EXTECH INSTRUMENTS

USER GUIDE

Dissolved Oxygen (DO) Meter

SD Card real-time Datalogger

Model SDL150

Introduction

Congratulations on your purchase of the Extech SDL150 Dissolved Oxygen Meter, an SD Logger Series meter. This meter displays and stores Dissolved Oxygen readings in the 0 to 20.0mg/L range, Oxygen in air from 0 to 100%, and Temperature from 0 to 50°C (32 to 122°F). The SDL150 uses a polarographic oxygen probe that also measures temperature. %Salt and Altitude compensation can be fine tuned by the user in the Setup mode. Logged data readings are stored on an SD card for transfer to a PC. In addition, an RS232 port allows data streaming to a PC. This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.

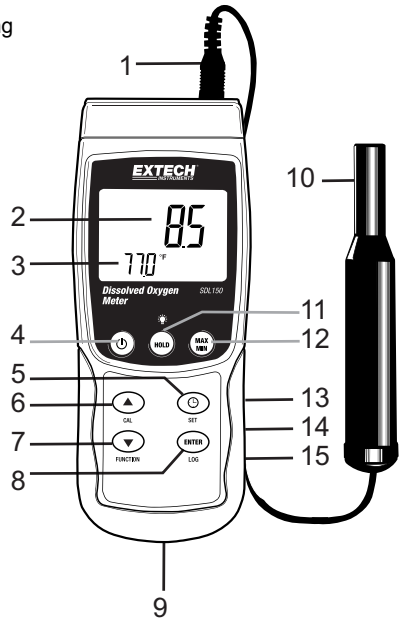
Safety

International Safety Symbols

This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.

Meter Description

1. Oxygen Probe Input Plug
2. Dissolved Oxygen or Oxygen in Air reading
3. Temperature reading
4. Power ON-OFF key
5. SET and Clock key
6. Up arrow ▲ / CAL key
7. Down arrow ▼ / Function key
8. ENTER and LOG key
9. SD card slot
10. Dissolved Oxygen/Temperature Probe
11. HOLD and Backlight key
12. MAX-MIN key
13. PC interface jack
14. Reset button
15. Power Adaptor jack



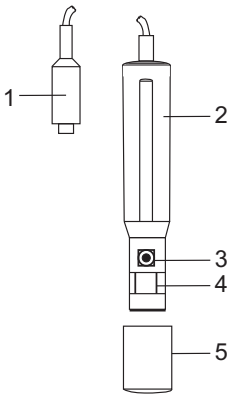
Notes:

Items 13, 14, and 15 are located behind the snap-off compartment cover on meter's right side.

Battery compartment, tilt stand, and tripod mount are located on the rear of the instrument

Probe Description

1. Probe to meter input plug
2. Probe body handle
3. Temperature Sensor
4. Probe head
5. Protective cap



Getting Started

Accessories

- The SDL150 includes batteries, SD card, probe (with spare probe head and diaphragm), electrolyte, and carry case. If items are missing please contact the distributor through which this product was purchased
- Optional AC adaptor and universal AC adaptors (UK, EU, US), as well as replacement probes, membranes, and electrolyte are available through Extech distributors

Power ON-OFF

- Press and hold the power button ⏻ for at least 1.5 seconds to power ON the meter.
- Press and hold the power button for 1.5 seconds to power OFF the meter.
- This meter is powered by six (6) 1.5VDC 'AA' batteries or by optional AC adaptor. If the meter will not switch ON please check that fresh batteries are installed in the rear battery compartment or, in the case of the AC adaptor, check that the adaptor is connected correctly to the meter and to an AC source.

Measurements

Connect the Oxygen Probe

The supplied probe connects to the keyed input jack (DIN style) at the top of the meter.

Measurement Ranges

Dissolved Oxygen measurements are displayed in the range of 0 to 20mg/L in the upper, larger digit display area of the meter's LCD. Measurements outside of this range will yield dashes (- - -) on the meter's LCD. Oxygen in Air measurements (O2) are displayed in the range of 0 to 100%. Temperature measurements are displayed in the range of 0 to 50°C (32 to 122°F) on the lower LCD line in smaller sized digits.

Calibration Considerations

For best accuracy, calibrate the meter with the probe before each use. The calibration should be performed before first use and after long periods of non-use. The calibration procedure is provided in a later section of this user guide.

Taking Dissolved Oxygen Measurements

1. Immerse the DO probe into the solution under test to a depth of at least 10cm. The depth specification is important since the temperature measurement of the solution and the automatic temperature compensation circuitry rely on the probe depth to operate correctly.
2. Allow the test to stabilize for several minutes to achieve thermal equilibrium between the probe and measurement sample.
3. To successfully measure DO the velocity of the solution striking the probe must be at least 0.2-0.3m/s (meters per second); if not, simply agitate the solution with the probe while waiting for thermal equilibrium to be achieved.
4. In laboratory environments use of a magnetic agitator to ensure proper velocity is recommended. In this way, errors due to the diffusion of the oxygen present in the surrounding air are minimized.
5. The Dissolved Oxygen measurements are displayed on the upper, larger digit display area of the meter's LCD. Measurements outside of the specified range will yield dashes (- - -). Temperature measurements are displayed in the range of 0 to 50°C (32 to 122°F) on the lower LCD line in smaller sized digits.
6. %SALT, Altitude (height) compensation, temperature units of measure, and other parameters, can be modified in the SETUP mode (refer to the SETUP mode section later in this guide).

