


# User instructions

## BOD LDO® Probe: Model LBOD10101

### Safety Information

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

	<p>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.</p> <p><b>Note:</b> 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.</p>
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### Overview

Figure 1 on page 2 shows the LBOD10101 probe, a luminescent dissolved oxygen (LDO®) sensor with an integrated stirring system. The LBOD10101 measures the dissolved oxygen for BOD (Biochemical Oxygen Demand) determination in BOD bottles. The probe uses the luminescent dissolved oxygen (LDO) technology (no membranes) and features a replaceable self-stirring assembly and a 1.8 meter cable.

### Specifications

Specifications subject to change without notice.

Specification	Details
% saturation resolution	0.1%
% saturation accuracy	± 0.59% of reading
Cable connection	Digital output and connector compatible with HQd meters
Dimensions	Diameter: 12 mm (0.47 in.), Length: 103 mm (4.06 in.), Total length: 220 mm (8.66 in.), Cable length: 1.8 meter (5.91 ft)
Dissolved oxygen accuracy	± 0.05 mg/L for 0.0 to 10 mg/L ± 0.1 mg/L for greater than 10 mg/L
Dissolved oxygen range	0.05 to 20.0 mg/L (ppm) 1 to 200% saturation
Minimum sample depth	10 mm
Pressure accuracy	± 3 mbar (0.3 kPa)
Pressure resolution	5 mbar (0.5 kPa)
Response time	T90% at 10 s (when stirred)
Temperature accuracy	± 0.3 °C (± 0.54 °F)
Storage temperature	5 to 40 °C (41 to 104 °F)
Temperature resolution	0.1 °C (0.18 °F)
Temperature range	0 to 50 °C (32 to 122 °F)
Warranty	Probe and sensor cap are covered by a 1 year warranty. Use outside of the laboratory environment may void warranty.

