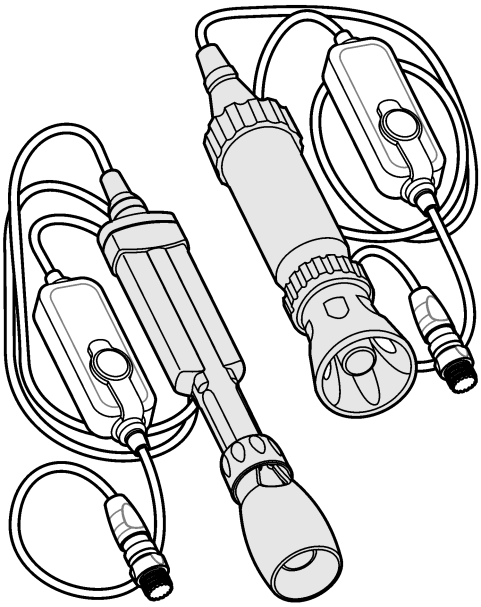
DOC022.53.80021

# LDO101

05/2022, Edition 5

**User Manual**

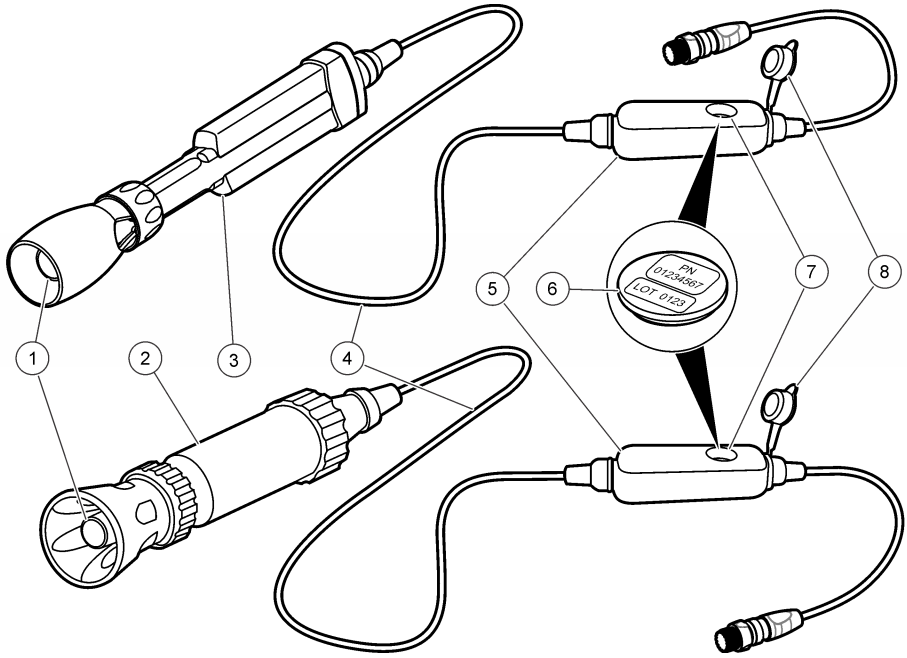


# Section 1 Product overview

The Intellical LDO101 series probes are digital, luminescent dissolved oxygen probes that measure the dissolved oxygen concentration in wastewater, drinking water and general water samples. The probes have temperature and absolute air pressure sensors for accurate dissolved oxygen measurements. The standard probes are for laboratory use. The rugged probes are for field use. Refer to Figure 1.

***Note:*** *For BOD applications, use the LBOD10101 probe, which has the LDO technology and a stirrer for measurements in a BOD bottle.*

**Figure 1 Probe overview**




| | |
|---|---|
| **1** LDO sensor cap | **5** Pressure sensor module |
| **2** Rugged probe | **6** iButton®[1,2] |
| **3** Standard probe | **7** iButton compartment |
| **4** Cable | **8** Pressure sensor module cap |

# Section 2 Specifications

Specifications are subject to change without notice.

| Specifications | Details |
|---|---|
| Probe type | Luminescent dissolved oxygen (LDO) probe |
| Dissolved oxygen range | 0.1 to 20.0 mg/L (ppm); 1 to 200% saturation |

