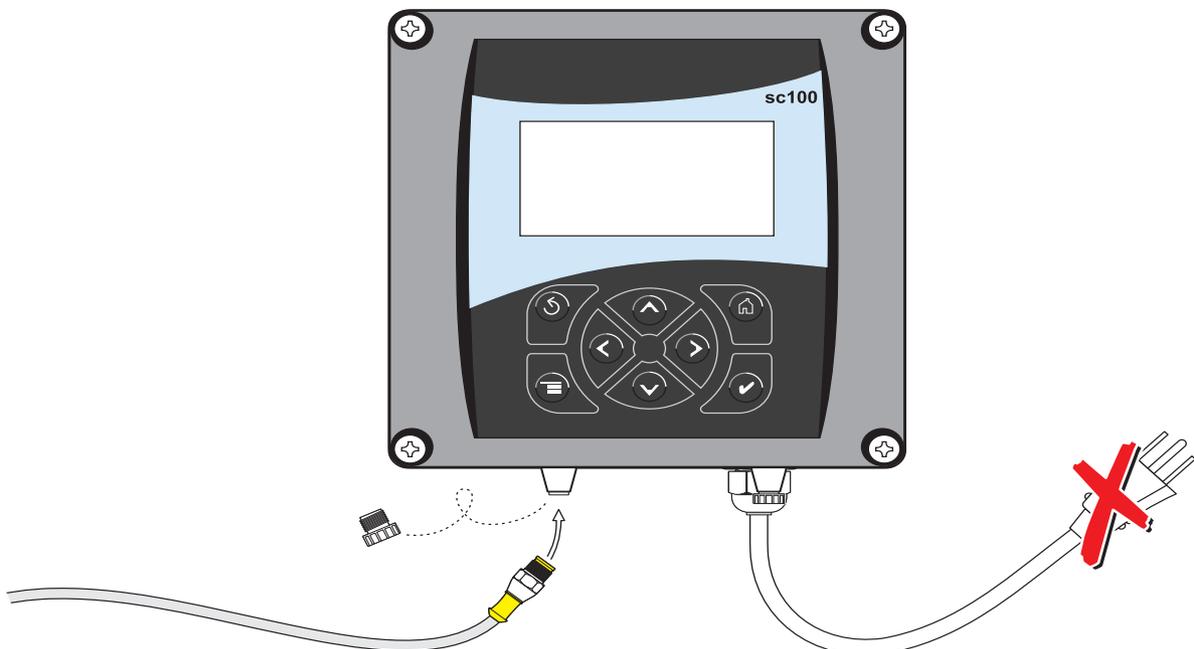
*Only qualified personnel should conduct the tasks described in this section of the manual. The 1720E/sc100 product configuration is not intended for installation in hazardous locations.*

## 3.1 Connecting/Wiring the Sensor to the sc100 Controller

### 3.1.1 Attaching a sc Sensor with a Quick-connect Fitting

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller, see [Figure 2](#). Retain the connector cap to seal the connector opening in case the sensor must be removed. The 1720E sensor cable may be extended by a maximum of 7.62 m (25 ft), see [Replacement Parts and Accessories on page 31](#).

**Figure 2** Attaching the Sensor using the Quick-connect Fitting



## 3.1.2 Hard-wiring a sc Sensor to the sc100 Controller

1. Disconnect power to the controller if powered.
2. Open the controller cover.
3. Disconnect and remove the existing wires between the quick-connect and terminal strip J5, see [Figure 3](#).
4. Remove the quick-connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.
5. Cut the connector from the sensor cable.
6. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.
7. Pass the cable through conduit and a conduit hub or a strain relief fitting (Cat. No. 16664) and an available access hole in the controller enclosure. Tighten the fitting.

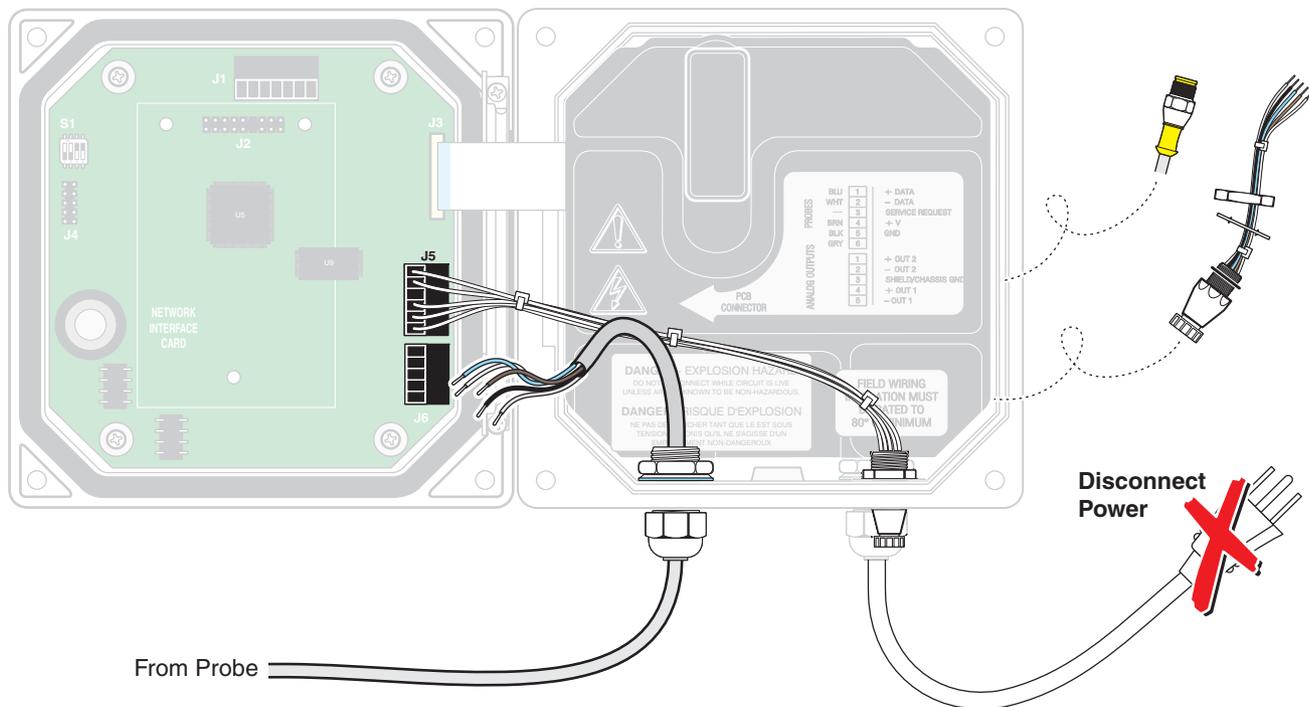
**Note:** Use of strain relief fitting other than Cat. No. 16664 may result in a hazard. Use only the recommended strain relief fitting.

8. Reinstall the plug on the sensor access opening to maintain the environmental rating.
9. Wire as shown in [Table 2](#) and [Figure 3](#).
10. Close and secure the cover.