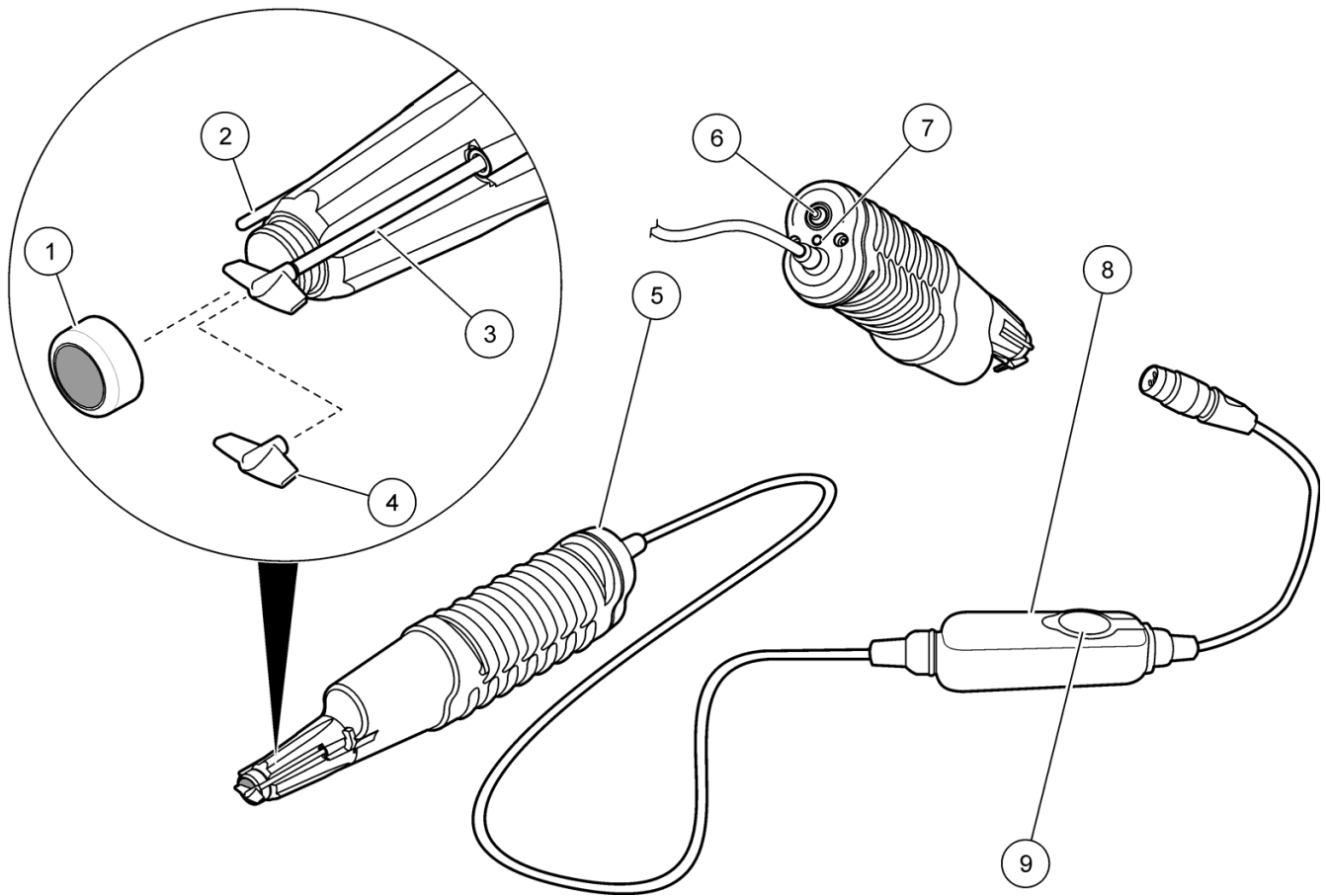


Figure 1 Probe overview

1	Sensor cap and seal	6	Stirrer On/Off switch
2	Thermistor	7	Power indicator LED
3	Stirrer assembly	8	Pressure-sensor module
4	Stirrer paddle	9	iButton® compartment <sup>1</sup>
5	Probe body with integrated stirrer		

<sup>1</sup> iButton is a registered trademark of Maxim Integrated Products, Inc.

## Preparation for use

1. Verify that the sensor cap and iButton are installed correctly (Figure 1). Avoid touching the sensor cap with a hand, fingers, or any surface that may scratch or cut the cap.

**Note:** The iButton label should face up.

2. Rinse the sensor cap with deionized water and blot dry.

# Calibration

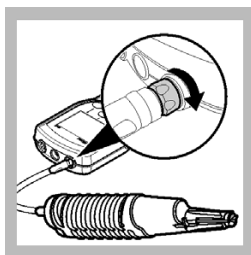
## Before calibration:

The probe must have the correct service-life time stamp. <b>Set the date and time in the meter before attaching the probe.</b>
It is not necessary to recalibrate when moving a calibrated probe from one HQd meter to another if the additional meter is configured to use the same calibration options. If the additional HQd meter uses different calibration options (e.g. calibration standards or acceptance criteria), calibrate the probe or change the method settings to select a different method.
To view the current calibration, select the <b>DATA LOG KEY, View Probe Data</b> , then <b>View Current Calibration</b> .
If any two probes are connected, push the <b>UP</b> or <b>DOWN</b> arrow to change to the single display mode in order to show the <b>Calibrate</b> option.
Analyze samples as soon as possible after collection.
Tighten the probe locking nut securely when connecting the probe to the meter.
If custom calibration or measurement settings are desired, a new method can be created.
Refer to <a href="#">Troubleshooting on page 10</a> for calibration errors.
Connect the HQd meter to AC power so the battery life is conserved. See the HQd user manual for instructions.
The slope value is the comparison between the latest calibration and the factory calibration expressed as a percentage.
% saturation or mg/L calibration methods are available in calibration options menu.

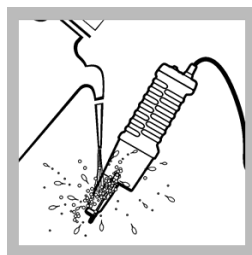
## Water-saturated air (100%) calibration

### Water-saturated air (100%) calibration notes:

- Probes are initially calibrated at the factory. However, regular calibration by the user is recommended for the best measurement accuracy.
- If both 0% and 100% calibration is desired, select User 100% with 0 from the Calibration Options menu.
- If the calibration slope does not meet the acceptance criteria, the display will show **Slope out of range**. Put the probe back in the BOD bottle and allow additional time for the air environment to become saturated with water. Select **Read**.