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

[2] An iButton is no longer supplied with the probe. It is not necessary for new probes to have an iButton, because the calibration data is installed on the probe at the factory.

| Specifications | Details |
|---|---|
| Dissolved oxygen accuracy | ±0.1 mg/L for concentrations less than 8 mg/L<br>±0.2 mg/L for concentrations more than 8 mg/L |
| % saturation resolution | 0.1% |
| Stabilization time | T90% at 10 seconds (when the solution is stirred) |
| Temperature resolution | 0.1 °C (0.18 °F) |
| Temperature accuracy | ±0.3 °C (±0.54 °F) |
| Pressure resolution | 1 mbar (1 hPa) |
| Pressure accuracy | ±0.8% |
| Operating temperature | 0 to 50 °C (32 to 122 °F) |
| Storage temperature | 0 to 40 °C (32 to 104 °F) |
| Minimum immersion depth | 25 mm (0.98 in.) |
| Dimensions (standard) | Diameter: 29 mm (1.14 in.)<br>Length: 191 mm (7.52 in.)<br>Cable length: LDO10101: 1 m (3.28 ft); LDO10103: 3 m (9.84 ft) |
| Dimensions (rugged) | Diameter: 46 mm (1.8 in.)<br>Length: 223 mm (8.7 in.)<br>Cable length: LDO10105: 5 m (16.4 ft); LDO10110: 10 m (32.8 ft); LDO10115: 15 m (49.2 ft); LDO10130: 30 m (98.4 ft) |
| Cable connection | M12 digital output and connector |
| Warranty | 3 years on the probe, 1 year on the sensor cap. This warranty covers manufacturing defects, but not improper use or wear. |
| Certifications | CE, FCC/ISED |

# Section 3 Safety information

## 3.1 Intended use

The Intellical probes are intended for use by individuals who measure water quality parameters in the laboratory or in the field. The Intellical probes do not treat or alter water.

## 3.2 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.

## 3.3 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

| | |
|---|---|
|  | Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user. |

## 3.4 Product hazards

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

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

# Section 4 Preparation for use

Prepare the probe for calibration and measurement as follows. Do not touch the protective black layer on the LDO sensor cap.

1. Remove the shroud. Refer to Remove or install the shroud on page 9.
2. Install the LDO sensor cap and tighten by hand. Do not tighten more than is necessary for a good seal.
3. Soak the probe in 100 mL of tap water for 30 minutes before use. For probes that will be in aqueous solutions for more than 6 hours continuously, soak the probe for 72 hours.

   ***Note:*** *After 72 hours, the LDO sensor cap is fully hydrated.*
4. Make sure that the meter has the correct date and time settings. The service-life time stamp in the probe comes from the date and time settings in the meter.

   ***Note:*** *Some meters automatically open the date and time settings when the meter starts for the first time, or after battery replacement.*
5. Connect the probe to the meter.
6. Install the shroud. Refer to Remove or install the shroud on page 9.

   ***Note:*** *Make sure to install the shroud during field use to prevent damage to the sensing elements. The product warranty does not include such damage.*

# Section 5 Calibration

The procedure that follows is applicable to meters that can connect to Intellical LDO probes. Refer to the applicable meter documentation for meter operation and probe-specific settings.

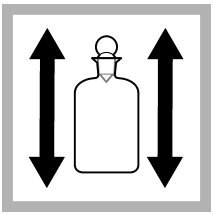
## 5.1 Calibration notes

Read the notes that follow before calibration.

- Measure samples as soon as possible after collection.
- Remove the shroud before calibration. Refer to Remove or install the shroud on page 9.
- The factory calibration is sufficient for most applications. If necessary, set the probe to use a different calibration option in the probe settings menu.
- Use the single display mode for calibration when more than one probe is connected to the meter (if applicable).
- Calibrate the probes and verify the calibration regularly for best results. Use the meter to set calibration reminders.
- The calibration data is stored in the probe. When a calibrated probe is connected to a different meter with the same calibration options, a new calibration is not necessary.
- Air bubbles below the sensor when in solution can cause a slow response or error in the calibration. Make sure to remove air bubbles during calibration.
- The meter uses the slope value shown at the end of the calibration to monitor the condition of the sensor cap.