**Table 2 Wiring the Sensor at Terminal Block J5**

Terminal Number	Terminal Designation	Wire Color
1	Data (+)	Blue
2	Data (-)	White
3	Service Request	No Connection
4	+12 V dc	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick disconnect fitting)

Figure 3 Hard-wiring the Sensor



### 3.2 Connecting the Sensor to the sc1000 Controller

#### 3.2.1 Connecting the Sensor using the Quick-connect Fittings

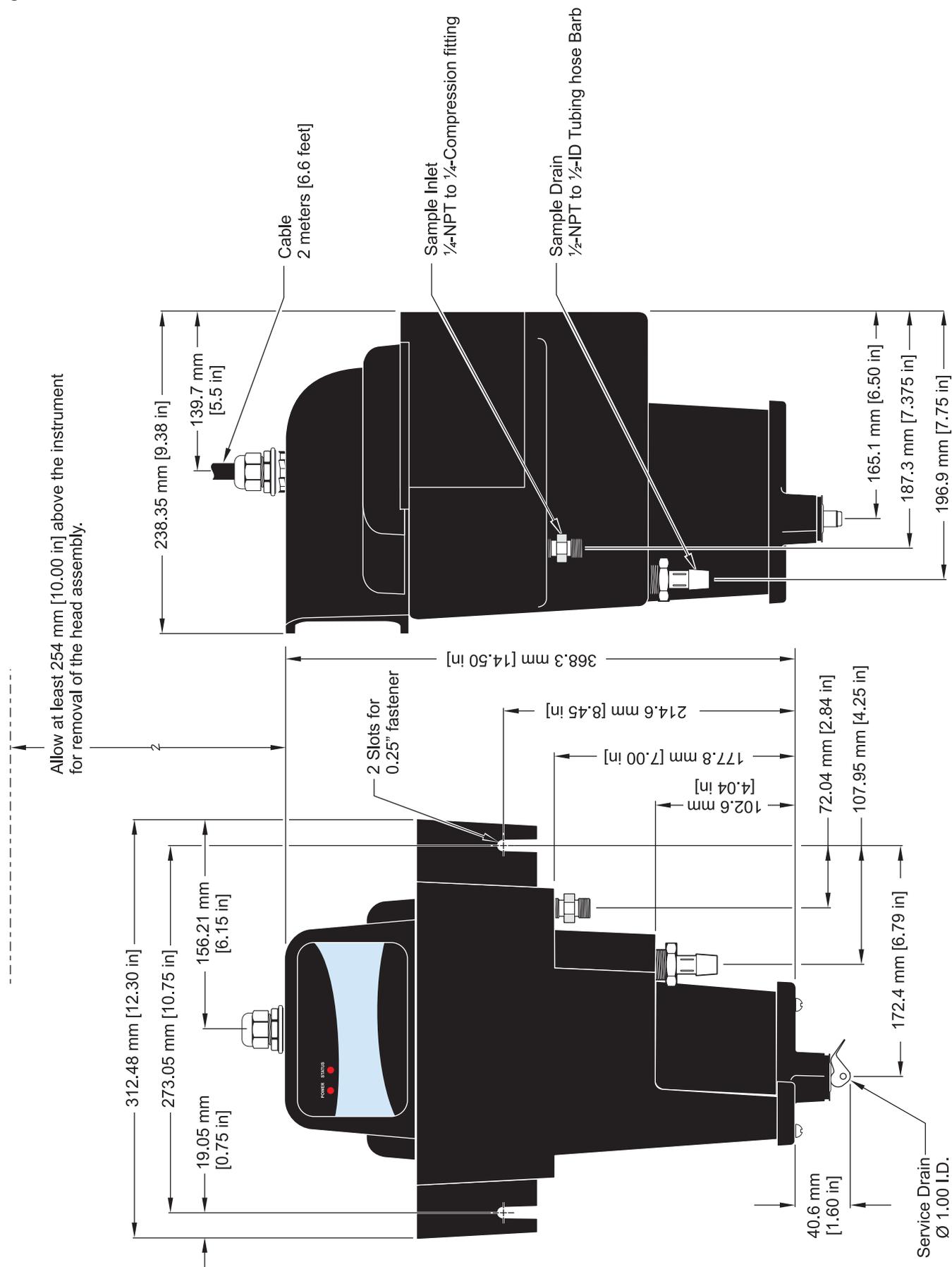
1. Unscrew the connector cap from the controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.
2. Push the connector into the socket.
3. Hand-tighten the union nut.

*Note: Do not use the middle connection for the sensors as this is reserved for the display module.*

### 3.3 Turbidimeter Installation Information

The turbidimeter body is designed for wall-mounting (although it may be mounted on the optional floor stand). The turbidimeter sensor must be mounted within six feet of the controller unless an extension cable is used. Maximum cable length is 9.6 m (31 feet).

Figure 4 1720E Dimensions



### 3.3.1 Mounting the Turbidimeter Body

Locate the turbidimeter as close to the sampling point as possible. A shorter distance for the sample to travel results in a faster response time.

Clean the turbidimeter body and bubble trap before installation using the instructions supplied in [section 6.4.2 on page 24](#). Slotted mounting brackets are integral parts of the turbidimeter body. Install customer-supplied hardware appropriate for the installation environment using the criteria detailed below:

- Install in a location that is isolated from vibration.
- Allow at least 22 cm (approximately 10 inches) clearance for removal of the head assembly and bubble trap cover from the top of the turbidimeter body.
- Leave enough room below the turbidimeter body to remove the bottom plug and to place a container under the drain when calibrating or cleaning.

**Note:** Make sure the top of the turbidimeter body is level.

- Install two ¼-20 bolts 10-¾ inches apart (on center). Leave at least ¼-inch of the bolt head exposed.
- Make sure the bolts are installed level.

Slide the slotted mounting brackets of the turbidimeter body onto the bolts.

### 3.3.2 Installing the Head Assembly

After the turbidimeter body has been mounted, install the bubble trap cover, then place the head assembly on the turbidimeter body with the label facing the front. Move the head assembly back and forth slightly to ensure it is properly seated on the body of the instrument. Failure to properly seat the head will result in light leakage and erroneous readings.

The rear portion of the head assembly has a molded “lip” which may be used to hang the head assembly on the turbidimeter body edge for routine maintenance.