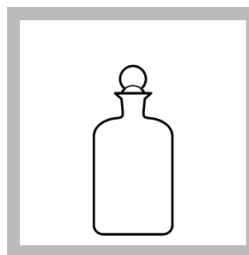
1. Connect the probe to the meter.



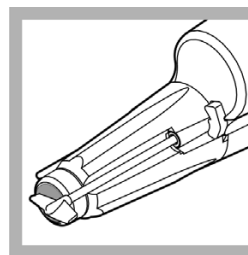
2. Rinse the sensor cap with deionized water and blot dry.



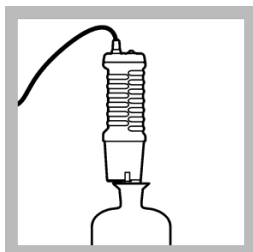
3. Fill a BOD bottle about  $\frac{3}{4}$  full with water (225 mL.)



4. Put the stopper in the BOD bottle and shake repeatedly. Remove the stopper.



5. Inspect the LBOD probe sensor surface. If it is wet, blot dry with a non-abrasive cloth.



6. Put the LBOD probe in the BOD bottle and allow approximately ten minutes to equilibrate.

7. Select **Calibrate** then **Read**. The display will show **Stabilizing...** and a progress bar as the probe stabilizes in the standard.

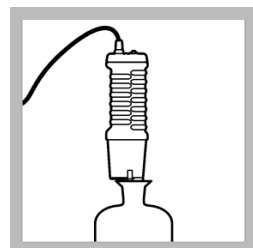
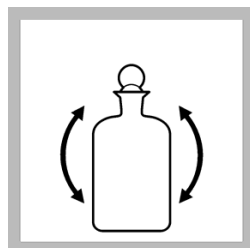
8. The display highlights the standard value. Continue with **Zero point calibration** if desired. If not, select **Done** to view the calibration summary.

9. Select **Store** to accept the calibration and return to the measurement mode. The calibration record is stored in the probe and the data log.

## Zero point calibration

### Zero point calibration notes:

- The zero point calibration is only necessary for dissolved oxygen measurements below 1 mg/L.
- The cobalt chloride acts as a reaction catalyst.
- It may take up to 30 minutes for a 0 mg/L point to be observed. A negative dissolved oxygen concentration value indicates that a 0 mg/L has not yet been met.
- The calibration record is stored in the probe and the data log. The calibration is also sent to a PC, printer, or flash memory stick if connected.



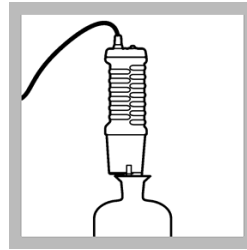
1. Fill a BOD bottle full with deionized water.

2. Add 300 mg of sodium sulfite to the bottle.

3. Add 2 mL of cobalt chloride solution.

4. Place the stopper in the BOD bottle and invert several times to mix the chemicals.

5. Place the LBOD probe in the bottle and start the stirrer.



**6. Select Read.**  
The display will show **Stabilizing...** and a progress bar as the probe stabilizes.

**7. Select Done** to view the calibration summary.

**8. Select Store** to accept the calibration and return to the measurement mode.

**9.** After the 0 saturated value is highlighted, place the probe in a BOD bottle full of deionized water, start the stirrer and run for 10 minutes to remove sulfite residue. Remove the probe from the BOD bottle and rinse thoroughly.