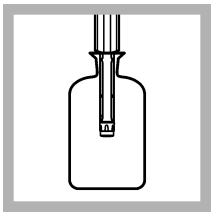
## 5.2 LDO water-saturated air (100%) calibration procedure

**1.** Fill a BOD bottle ¼ full with water.

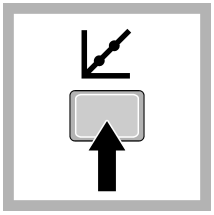


**2.** Put a stopper on the bottle and shake for 30 seconds.

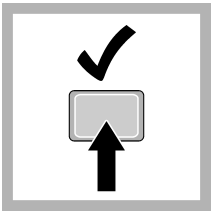
**3.** Rinse the probe with deionized water. Dry the probe with a lint-free cloth.



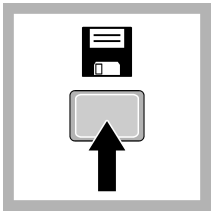
**4.** Put the probe in the bottle. Wait 10 minutes or more (30 minutes for best results) for the contents to adjust to ambient temperature.



**5.** Go to the calibrate menu. Select the probe, if applicable.



**6.** Read the dissolved oxygen value. The display shows 100% when the reading is stable.



**7.** Save the calibration.

# Section 6 Sample measurement

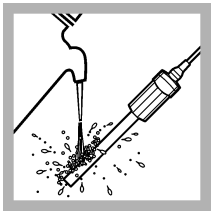
The procedure that follows is applicable to meters that can connect to Intellical LDO probes. Refer to the applicable meter documentation for meter operation and probe-specific settings.

## 6.1 Sample measurement notes

Read the notes that follow before sample measurements.

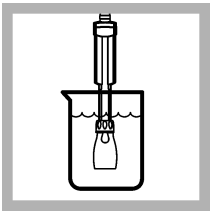
- Do not submerge the pressure sensor module.
- Salinity changes the solubility of oxygen in water. Measure the sample salinity and enter the value in the probe settings of the meter.
- To decrease the measurement time, condition the probe and try different stir rates.
- Rinse the probe with deionized water and dry with a lint-free cloth between measurements to prevent contamination.
- If complete traceability is necessary, enter a sample ID and operator ID before measurement. Refer to the meter manual for instructions.
- The meter automatically saves the measurement data when the user manually reads each data point and when the meter is set to read at regular intervals. The user must manually save each data point when the meter is set to read continuously.
- Air bubbles below the sensor can cause a slow response or error in the measurement. Make sure to remove air bubbles before and during measurements.
- Make sure to install the shroud before field use to prevent damage to the sensing elements. Refer to Remove or install the shroud on page 9. The probe warranty does not include such damage.
- To deploy a rugged probe at a distance, toss the probe body with a slow underhand throw. Do not throw the probe by the cable to prevent damage to cable, the probe or the user.

## 6.2 Sample measurement procedure

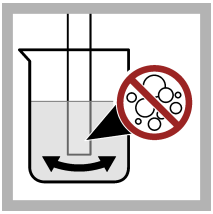


**1.** Rinse the probe with deionized water. Dry the probe with a lint-free cloth.

Rugged probes: install the shroud.

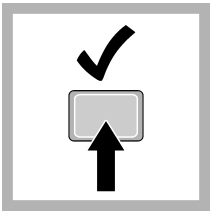


**2.** Put the probe in the sample 25 mm (1 inch) or more. Do not put the probe on the bottom or sides of the container. Stir the sample at a moderate rate or put the probe in flowing conditions.



**3.** Shake the probe from side to side to remove air bubbles.

Rugged probes: move the probe up and down to remove air bubbles.



**4.** Stir gently, then read the dissolved oxygen value of the sample. The display shows the dissolved oxygen value when the reading is stable.

# Section 7 Maintenance

## 7.1 Clean the probe

**NOTICE**

The LDO sensor cap has a protective black layer to increase the life of the LDO sensor. Do not rub the black layer to clean the LDO sensor cap. Do not use alcohol or other organic solvents to clean the LDO sensor cap.