## 3.4 Installing a Sample Line

### **DANGER**

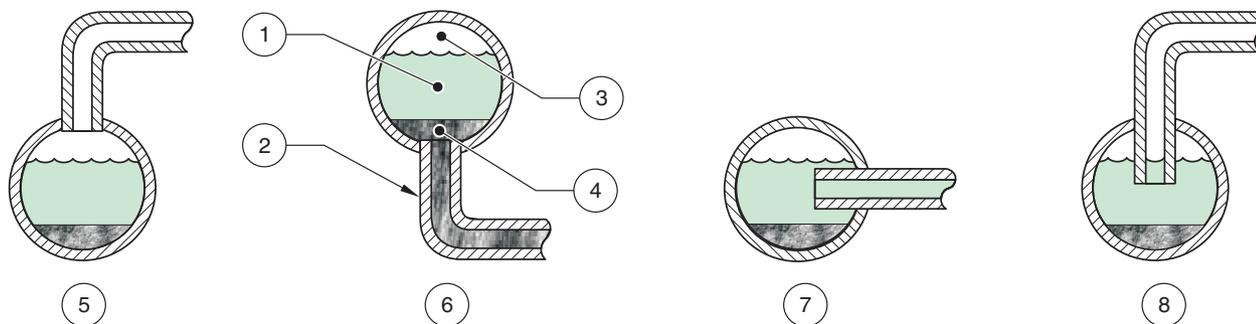
***This turbidimeter is not designed for use in hazardous locations or with samples that are flammable or explosive in nature. If any sample solution other than water is used in this product, test the sample/product compatibility to ensure user safety and proper product performance.***

One-fourth inch OD rigid or semi-rigid tubing is recommended for sample lines. Run them as directly as possible between the turbidimeter body and the sampling point to minimize sample flow lag time.

Install sample line taps into larger process pipes to minimize interference from air bubbles or pipeline bottom sediment. A tap projecting into the center of the pipe is ideal. [Figure 5](#) shows examples of sample tap installations.

**Note:** When setting the flow rate, take care to avoid sweeping air “micro-bubbles” through the internal bubble trap. Observe the sample flow inside the turbidimeter body. If small air bubbles can be seen flowing up through the center, reduce the flow rate.

**Figure 5 Sampling Techniques**



1. Sample Flow	4. Sediment (Typical)	7. Good
2. Sampling Line to Sensor	5. Poor	8. Best
3. Air (Typical)	6. Poor	

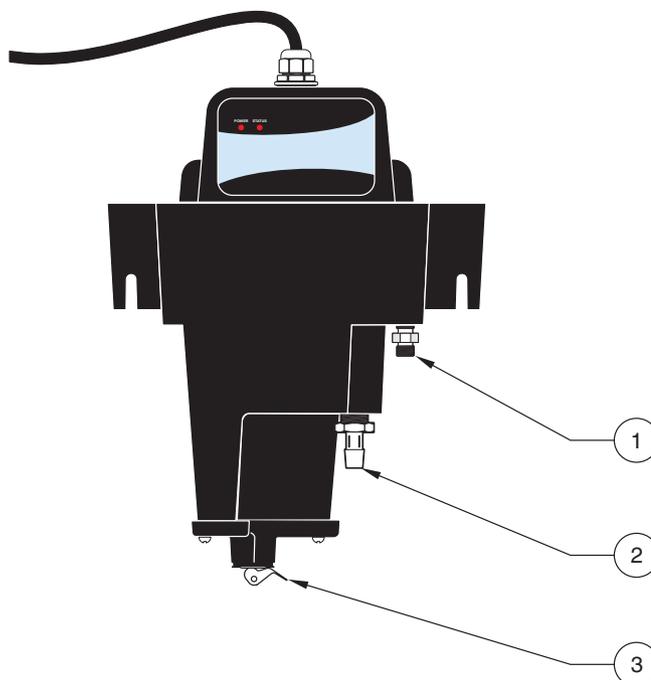
## 3.5 Sample Connections

Sample inlet and drain connections are made on the turbidimeter body. The sample inlet fitting installed in the body is a ¼-inch NPT x ¼-inch compression fitting. One additional fitting supplied with the instrument is a ½-inch NPT-to-hose fitting for use with ½-inch ID flexible plastic tubing on the drain.

**Note:** For samples with high solids content (high turbidity), operate at the highest flow rate possible. For samples with low solids content (low expected turbidity), operate at a low flow rate (200–300 mL/min).

The required flow rate is 200 to 750 mL/min (4.0 to 11.9 gal/hour). Flow rate into the turbidimeter may be controlled with a flow restriction device on the inlet line. Flow rates below 200 mL/min will reduce response time and cause inaccurate readings. Flow rates above 750 mL/min will cause the turbidimeter to overflow, indicating flow rate is too high.

**Figure 6 Sample Connections**



1. Sample Inlet, ¼-28 NPT x ¼-inch Compression fitting	2. Drain, ½-inch NPT fitting	3. Service Drain
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## Section 4 System Startup

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### 4.1 General Operation

Plug the sensor into the unpowered controller by aligning the orientation tab on the cable connector with the channel in the controller connector. Push in and turn to secure the connection. Tug gently to check the connection.

After all plumbing and electrical connections have been completed and checked, place the head on the body and supply power to the system. Ensure the head is seated on the body when power is applied, since dark readings are measured at this time. If power is applied while the sensor head is off the turbidimeter body, cycle the power with the sensor head on the body.

The first time a controller is powered up, a language selection menu will appear. The user must select the correct language from the displayed options.

Following language selection and upon power-up, the controller will search for connected sensors. The display will show the main measurement screen.

### 4.2 Starting Sample Flow

Start sample flow through the instrument by opening the sample supply valve. Allow the turbidimeter to run long enough for the tubing and body to become completely wetted and the reading on the display to stabilize. One to two hours or longer may be required initially for complete stabilization. Allow measurements to become stable through adequate conditioning before completing instrument settings or performing calibrations.



# Section 5 Operation

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## 5.1 Sensor Setup

When a sensor is initially installed, the serial number of the sensor will be displayed as the sensor name. To change the sensor name refer to the following instructions:

1. Select Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Highlight the appropriate sensor if more than one sensor is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu.

## 5.2 Sensor Data Logging

The sc100 provides two data logs (one for each sensor) and two event logs (one for each sensor). The data logs store the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, and warning conditions. The data logs are stored in a packed binary format and the event logs are stored in a CSV format. The logs can be downloaded through the digital network port, service port, or the IrDA port. DataCom is needed for downloading logs to a computer. If the datalogging frequency is set to 15 minute intervals, the instrument can continue to store data for approximately six months.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select CONFIGURE and confirm.
3. Select the datalog interval (30 seconds, 1 minute, 5 minutes, 10 minutes or 15 minutes). Confirm.

## 5.3 Sensor Diagnostics Menu

SELECT SENSOR	
ERROR LIST	See <a href="#">section 7.1 on page 27</a> .
WARNING LIST	See <a href="#">section 7.2 on page 27</a> .