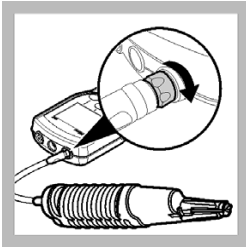
## Measurement

### Before measurement:

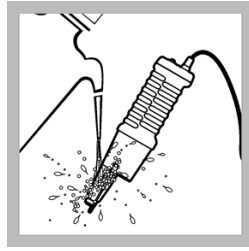
The probe must have the correct service-life time stamp. <b>Set the date and time in the meter before attaching the probe.</b>
The probe is factory calibrated and ready for use. For applications that require greater accuracy and precision, perform a user calibration.
If complete traceability is required, enter a sample ID and operator ID before measurement.
Refer to <a href="#">Troubleshooting on page 10</a> for measurement errors.
Tighten the probe locking nut securely when connecting the probe to the meter.
Connect the HQd meter to AC power so the battery life is conserved. See the HQd user manual for instructions.

### Measurement notes:

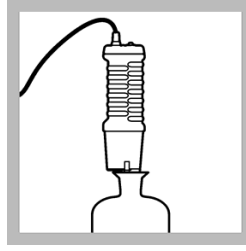
- Make sure that the BOD bottle is filled with sample and no air bubbles are present.
- The LBOD10101 magnetic-based motor produces more noise than a conventional-based stirrer.
- Data is stored automatically in the data log when **Press to Read** or **Interval** is selected in the Measurement Mode. When Continuous is selected, data will only be stored when **STORE** is pushed.
- Make sure the BOD bottle does not contain air bubbles when the stopper is installed for accurate final results.



1. Connect the probe to the meter.



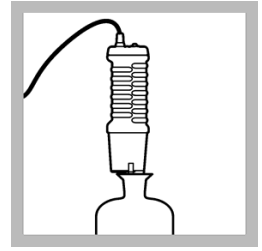
2. Rinse the probe with deionized water and blot dry.



3. Put the probe in the sample. Engage the stir paddle by pushing the button on the top of the probe.



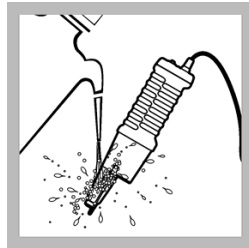
4. Select **Read**. The display will show **Stabilizing...** and a progress bar as the probe stabilizes in the sample.



5. Record the value. Turn off the stir paddle.



6. Remove the probe from the BOD bottle. Be careful not to catch the stir paddle on the inside lip of the BOD bottle. Carefully install the stopper into the bottle.



7. Repeat steps 2. to 6. for additional measurements.

## Maintenance

### General maintenance

- Rinse the probe with water to clean. The stirrer does not need to be removed.
- Do not scrub the sensor cap or lens.
- Do not handle the face of the sensor cap.
- Do not use organic solvents on the sensor cap.
- High concentrations (over 1 molar) of bases or acids will decrease the service life of the sensor cap.

### Replace the sensor cap and iButton®

1. Remove the used sensor cap. Pull straight down on the rubber sides of the cap. Discard the used sensor cap. Do not touch or soil the exposed, clear sensor lens with oils from fingers.

*Note: If the sensor lens is soiled, rinse with dilute isopropyl alcohol (10% or less) or deionized water and blot dry with a non-abrasive cloth. Do not wipe the lens or use abrasive cleaners.*

2. Push the new sensor cap on the probe until the rubber seal is firmly against the sensor cap. Make sure the rubber seal is firmly seated.

**Important Note:** Avoid handling the black face of the sensor cap. Do not use alcohol or other organic solvents to clean the black face of the sensor cap. These solvents will destroy the sensor cap.

3. Pull to open the iButton®1 cover on the pressure-sensor module (Figure 1 on page 2.) Tip the module to remove the existing iButton.
4. Insert the new iButton with the label facing up.
5. Close the iButton cover and press until it seats against the surface of the module housing. The cover must be closed properly to ensure good electrical contact with the iButton to ensure a proper seal.
6. Reconnect the LBOD101 probe to the meter.

### Cleaning

If the sensor cap becomes fouled, clean it gently with mild detergent, water and a soft cloth or cotton swab.