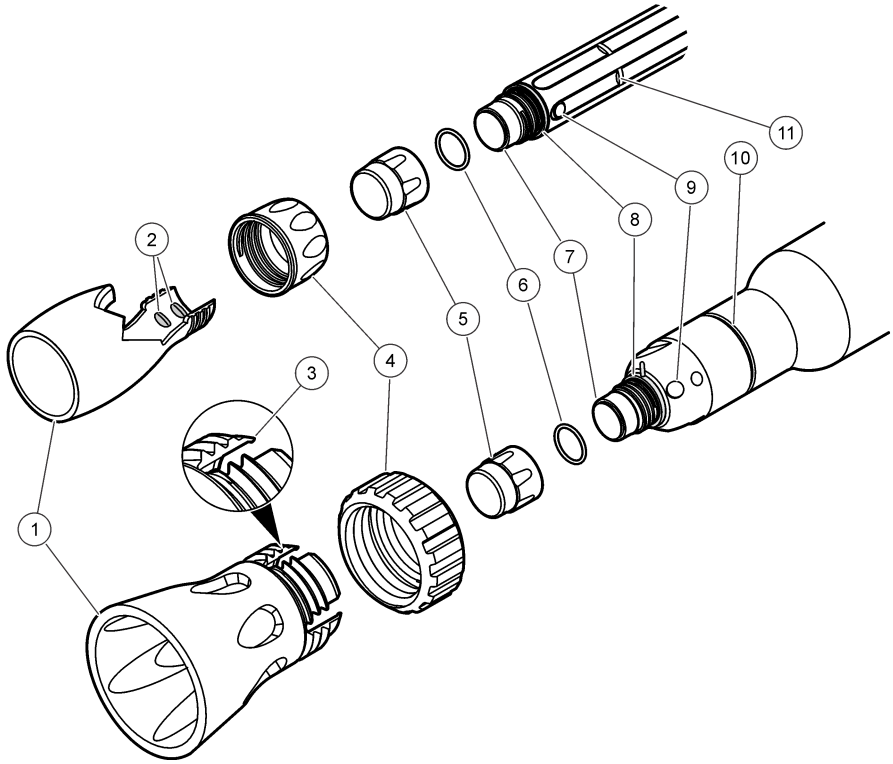
Keep the LDO sensor cap clean for best results. Use only water and neutral detergents to clean the probe.

1. Remove the shroud. Refer to Remove or install the shroud on page 9.
2. If water is seen between the LDO sensor cap and lens:
   a. Remove the LDO sensor cap.
   b. Blot dry the LDO sensor cap and lens with a soft dry cloth. Refer to Figure 2.

      If the probe lens is dirty, rinse the lens with dilute isopropyl alcohol (10% or less) or deionized water. Blot dry with a non-abrasive cloth. Do not rub the lens or use abrasive cleaners.
   c. Install the LDO sensor cap and tighten by hand. Do not tighten more than is necessary for a good seal.
3. Put the probe in a neutral cleaning solution and stir the solution. Do not rub or remove the black layer on the LDO sensor cap.

   ***Note:*** *If disinfection is necessary, put the probe in a dilute alcohol solution for a maximum of 2 minutes and rinse immediately with deionized water. Do not use an alcohol solution more than two times a day.*
4. Rinse the probe with deionized water. Blot dry with a lint-free cloth.
5. Install the shroud. Refer to Remove or install the shroud on page 9.

**Figure 2 Probe exploded view**




| | |
|---|---|
| **1** Shroud | **7** Probe lens |
| **2** Locking ridges (8x) | **8** Cap seal |
| **3** Locking rib | **9** Temperature sensor |
| **4** Locking ring | **10** Locking groove |
| **5** LDO sensor cap | **11** Locking ribs (4x) |
| **6** O-ring | |

## 7.2 Replace the sensor cap and iButton

Replace the LDO sensor cap after 365 days, or more frequently if the cap becomes damaged or dirty. The LDO sensor cap and iButton operate together and must be replaced at the same time. Refer to the instructions that are supplied with the LDO sensor cap replacement kit.

## 7.3 Remove or install the shroud

Remove the shroud during calibration and maintenance. Refer to Figure 3. Keep the shroud installed on the probes during sample measurements to prevent damage to the LDO sensor cap. Refer to Figure 4.