## 5.4 Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)	
<b>CALIBRATE</b>	
USER PREPD CAL	Calibration using 4000 NTU stock solution diluted to 20.00 NTU formazin.
STABLCAL CAL	Calibration using 20 NTU StablCal Stabilized Formazin Standard
VERIFICATION	Perform a verification, set the pass/fail criteria, and view the verification history.
0 ELECTRONICS	Zero electronics
CAL HISTORY	View the last 12 entered calibrations. Confirm to move to the next history entry. See <a href="#">section 5.6 on page 20</a> for more information.
<b>CONFIGURE</b>	
BUBBLE REJECT	Choose Yes or No to enable/disable bubble reject. Default: Yes
SIGNAL AVG	Choose no averaging or specify the amount of time for signal averaging. Available options are: no averaging, 6 sec., 30 sec., 60 sec., or 90 sec. Default is 30 seconds.
MEAS UNITS	Select the appropriate measurement units to display. Choose from mg/L, NTU, TE/F, FTU and Degree. Default: NTU
EDIT NAME	Enter up to a 12-digit name in any combination of symbols and alpha or numeric characters. Confirm when the entry is complete. The name will be displayed on the status line above the measurement value on the main display.
SET RESOLUTION	Set the number of significant digits to display. Default is three significant digits.
DATALOG INTRVL	Choose the amount of time between saving data points to the data log. Default: 15 min.; Options: 30 sec., 1 minute, 5 minutes, 10 minutes, or 15 minutes.
OFFSET	Enter an offset between -0.05 to 0.05 NTU. Values outside this range are not accepted.
<b>DIAG/TEST</b>	
SOFTWARE VERS.	Displays the software version number.
SERIAL NUMBER	Displays the serial number of the sensor.
INT TEMP	Displays the internal temperature of the sensor electronics in °C.
DEFAULT SETUP	Restores the sensor's factory default settings and invalidates the current calibration.
POWER CHECK	Displays the electrical statistics for the sensor.
SERVICE MODE	Choose On or Off to enable/disable service mode. Default: Off
SERVICE DIAGS	Passcode protected. Menu options only available to service personnel.

## 5.5 Sensor Calibration and Verification

The manufacturer offers two EPA-approved calibration methods one using user-prepared formazin and the other using StablCal® Stabilized Formazin. Two verification methods (wet and dry) are also offered.

The 1720E Turbidimeter is factory-calibrated using StablCal Stabilized Formazin before shipment. **The instrument must be recalibrated before use to meet published accuracy specifications.** In addition, recalibration is recommended after any significant maintenance or repair and at least once every three months during normal operation. **The turbidimeter body and bubble trap must be thoroughly cleaned and rinsed before initial use and prior to each calibration.**

### Tips to achieve the most accurate calibrations:

- Optimum performance is achieved when calibration is performed in the turbidimeter body. Accurately prepare the standard then add it to the turbidimeter body at the appropriate step in the procedure. Do not prepare the standard in the body.

- Stop sample flow, drain, and clean the turbidimeter body before beginning the calibration procedure.
- Always clean the photocell window per the instructions in [section 6.4.1 on page 24](#). Rinse the photocell with deionized water and dry with a soft, lint-free cloth before calibrating.
- Always clean the turbidimeter body or calibration cylinder per the instructions in [section 6.4.2 on page 24](#). Rinse with deionized water before calibrating.
- Store the calibration cylinder upside-down to minimize contamination between calibrations.
- Pour the calibration standard into the turbidimeter body at the inflow end (left side when facing the instrument).
- Gently invert StablCal standards for 1 minute before opening. Do not shake. This ensures a consistent turbidity of the standard.
- If the 20.0 NTU StablCal standard is allowed to sit in the calibration cylinder or turbidimeter body for more than 15 minutes, it must be remixed (gently swirled in the calibration cylinder) before use to ensure a consistent turbidity.
- Discard all standards after use per the instructions on the container. Never transfer the standard back into its original container. Contamination will result.
- Always recalibrate after restoring default settings.

### 5.5.1 User-prepared Calibration

The user-prepared calibration is a two-step calibration in which the difference between the DI water and the standard value is used to determine the gain of the instrument. The water used for the standard solution must be from the same source as that which the DI water measurement is made. Variation in dilution of the water source could negatively impact the accuracy of the calibration. **The manufacturer does not recommend calibrating below 1.0 NTU, and instrument specifications are based on the calibration point at 20 NTU.** Before starting the calibration, read and apply the tips in [section 5.5 on page 16](#).

Follow the procedure as written (using 1 L of deionized water and 5.0 mL of 4000 NTU formazin) **if using a calibration cylinder** for calibration.

**If using the turbidimeter body for the user-prepared calibration follow the procedure below using 20.0 NTU formazin in step 12.** Follow the steps below for proper calibration:

1. Stop the sample flow, then drain and clean the body.
2. Prepare a 20.0 NTU standard by adding 5.0 mL of 4000 NTU formazin to a 1-L flask. Dilute to the mark with deionized water and invert gently to mix.
3. Drain the deionized water and pour the prepared 20.0 NTU standard into the turbidimeter body at step 12. Do not add additional 4000 NTU formazin.
4. From the Main Menu, select SENSOR SETUP and confirm.
5. Select the appropriate sensor if more than one is connected and confirm.
6. Select CALIBRATE and confirm.
7. Select USER PREPD CAL and confirm.
8. Select the available Output Mode (Active, Hold, or Transfer) from the list and confirm.

9. Stop the sample flow. Drain and clean the body and bubble trap. Fill the cylinder with 1 L deionized water. Replace the head and confirm.

**Important Note:** Carefully pour the DI water in such a way that minimizes any bubble formation that would result in a false, high reading.

10. The measured reading (based on a gain of 1.0) is displayed. Confirm.
11. Enter the standard turbidity value of the user prepared standard and confirm.
12. Drain the cylinder. Pour the prepared standard into the cylinder and confirm.
13. The measured reading (based on a gain of 1.0) is displayed. Confirm.
14. The display will read GOOD CAL! GAIN: X.XX ENTER TO CONT. Confirm. (If the calibration was unsuccessful, the display will read BAD CAL! Confirm to redo or exit.)
15. The display will read VERIFY CAL? Confirm to verify or exit without verification.

**Note:** If a dry verification is performed directly after a calibration, the measured value is assigned as the expected value for future verifications (when using the dry verification device with the same serial number). As long as the verification exists within the verification history, the expected value will be retained. Otherwise, the expected value will be the nominal labeled value associated with the dry verification device.

16. Select the verification type (begin at step 5 in [section 5.5.3.1 on page 19](#) for dry verification or [section 5.5.3.2 on page 19](#) for wet verification) or enter initials to complete calibration.
17. Return the sensor to measure mode and confirm.

### 5.5.2 Calibration with StablCal®

Before starting the calibration, read and apply the tips in [section 5.5 on page 16](#).

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is connected and confirm.
3. Select CALIBRATE and confirm.
4. Select STABLCAL CAL and confirm. Select the available Output Mode (Active, Hold, or Transfer) from the list and confirm.
5. Enter the standard turbidity value of the user prepared standard and confirm.
6. Drain/clean/rinse the turbidimeter body or cal cylinder. Pour the 20 NTU standard into the cylinder body. Replace the head and confirm.
7. The measured reading (based on a gain of 1.0) is displayed. Confirm.
8. The display will read GOOD CAL! GAIN: X.XX ENTER TO CONT. Confirm. (If the calibration was unsuccessful, the display will read BAD CAL! Confirm to redo or exit.)
9. The display will read VERIFY CAL? Confirm to verify or exit without verification.

**Note:** If a dry verification is performed directly after a calibration, the measured value is assigned as the expected value for future verifications (when using the dry verification device with the same

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*serial number). As long as the verification exists within the verification history, the expected value will be retained. Otherwise, the expected value will be the nominal value associated with the dry verification device.*

10. Select the VERIFICATION type (begin at step 5 in [section 5.5.3.1 on page 19](#) for dry verification or [section 5.5.3.2 on page 19](#) for wet verification) or enter initials to complete calibration.
11. Return the sensor to measure mode and confirm.