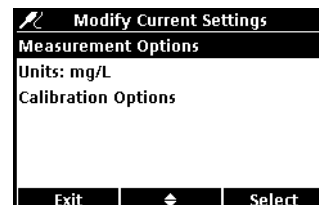
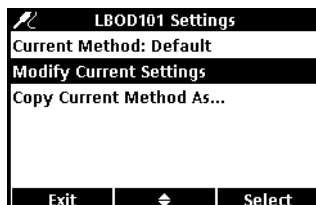
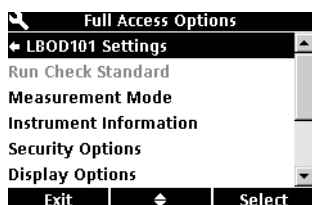
**Note:** Do not remove the black colored substrate from the sensor cap.

### Storage

Store the probe in a BOD bottle partially filled (¼ minimum) with water when not in use.

## Advanced operation

Parameter-specific settings can be changed through the Full Access Options menu. Details about menu navigation, available options and how to change them are given in the screens, tables and procedures throughout this section.



The settings that can be changed are shown in Table 1.

**Table 1 Parameter-specific settings**

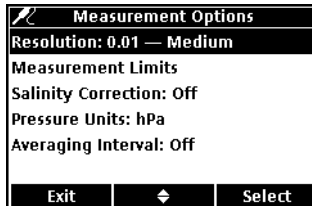
Setting	Options	Description
Measurement options	<ul style="list-style-type: none"> <li>• Resolution</li> <li>• Measurement limits</li> <li>• Salinity correction</li> <li>• Pressure units</li> <li>• Averaging interval</li> </ul>	<ul style="list-style-type: none"> <li>• Defines measurement resolution</li> <li>• Upper and lower measurement limits</li> <li>• Value for salinity correction</li> <li>• Atmospheric pressure units</li> <li>• Frequency at which meter calculates average of readings</li> </ul>
Units	<ul style="list-style-type: none"> <li>• mg/L</li> <li>• %</li> </ul>	<ul style="list-style-type: none"> <li>• Units of basic measurement</li> </ul>
Calibration options	<ul style="list-style-type: none"> <li>• Calibration</li> <li>• Calibration Reminder</li> </ul>	<ul style="list-style-type: none"> <li>• Type of calibration</li> <li>• Reminder repeat and calibration expiration</li> </ul>

### Change measurement options

Methods are groups of default or user defined settings relevant to specific applications. If the meter is set to the default method and the Modify Current Settings option is chosen, a prompt will display to name the method after changes are entered. The settings are saved

1iButton is a registered trademark of Maxim Integrated Products, Inc.

with this name to distinguish them from the default method settings, which cannot be changed. A saved method can be used instead of repeatedly adjusting individual settings. Changes made to a user defined method are automatically saved with the existing name. Multiple methods can be saved for the same probe.



1. Make sure a probe is connected to the meter.
2. Push the **METER OPTIONS** key and select (Probe Model) Settings.
3. Select Modify Current Settings.
4. Select Units to change the units between mg/L (default) and % (both are displayed on Reading screen).
5. Select Measurement Options.
6. Update the settings. Refer to [Table 2](#).

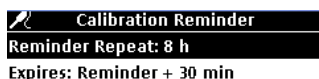
**Table 2 Measurement settings options**

Setting	Options	Description
Resolution	0.1—Fast (0.35 mg/L)/min 0.01—Fast (0.35 mg/L)/min 0.01—Medium (0.15 mg/L)/min (default) 0.01—Slow (0.05 mg/L)/min	The resolution affects the number of decimal places and the stabilization time. Higher resolution measurements take more time to stabilize.
Measurement limits	Lower limit (default: 0.0 mg/L; 0%) Upper limit (default: 20.0 mg/L; 200%)	The measurement limits can be set to match the acceptable values for the sample. When the measurement is above the upper limit setting or below the lower limit setting, the meter will show an "Out of limits" message. This message is an alert to a potential problem with process conditions.
Salinity correction	Off (default) Manual	Salinity lowers the solubility of dissolved oxygen in water. To correct for salinity in the sample, set salinity correction to manual and then enter the salinity value.
Salinity value	‰ (default: 35.0 ‰)	When salinity correction is set to manual, enter the salinity value of the sample. Salinity can be measured with a conductivity probe.
Pressure units	hPa mBar inHg or mmHg	The meter shows the atmospheric pressure at the current elevation, which is necessary for accurate measurements. This pressure reading will not agree with readings from sources such as weather stations, which report atmospheric pressure at sea level.
Averaging interval	Off 30 s 60 s 90 s 3 min 5 min	The averaging interval is useful for samples that contain a lot of air bubbles, for example in an aeration basin. The air bubbles cause the dissolved oxygen readings to vary greatly from one reading to the next. To make the readings more consistent, increase the averaging interval. The meter will take measurements at the same frequency but show only the average over a longer interval.
<b>Note:</b> Labels and options may vary depending on units selected.		



7. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.
8. Push **EXIT** until the meter returns to the measurement mode.

## Change calibration options


  
**Calibration Reminder**  
 Reminder Repeat: 8 h  
 Expires: Reminder + 30 min


  
 Exit    ◆    Select

1. Make sure a probe is connected to the meter.
2. Push the **METER OPTIONS** key and select (Probe Model) Settings.
3. Select Modify Current Settings.
4. Select Calibration Options.
5. Update the settings. Refer to [Table 3](#).

**Table 3 Calibration options settings**

Settings	Options	Description
Calibration	User — 100% User — 100% with 0 User — mg/L User — mg/L with 0 Resolution	Water-saturated air (100%) calibration
Calibration Reminder	Reminder Repeat On	8 h, 12 h, 1 d, 2 d, 5 d, 7 d
	Expires	Immediately, Reminder + 30 min, Reminder + 1 h, Reminder + 2 h, Continue Reading

6. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.
7. Push **EXIT** until the meter returns to the measurement mode.

## Troubleshooting

Message or symptom	Possible cause	Action
Probe not supported	Software not updated	Update the HQd software to the newest revision at <a href="http://www.hach.com/SoftwareDownloads">www.hach.com/SoftwareDownloads</a> . Refer to the HQd Series Meter manual.
	HQd meter does not support IntelliCAL probe.	Contact a Hach Technical Support Representative.
Connect a probe or Probe requires service	Probe not connected properly	Disconnect, then connect the probe. Tighten the locking nut.
	Software not updated	Update the HQd software to the newest revision at <a href="http://www.hach.com/SoftwareDownloads">www.hach.com/SoftwareDownloads</a>
	Damaged probe	Verify connectivity with another probe or meter to confirm isolated issue with probe. Contact a Hach Technical Representative.
Out of range	Sensor cap scratched or damaged	Replace the LBOD sensor cap.
	Large number of methods stored on probe.	Continue to let probe connect. Do not disconnect probe.
	Temperature and/or pressure sensor error.	Verify that both temperature and pressure sensors are reading accurately. <sup>1</sup>
	Sample outside of specifications	Make sure that the sample measurement is within the specifications of the probe or contact a Hach Technical Representative.
Slope out of range	Probe not prepared for sample	Allow the probe to reach equilibrium in a selected calibration environment (e.g. water saturated air) and repeat calibration.
	Calibration method settings	Verify the calibration standards in the method are correct.
	Sensor cap loose, scratched or damaged	Install or replace the sensor cap.
	Temperature and pressure errors	Verify temperature and pressure are reading accurately. <sup>1</sup>
	LED lights not functioning	Contact a Hach Technical Representative.
Stirrer assembly not rotating	AC power not connected	Connect AC power
	Switch in OFF position	Push the ON/OFF switch and verify that the indicator light is illuminated.
	Bent stirrer assembly	Remove the bearing clip and reposition the bearing position in the bearing pocket. If ineffective, replace the stirrer assembly.
Stirrer assembly noisy (> 70 dB Tested 1 inch from source in < 5 dB background)	Bent stirrer assembly	Remove the bearing clip and reposition the bearing position in the bearing pocket. If ineffective, replace the stirrer assembly.
	Stirrer assembly contacting BOD container.	Reposition the stirrer assembly in the BOD bottle or replace the stirring assembly.
O <sub>2</sub> Sensor 0 days remaining	There are 0 days remaining in the life of the LBOD sensor cap.	Replace the LBOD sensor cap. Calibration will be allowed, however the calibration icon along with a question mark will appear on the measurement screen even if the calibration has passed.
	Meter currently set to incorrect date and time.	Disconnect the probe from the meter. Set the correct date and time in the Meter Options menu. Connect the probe and verify that message has been removed.
	Software not updated	Update the HQd software to the latest version and test again.
O <sub>2</sub> Sensor ## of days remaining	There are 30 days or fewer remaining in the life of the LBOD sensor cap.	Replace the LBOD sensor cap soon.