**Figure 3 Remove the shroud**

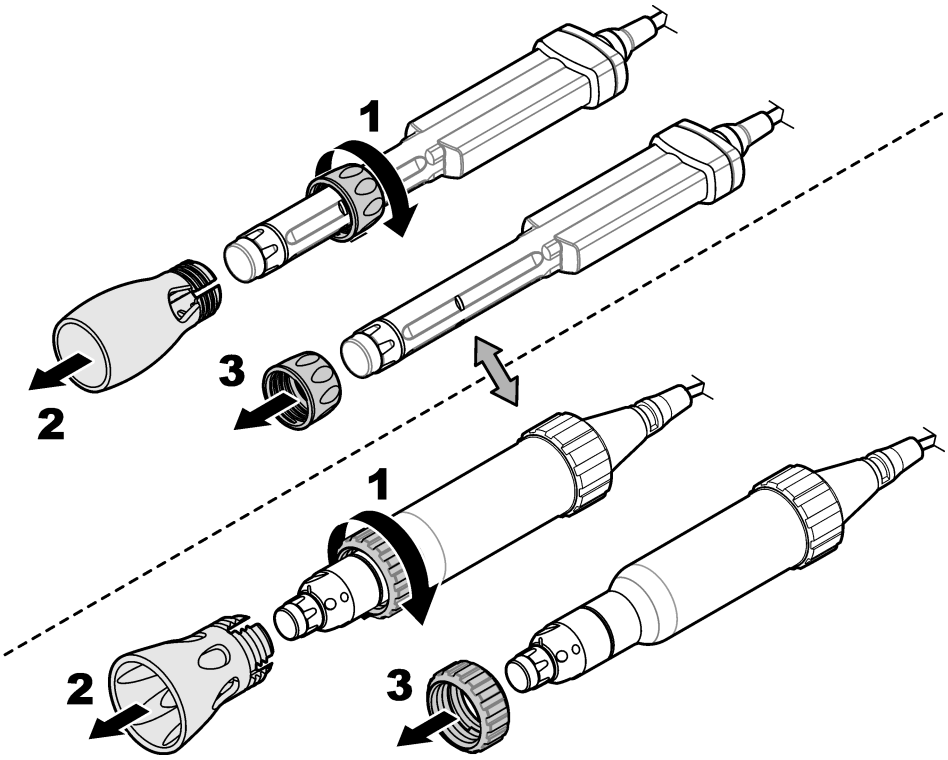
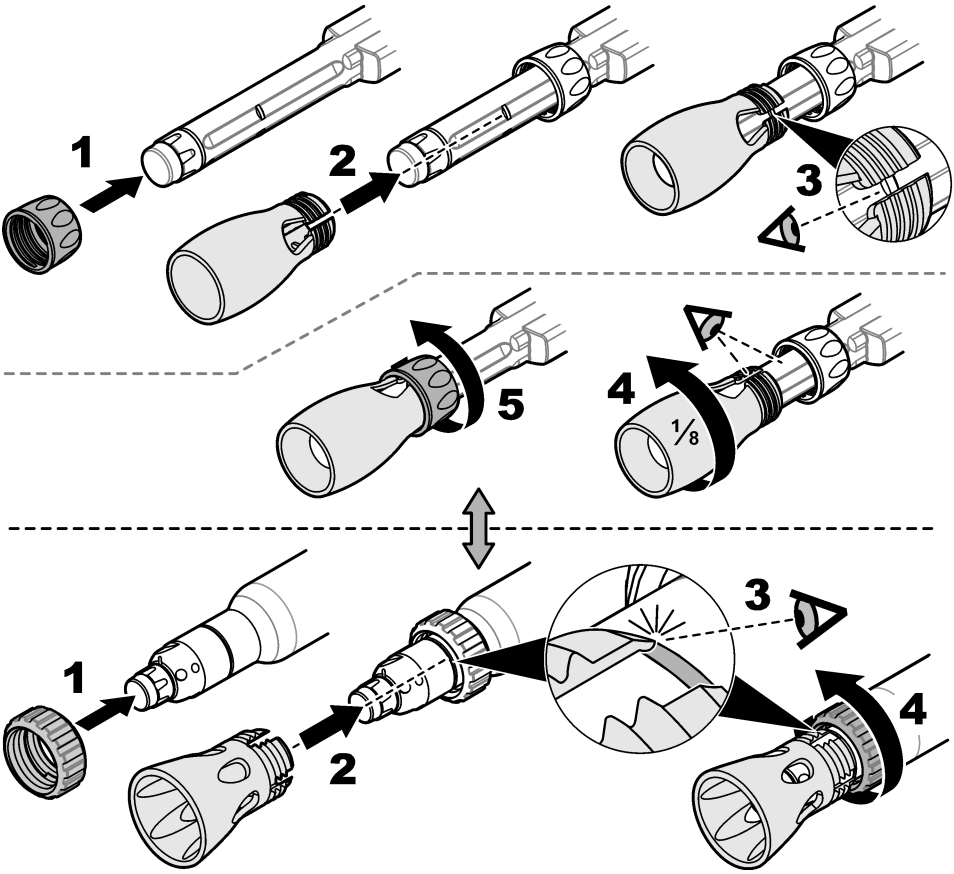