### 5.5.3 Instrument Verification

Instrument verification is intended as a simple check to ensure Turbidimeter functionality between calibrations. Two types of verifications are offered. The dry verification is performed using a “dry” calibration device such as the ICEPIC™. A wet verification is performed using a standard with a predetermined value such as StablCal® Stabilized Formazin.

A dry verification directly after calibration is used to establish the baseline. Any verification afterwards, until the next calibration, that uses the same dry verification standard will reference the recorded value from the baseline verification as the “expected” value. In order for the verification to pass, the measured value should be within the limits set by the Pass/Fail Criteria of the baseline value.

#### 5.5.3.1 Dry Verification

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select CALIBRATE and confirm.
3. Select VERIFICATION and confirm.
4. Select PERFORM VER and confirm. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Select DRY for the verification type and confirm.
6. Select 1 NTU STD or 20 NTU STD or verify SN of previously used calibration device and confirm.
7. Set the Head to Standard and confirm. Confirm again to accept the reading.
8. The display will read GOOD VER!. Confirm.
9. Enter initials and confirm.
10. Return the sensor to measure mode and confirm.

#### 5.5.3.2 Wet Verification

Before starting the verification, read and apply the appropriate tips in [section 5.6](#). For wet verification values at or below 1.0 NTU, only use the cleaned turbidimeter body.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select CALIBRATE and confirm.
3. Select VERIFICATION and confirm.

4. Select PERFORM TEST and confirm. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Select WET for the verification type and confirm.
6. Enter the Std Turbidity and confirm.
7. Drain and clean the sensor body and confirm.
8. Pour the standard into cylinder. Replace the head and confirm.
9. The reading will be displayed. Confirm to accept the verification.
10. Return the sensor to measure mode and confirm.

## 5.6 Calibration and Verification History

The calibration and verification history logs contain information on the last 12 calibrations and the last 12 verifications. The calibration history log shows the gain value, the time and date of the calibration, and the initials of the operator performing verification.

**Note:** Restoring default settings from the DIAG/TEST menu will return the turbidimeter to its non calibration state (gain = 1.0) but it will not remove the previous calibration history from memory.

The calibration history log is accessed from the Calibrate menu. The verification history log is accessed from the Verification menu (a submenu of the Calibrate menu).

Each verification history entry shows the serial number of the verification device (dry verification) or the value of the verification standard (wet verification), the time and date of the verification, and the initials of the operator performing the verification.

Scroll through the entries by pressing the **ENTER** key. After scrolling through all 12 histories, the display will return to the calibration menu level.

When the instrument is received from the factory, default values or blank spaces will be shown for the calibration and verification history information. Those values will be replaced with real data as the history log is filled.

The data is retained as first in, first out. When the log is full, the newest entry is stored and the oldest entry in the log is deleted.

## 5.7 Offset Feature

The offset or clean water offset (CWO) feature will allow a  $\pm 0.05$  NTU offset to the measured value. The offset value denoted as CWO will be subtracted from the value displayed on the sc Interface. The 0.05 NTU offset can be entered after a calibration is complete and is based on an independent determination of the water used in the preparation of the turbidity standards.

**Note:** The offset is a limited value. An offset outside the range of  $\pm 0.05$  mg/L,  $\pm 0.05$  NTU,  $\pm 0.05$  TE/F,  $\pm 0.05$  FTU or  $\pm 0.05$  Degree will not be accepted.

For example, if a standard is prepared with a value of 0.8 NTU, the 0.05 NTU offset would result in a displayed value of 0.75 NTU. See the [Setting the Offset](#) section to change the offset value. When the offset is used, the letters CWO are displayed after the turbidity value in the upper-right corner.

### 5.7.1 Setting the Offset

Follow the steps below to enter an offset:

**Note:** *The data log for this channel will be erased if the offset is changed to anything other than zero.*

1. From the Main Menu select SENSOR SETUP and confirm.
2. Select 1720E and confirm.
3. Select CONFIGURE and confirm.

**Note:** *Offset is not used during calibration. During calibration the offset is zero.*

4. Move the pointer to OFFSET and confirm.
5. The display will show an Offset screen. Use the arrow keys to enter the offset. The value entered must be between  $-0.05$  to  $0.05$  NTU, values outside this range are not accepted.
6. Confirm to accept the offset reading.



# Section 6 Maintenance

---

**DANGER**

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

## 6.1 Maintenance Schedule

Maintenance Task	Frequency
Clean the sensor	Before each calibration and as needed. Depends on sample characteristics.
Calibrate Sensor (as required by regulatory agency)	Per agency-dictated schedule.

Scheduled periodic maintenance requirements of the 1720E are minimal and include calibration and cleaning of the photocell window, bubble trap, and body. Check and clean the bubble trap and turbidimeter body (as described in [section 6.4.2](#)) if visual inspection shows that it is necessary. Perform other maintenance on a regular basis; experience will dictate scheduling and may depend on the installation, sample type, and season.

It is very important to maintain the cleanliness of the interior and exterior of the turbidimeter body, head assembly, the integral bubble trap, and the surrounding area. Doing so will ensure accurate, low-level turbidity measurements.

Clean the turbidimeter body before performing any calibration or wet verification (especially when measurements are being made at 1.0 NTU or lower).

Check and/or perform a calibration periodically (as experience dictates) using one of the methods described in [section 5.5 on page 16](#). A calibration history menu option is available under Sensor Setup/Calibrate.

## 6.2 Removing a Sensor from the System

Prior to physically removing a sensor from the system, record all user defined settings such as relays, signal averaging, etc. Disconnect the sensor connector at the controller.

## 6.3 Reinstalling a Sensor on the System

To return the system to normal operation following a software upgrade or sensor repair perform the following procedure:

1. Detach all sensors from the sc100 controller.
2. From the main menu, press the down arrow key to highlight TEST/MAINT. Press **ENTER**.
3. Use the down arrow key to scroll to SCAN SENSORS and press **ENTER**.
4. Remove attached sensors by selecting the corresponding serial number or select "All".
5. **Power down the sc100 then attach the 1720E.**

*Note: Clean sensors before reinstallation on the system.*

6. Supply power to the sc100. The system will initialize automatically.

### 6.4 Cleaning

#### 6.4.1 Cleaning the Photocell Window

Occasional cleaning of the photocell window is required. The frequency will depend on the nature and concentration of dissolved and suspended solids in the sample. Biological activity is a primary factor in mineral scale deposit on the window and the amount differs with sample temperature. In general, more growth will occur in warm temperatures and less in cold.