## Troubleshooting (continued)

Message or symptom	Possible cause	Action
Calibration failed: outside of acceptance criteria/Temperature out of range/Offset out of limits	Water Saturated air equilibration not reached	Allow longer equilibration time.
	Sensor cap loose, scratched or damaged	Reposition or replace the LBOD sensor cap.
	Temperature and/or pressure sensor malfunction error	Verify that both temperature and pressure sensors are reading correctly and within range. <sup>1</sup>
	Damaged probe	Verify both blue and red LEDs are illuminated. If not, replace the probe or contact a Hach Technical Representative (800-227-4224).

<sup>1</sup> The pressure as measured by the LBOD or LDO is what is referred to as atmospheric pressure and is not corrected to sea level. Weather station pressures are reported at sea level and commonly referred to as “mean sea level pressure.” As a result, the LBOD or LDO will not read the same as most household or professional barometers or weather station reports (which are compensated), unless reported at sea level. In order to compare the pressure results obtained from the LBOD or LDO probe barometers and these compensated barometers, it is necessary to first compensate the pressure reported by the probes mathematically.

## Replacement parts

Description	Quantity	Item Number
IntelliCAL LBOD probe, standard, with 1.8 m cable	1	LBOD10101
USB and AC power adapter for HQd meters (included with the HQ40d)	each	5826300

## Accessories

Description	Quantity	Item Number
BOD bottle (300 mL)	1	62100
BOD bottle (300 mL)	6/pkg	62106
Citizen PD-24 USB handy printer, 120-220 VAC	1	2960100
Color coded probe clips (5 color coded sets)	10/pkg	5818400
Erlenmeyer flask (250 mL)	1	2089846
Printer paper for PD-24, thermal	5/pkg	5836000
Probe holder for HQd meter (IntelliCAL standard models only)	1	5829400
USB keyboard for HQd meters (must have 5826300)	1	LZV582

## Consumables

Description	Quantity	Item Number
BOD standard solution, 300 mg/L GGA, 10-mL Voluette® ampules (25x)	16/pkg	1486510
Buffer solution, APHA, for BOD, pH 7.2, 1 43153 phosphate type (1 L)	1	43153
Calcium chloride solution, APHA (500 mL)	1	42849
Cobalt chloride solution (500 mL)	1	1422249
eZGGA BOD standards	20/pkg	2514420
Ferric chloride solution, APHA (1 L)	1	42953
LBOD sensor cap	1	5838000
Magnesium sulfate solution, APHA (500 mL)	1	43049
Nitrification inhibitor (TCMP) - (200 tests), 25 g	1	253335
Nitrification inhibitor (TCMP) - (2500 tests), 500 g	1	253334

## Consumables (continued)

Description	Quantity	Item Number
Nitrification inhibitor (ATU), 50 g	1	2845425
Nutrient buffer pillow, 0.5 mL (for preparing 300 mL of dilution water) (50x)	1	1416066
Nutrient buffer pillow, 3 mL (for preparing 3 L of dilution water) (50x)	1	1486166
Nutrient buffer pillow, 4 mL (for preparing 4 L of dilution water) (50x)	1	2436466
Nutrient buffer pillow, 6 mL (for preparing 6 L of dilution water) (50x)	1	1486266
Nutrient buffer pillow, 19 mL (for preparing 19 L of dilution water) (25x)	1	1486398
Polyseed BOD inoculum (50 tests), 50 1 2918700 capsules	1	2918700
Sodium sulfite, ANHYD ACS (454g)	1	19501H
Stirrer assembly with paddle	1	5850800
Stirrer paddle only	1	5852700

## HACH Company World Headquarters

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

International customers:  
Tel +001 (970) 669-3050  
Fax +001 (970) 669-2932  
intl@hach.com