**Figure 4 Install the shroud**




## 7.4 Storage

The storage conditions for the LDO probe can be dry, wet, or humid. Wet storage conditions help to keep the LDO sensor cap fully hydrated.
***Note:*** *After 72 hours of storage in tap water, the LDO sensor cap is fully hydrated.*

For daily measurements in the laboratory, keep the probe in a humid environment such as a BOD bottle filled approximately ¼ full with tap water. If the probe is used to monitor DO concentrations continuously for more than 6 hours, keep the probe in tap water.

When the probe is used for short periods (less than 6 hours), the storage can be dry. Before dry storage, rinse the probe in deionized water and blot dry. Soak the probe in tap water for 30 minutes before use.

## Section 8 Troubleshooting

| Problem | Possible cause | Solution |
|---|---|---|
| Decreased probe performance causes slow stabilization and prevents accurate calibrations or measurements. | The sensor cap is loose or damaged. | Tighten or replace the sensor cap. Always replace the sensor cap and the iButton at the same time. Refer to Replace the sensor cap and iButton on page 9. |
| | Water is between the sensor cap and the probe lens. | Remove the sensor cap and dry the probe lens. Refer to Clean the probe on page 7. |
| | The sensor cap is not sufficiently conditioned. | Keep the probe in the BOD bottle with some water for more time, then try the calibration again. |
| | The temperature or pressure sensor does not operate correctly. | Compare the temperature and pressure readings of the probe with external measurements. The pressure sensor reads absolute pressure, which is not adjusted to sea level. If the measurements are not correct, contact technical support. |
| | The lot code on the iButton is not the same as the lot code on the sensor cap. | Replace the sensor cap and iButton. |
| Sample properties cause slow stabilization or inaccurate measurements. | The measurement was not adjusted for salinity in the sample. | Measure the salinity of the sample and enter the value as a salinity correction factor in the meter. |
| Procedure problem causes slow stabilization and prevents accurate calibrations or measurements. | Air bubbles are around or below the probe tip. | Carefully tap or shake the probe to remove air bubbles. |
| | The LDO sensor cap is in direct sunlight. | Install the protective shroud. |
| | The calibration mode in the meter is set to factory. | If user calibration is necessary, change the calibration mode in the meter. |

## Section 9 Consumables

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

| Description | Quantity | Item no. |
|---|---|---|
| LDO sensor cap replacement kit (includes iButton) | 1 | 5811200 |
| BOD bottle with glass stopper, 300 mL | 1 | 62100 |
| Beaker, 250 mL, polypropylene | 1 | 108046 |
| Probe stand for standard Intellical probes | 1 | 8508850 |
| Probe cable depth markers for rugged Intellical probes | 5/pkg | 5828610 |
| Disposable wipes, 11 x 22 cm | 280/pkg | 2097000 |
| Wash bottle, polyethylene, 500 mL | 1 | 62011 |
| Shroud kit for standard LDO probes | 1 | 5832500 |
| Shroud kit for rugged probes | 1 | 5825900 |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