**Note:** Do not disassemble the photocell assembly. It contains liquid.

**Note:** Take care to not scratch the photocell window.

Inspect the photocell window often to determine cleaning needs. Remove any organic growth or film on the photocell window before standardization or calibration. Use a cotton swab and isopropyl alcohol or a mild detergent (such as Liqui-nox®) to remove most sediment and dirt. Mineral scale buildup may require cleaning with a mild acid applied with a cotton swab followed by a detergent wash. **Do not use abrasive cleaners.**

#### 6.4.2 Cleaning the Turbidimeter Body and Bubble Trap

Sediment may collect in the turbidimeter body after extended use. Noise (fluctuation) in the reading could indicate the need to clean the body and/or bubble trap. The 1720E bubble trap and bottom plate may be removed to make cleaning easier. Drain and clean the turbidimeter body before each calibration. Establish a regular schedule or perform cleaning as determined by visual inspection.

##### Cleaning the Turbidimeter Body

**Note:** The turbidimeter body, bubble trap, and detector must be cleaned before each calibration.

1. Turn off sample flow to the turbidimeter body.
2. Remove the head assembly and bubble trap cover from the body. Remove the bubble trap by lifting it vertically. Set it aside to be cleaned separately.
3. Drain the body by removing the plug from the bottom of the body.
4. Replace the drain plug and fill the body to the weir with cleaning solution. This cleaning solution can consist of dilute chlorine solution (25 mL of household bleach in 3.78 liters of water) or a laboratory detergent such as Liqui-nox (1 mL detergent in 1 liter of water).
5. Use a soft brush to clean the inside surfaces of the body.
6. Remove the drain plug again and thoroughly flush the turbidimeter body with ultra-filtered deionized water. Clean and replace the plug.

##### Cleaning the Bubble Trap

1. Prepare a cleaning solution (as in step 4 above) in a container large enough to submerge the entire bubble trap.
2. Using a test tube brush such as Cat. No. 690-00, clean each surface.
3. Rinse the bubble trap thoroughly with ultra-filtered deionized water and reinstall it in the turbidimeter body.

4. Replace the bubble trap cover and head assembly on the top of the body.
5. Restore sample flow to the instrument.
6. Calibrate the instrument using one of the methods in [section 5.5 on page 16](#).

If the above cleaning procedures have been performed and the turbidimeter readings are still noisy, the bottom plate and gasket may need to be removed and cleaned. Carefully perform the following procedure to ensure the turbidimeter body integrity is maintained.

1. Turn off sample flow to the turbidimeter body.
2. Remove the head assembly, bubble trap cover, and bubble trap (by lifting it vertically) from the body.
3. Drain the body by removing the plug from the bottom of the body.
4. Lift the body off of its mounting screws.
5. With the body turned upside-down, remove the two Phillips-head screws holding the bottom plate.
6. Lift the bottom plate off the body; set the gasket aside for use in reassembly.
7. Use a soft brush and a dilute cleaning solution (as prepared above) to clean the bottom plate and inside surfaces of the turbidimeter body. Rinse the entire body and bottom plate with ultra-filtered deionized water.
8. Reassemble by inserting the gasket into the molded channel in the bottom plate.
9. Fit the bottom plate onto the turbidimeter body.
10. Reinstall both screws and carefully tighten to 15 inch-lb maximum.
11. Reinstall the turbidimeter onto the wall mounting screws.
12. Replace the bubble trap, bubble trap cover, and head assembly on the top of the body.
13. Restore sample flow to the instrument.

### 6.4.3 Replacing the Lamp Assembly

The Lamp Assembly is located on the head assembly. Under normal use, Hach recommends replacing the lamp once a year to maintain peak performance. Replacement bulbs have been “burned-in” at the factory and are ready for installation and use.

To change the lamp, refer to [Figure 7 on page 26](#) and perform the following steps:

1. Disconnect power to the controller to remove all power to the turbidimeter.
2. Disconnect the lamp leads by unplugging the connector.

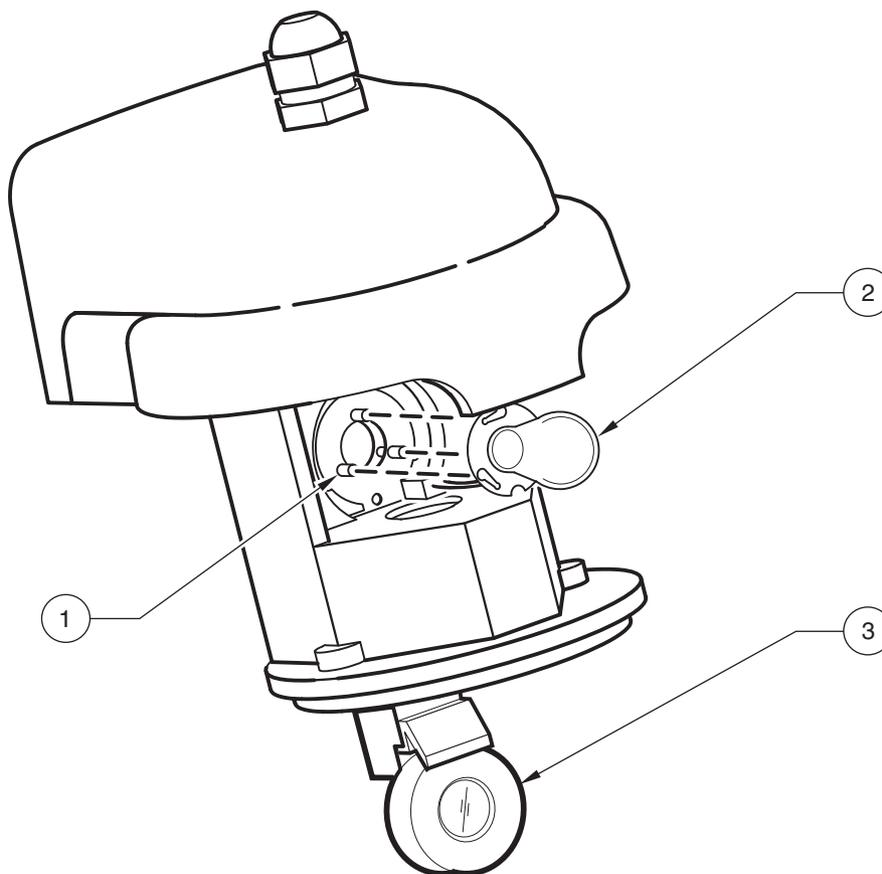
3. After the bulb has cooled, remove as follows:
  - a. Wear cotton gloves to protect your hands and to avoid fingerprints on the bulb.
  - b. Grasp the bulb.
  - c. Twist the bulb in a counterclockwise direction, pulling out slightly, until it is released from the housing.
  - d. Pull the lamp leads and connector through the hole in the lamp housing.

Do not touch the new bulb with bare hands. Etched glass and reduced lamp life will result. Wear cotton gloves or grasp the lamp assembly with a tissue to avoid contamination. If contamination occurs, clean the glass bulb portion with isopropyl alcohol.

Replace the bulb by reversing the above instructions. The bulb base only fits one way; align the notch in the metal bulb flange with the hole in the lamp holder.

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**Figure 7**      **Lamp Replacement**



1. Lamp Housing	2. Lamp Assembly	3. Photo Detector
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# Section 7 Troubleshooting

## 7.1 Error Codes

When a sensor is experiencing an error condition, the sensor reading on the measurement screen will flash and all relays and analog outputs associated with the sensor will be held.

Highlight the Probe Diag menu and press **ENTER**. Highlight Errors and press **ENTER** to determine the case of the error. Errors are defined in [Table 3](#).

**Table 3 Error Codes**

Displayed Error	Definition
A/D Fail	Failed A/D converter. Call the Service Department.
Lamp Fail	The light source has failed. See <a href="#">section 6.4.3 on page 25</a> for instructions for replacing it.
Flash Fail	Datalog and event log will not work.

## 7.2 Warnings

A sensor warning will leave all menus, relays, and outputs functioning normally, but will cause a warning icon to flash on the right side of the display. Highlight the Probe Diag menu and press **ENTER** to determine the cause of the error. Warnings are defined in [Table 4](#).

A warning may be used to trigger a relay and users with the sc100 controller can set warning levels to define the severity of the warning (see the sc100 controller user manual for more information about warning levels). Errors are defined in [Table 4](#).

**Table 4 Warning Codes**

Warning Number	Displayed Warning	Definition/Resolution
1	Dark Reading Warning	Dark reading detects too much light. (> 0.05 NTU)
2	Temp Warning	Sensor head internal temperature is higher than specified. Contact the Service Department. (> 70 °C)
3	Data Log Full	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
4	Event Log Full	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
5	5 Volt Warn	Monitored voltage is outside the range of 4.5–5.5 V.
6	Inp V Warn	Monitored voltage is outside the range of 9.08–14.13 V.
7	Lamp Volt Warn	Monitored voltage is outside the range of 3.96–4.48 V.
8	Lamp Curr Warn	Monitored current is outside the range of 1.67–2.75 Amps.
9	Output Mode Warn	Activated when the sensor is not in normal measurement mode (such as when in calibration or verification mode).

Table 5 presents sensor warnings displayed in the Event Log, possible causes, and corrective actions.

**Table 5 General Troubleshooting**

Sensor Warning	Possible Cause	Corrective Action
Bad Lamp	Lamp burned out	Replace the lamp. See <a href="#">section 6.4.3 on page 25</a> .
	Lamp unplugged	Restore connection
	+12 V connection loose at controller	Restore connection
	Dislodged lamp	Reinstall lamp
	Bad circuit board in turbidimeter head	Contact the Customer Service Department.
Low Signal	Photocell coated/dirty	See <a href="#">section 6.4.1 on page 24</a> . Contact the Customer Service Department.
	Photocell wires disconnected	Reconnect wires
	Photocell broken/cracked	Replace photocell Contact the Customer Service Department.
	Lens coated/dirty	Clean the lens using isopropyl alcohol and a cotton swab.
	Obstructed light path	Remove obstruction
	See Bad Lamp causes above	See Bad Lamp corrective actions above
Bad System Voltage	Improper wiring at controller	Refer to <a href="#">section 3.1 on page 7</a> .
	Turbidimeter head cable shortened to improper length	Contact the Customer Service Department.
	Fluctuation in voltage	Turn instrument power off and back on.
	Bad circuit board in turbidimeter head	Contact the Service Department
A/D Converter Timeout	Fluctuation in voltage	Turn instrument power off and back on.
	Bad circuit board in turbidimeter head	Contact the Customer Service Department.
High Dark Counts	Light Leak—Turbidimeter head not on turbidimeter body or calibration cylinder during Power Up or Zero Electronics	Make sure the turbidimeter head is on the turbidimeter body and properly aligned and repower instrument or perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Light Leak—Turbidimeter head not properly aligned on the turbidimeter body or calibration cylinder during Power Up or Zero Electronics	Make sure the turbidimeter head is properly aligned and repower instrument or perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Photocell broken/cracked	Contact the Customer Service Department.

Table 6 presents additional malfunctions which may not be recorded in the Event Log.

**Table 6 Additional Malfunctions Not Recorded in the Event Log**

Symptom	Possible Cause	Corrective Action
Continuous Underrange	The calibration standard was either improperly prepared or was unstable at the time the calibration was accepted.	Verify the accuracy of calibration standards and recalibrate the instrument. See Low Signal in <a href="#">Table 5</a> .
Continuous Overrange (100 NTU)	The calibration standard was either improperly prepared or was unstable at the time the calibration was accepted.	Verify the accuracy of calibration standards and recalibrate the instrument.
Erratic Readings	Inadequate bubble removal from sample	Verify the accuracy of calibration standards and recalibrate the instrument. Increase the signal averaging time to a longer interval. Make sure the Bubble Reject feature is turned on. Slow the flow of sample into the instrument.

**Table 6 Additional Malfunctions Not Recorded in the Event Log (continued)**

Symptom	Possible Cause	Corrective Action
High Readings	Deionized water turbidity is greater than 0.5 NTU	Clean the instrument. Access Calibration History for turbidity value of ultra-filtered water. Verify the flow is between 200–750 mL/min. Recalibrate the instrument.

### 7.3 Event Codes

Event codes are not displayed on controller and must be downloaded from the event log to be viewed. Troubleshooting actions are provided in [Table 5 on page 28](#).

**Table 7 Event Log List**

Event	Event #	Data1	Data2	Data3
Bubble Reject Change	0	0 = OFF 1 = ON	—	—
Filter Size Change	1	0 = No avg, 1 = 6 sec 2 = 30 sec, 3 = 60 sec 4 = 90 sec	—	—
Data Log Interval Change	2	0 = 30 sec, 1 = 1 min 2 = 5 min, 3 = 10 min 4 = 15 min	—	—
Power On	3	1	—	—
Calibration	4	Cal Gain	Initials	—
Verification	5	Expected Value	Meas Value	Initials
Dark Reading Warning	6	Measured Value	—	—
Temperature Warning	7	Temperature Value	—	—
Voltage Warning	8	16 = +5V high 32 = +5V low 64 = V in high 128 = V in low	—	—
Lamp Warning	9	1 = lamp V high 2 = lamp V low 4 = lamp I high 8 = lamp I low	—	—
A/D Fail	10	1	—	—
Lamp Fail	11	2	—	—
Flash Fail	12	4	—	—
Output Mode Change	13	0 = Active, 1 = Hold 2 = Transfer, 4 = Normal	—	—



## Section 8 Replacement Parts and Accessories

### 8.1 Replacement Items

Description	QTY	Catalog Number
Lamp Assembly	each	18950-00
Instruction Manual, 1720E Turbidimeter System, English	each	60100-18

### 8.2 Optional Accessories

Description	QTY	Catalog Number
Cable, sensor extension, 7.7 m (25 ft)	each	57960-00
Cap, Connector Receptacle	each	52100-00
Deionized (demineralized) water	1 L	272-56
Drain plug for the 1720E body	each	44116-00
Filter, 0.45 µm, to produce ultra-filtered water for cleaning and calibration	each	26705-00
Filter, 0.2 µm, to produce ultra-filtered water for calibration standard preparation	each	23238-10
Formazin Calibration Kit includes: Calibration Cylinder, TenSette® Pipet, 4000 NTU Formazin Primary Standard (500 mL)	each	44156-00
Floor Stand	each	57432-00
Flow meter, 50–700 mL/min	each	40282-00
ICE-PIC Module for Calibration and Calibration Verification, 20 NTU	each	52250-00
ICE-PIC Module for Calibration and Calibration Verification, 1 NTU	each	52215-00
Lid, Bubble Trap, 1720E	each	52012-00
Photocell Replacement Kit for the 1720E	each	52180-00
Pipet tips for 19700-01 TenSette Pipet	50/pkg	21856-96
Pipet tips for 19700-10 TenSette Pipet	50/pkg	21997-96
StablCal Calibration Set for the 1720 Series Turbidimeter		
Includes: StablCal Standards, < 0.1 NTU, 20.0 NTU	1 L/each	26596-00
StablCal Standard, 0.1 NTU	1 L	27233-53
StablCal Standard, 0.3 NTU	1 L	26979-53
StablCal Standard, 0.5 NTU	1 L	26980-53
StablCal Standard, 1.0 NTU	1 L	26598-53
Strain relief, Heyco	each	16664
Swabs, Cotton, presterilized for cleaning the photodetector	100/pkg	25543-00
TenSette Pipet, 0.1 to 1.0 mL	each	19700-01
TenSette Pipet, 1.0 to 10.0 mL	each	19700-10
Tubing, Outlet, ½-inch ID, ¾ inch OD, Tygon R3603	per foot	51263-00

### 8.3 Calibration and Verification Standards and Accessories

Description	QTY	Catalog Number
Calibration Cylinder	each	44153-00
Formazin Calibration Standards, Formazin, 4000 NTU Stock Solution	500 mL	2461-49
Calibration/Verification Modules		
ICE-PIC™ Module, 1 NTU	1 each	52215-00
ICE-PIC™ Module, 20 NTU	1 each	52250-00
StablCal® Calibration Standards		
StablCal® Stabilized Formazin Standard, 1 NTU	1 L	26598-53
StablCal® Stabilized Formazin Standard, 20 NTU	1 L	26601-53
StablCal® Stabilized Formazin Standard, <0.1 NTU	1 L	26597-53
StablCal® Stabilized Formazin Set, four 1-L bottles 20-NTU and four 1-L bottles <0.1 NTU	1 L each	26596-00
StablCal® Stabilized Formazin Standard, 40 NTU	1 gallon (3.78 L)	27463-56
StablCal® Stabilized Formazin Standard, 0.1 NTU	1 gallon (3.78 L)	27233-56

## Section 9 Compliance Information

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Hach Co. certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The **Model sc100/sc1000 with 1720E Sensor** has been tested and is certified as indicated to the following instrumentation standards:

### Product Safety

UL 61010A-1 (ETL Listing # 65454)  
CSA C22.2 No. 1010.1 (ETLc Certification # 65454)  
Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

### Immunity

This equipment was tested for Industrial level EMC per:

**EN 61326** (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 89/336/EEC EMC**: Supporting test records by Hach Company, certified compliance by Hach Company.

#### Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)  
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Field Immunity (Criteria A)  
IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)  
IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)  
IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)  
IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

#### Additional immunity Standard/s include:

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria A)

### Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per **89/336/EEC EMC: EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

#### Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment  
EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

#### Additional Emissions Standard/s include:

**EN 55011 (CISPR 11)** Class “A” emission limits

### **Canadian Interference-causing Equipment Regulation, IECS-003, Class A**

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

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

### **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 Controller from its power source to verify that it is or is not the source of the interference.
2. If the Controller is connected into the same outlet as the device with which it is interfering, try another outlet.
3. Move the Controller and 1720E sensor away from the device receiving the interference.
4. Reposition the device receiving the interference.
5. Try combinations of the above.

# Appendix A Modbus Register Information

**Table 8 Sensor Modbus Registers**

Group Name	Tag Name	Register #	Data Type	Length	R/W	Units (U)	Range
Measurements	Cal Gain	40013	float	2	R	none	0.5 to 2.0
Verification	PF Criteria	40062	Integer	1	R/W	%	5 to 10
Measurements	Turbidity	40001	Float	2	R	NTU	0/100
Diagnostics	Temperature	40005	Float	2	R	Deg C	—
Diagnostics	Dark Reading	40009	Float	2	R	NTU	0/100
Diagnostics	Raw Turbidity	40011	Float	2	R	NTU	0/100
Diagnostics	Lamp Voltage	40018	Float	2	R	Volts	0/5
Diagnostics	Lamp Current	40020	Float	2	R	Amps	0/2.75
Diagnostics	Plus 5V	40022	Float	2	R	Volts	0/5.5
Diagnostics	Voltage In	40024	Float	2	R	Volts	0/1443
Setup	Software Version	40015	Float	2	R	—	—
Setup	Bubble Rej	40017	Integer	1	R/W	—	On/Off
Setup	DataLog Interval	40026	Integer	1	R/W	Sec or Min	30 sec, 1 min, 5 min, 10 min, 15 min
Setup	Sensor Name	40027	String	6	R/W	—	—
Setup	Filter Size	40033	Integer	1	R/W	sec	no averaging, 6, 30, 60, 90
Setup	Sensor Ser Num	40036	String	6	R	—	12 digits
Setup	Output Mode	40042	Integer	1	R	—	0, 1, 2, 4
Setup	Set Resolution	40061	Integer	1	R/W	decimal places	4, 3, or 2



<b>Numerics</b>		<b>P</b>	
90 Degree Detector .....	6	Photocell Window .....	24
<b>A</b>		Power Requirements .....	3
Accuracy .....	3	<b>R</b>	
<b>B</b>		Range .....	3
Bubble trap .....	6	Response Time .....	3
<b>C</b>		<b>S</b>	
Calibration .....	16	Safety Information .....	5
History .....	20	Sample	
StablCal .....	18	Connections .....	12
User-prepared .....	17	Flow .....	13
Calibration Methods .....	3	Sample Line Installation .....	11
Cleaning .....	24	Sensor Cable	
<b>E</b>		Connecting .....	7
Event Codes .....	29	Wiring .....	7
<b>F</b>		Starting Sample Flow .....	13
Flow Rate .....	12	System Power .....	13
<b>H</b>		System Startup .....	13
Head Assembly .....	11	<b>T</b>	
<b>M</b>		Theory of Operation .....	6
Maintenance		Turbidimeter Body .....	24
Cleaning .....	24	<b>V</b>	
Schedule .....	23	Verification .....	16
Mounting .....	11	<b>W</b>	
		Warnings	
		Sensor .....	28





**HACH COMPANY World Headquarters**

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.  
Tel. (970) 669-3050  
(800) 227-4224 (U.S.A. only)  
Fax (970) 669-2932  
orders@hach.com  
www.hach.com

**HACH LANGE GMBH**

Willstätterstraße 11  
D-40549 Düsseldorf, Germany  
Tel. +49 (0) 2 11 52 88-320  
Fax +49 (0) 2 11 52 88-210  
info-de@hach.com  
www.de.hach.com

**HACH LANGE Sàrl**

6, route de Compois  
1222 Vézenaz  
SWITZERLAND  
Tel. +41 22 594 6400  
Fax +41 22 594 6499