Taking Oxygen in Air Measurements

1. The probe measures Oxygen in the air surrounding the probe (in percent).
2. The meter defaults to the DO measurement mode. Therefore, press and hold the FUNCTION button for 1.5 seconds to switch to the %O2 mode (oxygen in air). The displayed unit of measure will switch from **mg/L** to **02**. To return to the DO measurement mode simply press and hold the FUNCTION button again for 1.5 seconds.
3. The Oxygen in Air measurements are displayed on the upper, larger digit display area of the meter's LCD. Measurements outside of the specified range will yield dashes (- - -). Temperature measurements are displayed in the range of 0 to 50^{o}C (32 to 122^{o}F) on the lower LCD line in smaller sized digits.

Calibration

Meter Zero calibration

1. Disconnect the DO probe to the input jack at the top of the meter
2. Power the meter by pressing and holding the power button for 1.5 seconds
3. Press and hold the FUNCTION button for 1.5 seconds to switch from **mg/L** mode to **O2** mode
4. Press and hold the CAL button for 1.5 seconds. The CAL icon will appear
5. Momentarily press the ENTER button while the CAL icon is displayed. The display will indicate a countdown from 30 to zero. Note that if the ENTER button is not pressed while the CAL icon is being displayed, the calibration procedure must be attempted again
6. When the countdown finishes the zero calibration is complete.

20.9% Oxygen in Air Calibration

1. Connect the DO probe to the input jack at the top of the meter
2. Power the meter by pressing and holding the power button for 1.5 seconds
3. Press and hold the FUNCTION button for 1.5 seconds to switch from **mg/L** mode to **O2** mode.
4. Allow the probe to stabilize for at least 5 minutes in a large well ventilated environment.
5. Press and hold the CAL button for 1.5 seconds. The CAL icon will appear
6. Momentarily press the ENTER button while the CAL icon is displayed. The display will indicate a countdown from 30 to zero. Note that if the ENTER button is not pressed while the CAL icon is being displayed, the calibration procedure must be attempted again
7. When the countdown finishes the calibration is complete
8. If the calibration is unstable, check the electrolyte level and/or replace the probe head (includes diaphragm)

Probe Zero Calibration

The 0% calibration is available for high accuracy measurements at low O^2 levels. The calibration requires a Zero Oxygen Solution which can be purchased from most laboratory supply distributors. This calibration is not required for typical O^2 measurements.

First check to see if zero calibration is necessary.

Measure a 0% Oxygen solution. If the meter reads less than +/- 0.04mg/L then nothing else is required. If the meter reads above this threshold then perform the calibration below.

1. Power the meter on and set it to DO mode (you should see mg/L in the top right of display).
2. Immerse the probe in 4” of zero oxygen solution; agitate or slowly stir the probe in the solution to remove any air bubbles and allow the reading to stabilize.
3. Once the reading has stabilized, press and hold the UP and DOWN arrow buttons until CAL 0 appears in the lower portion of the display.
4. Release the UP and DOWN arrow buttons; calibration is complete.

Probe Storage

For short term storage, the probe should be stored in a moist environment to keep the membrane from drying out and needing replacement. Moisten the sponge with distilled water in the protective cap. Do not store it directly in the water since that could encourage algae growth on the probe.

Probe Maintenance

First time use

Before first use, ensure that the probe is filled with the supplied electrolyte solution (refer to the electrolyte filling instructions later in this guide)

Subsequent uses

1. Ensure proper electrolyte level in probe
2. Calibrate the probe with the meter before each use
3. Replace the probe head and diaphragm if the diaphragm appears soiled (re-calibrate after replacing diaphragm)

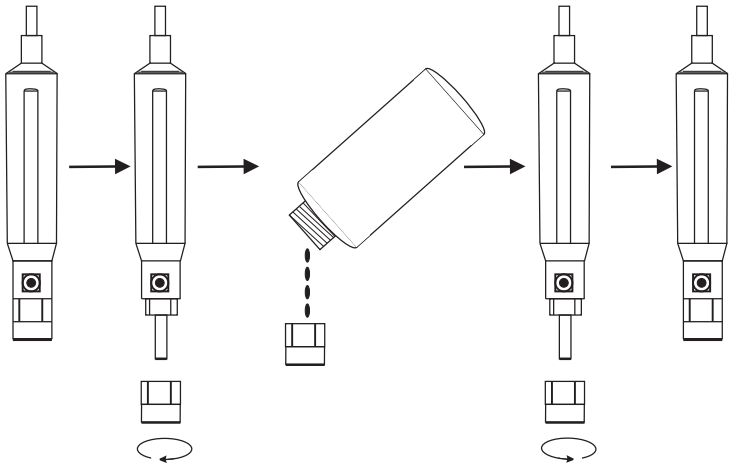
Diaphragm considerations

The main oxygen probe component is the thin Teflon diaphragm housed in the tip of the supplied probe. The diaphragm is made permeable by the oxygen molecules but not by the considerably larger molecules contained in the electrolyte. Due to this characteristic, the oxygen may diffuse throughout the electrolyte solution contained in the probe and its concentration is quantified by the meter's measurement circuitry.

Refilling the Probe's Electrolyte

Refer to the illustrated instructions below.

1. Unscrew the probe head
2. Pour out the old electrolyte from the probe head container
3. Fill the probe head container with the fresh electrolyte
4. Replace the probe head onto the probe body
5. When not in use the probe head should be kept in the protective cover



Display Backlight

To turn the display backlight ON or OFF, press and hold the backlight button for at least 1.5 seconds.

Data Hold

To freeze a displayed reading on the LCD, momentarily press the HOLD button (the HOLD display icon will appear). To release the held reading, press the HOLD button again.

Max-Min Reading Record and Recall

For a given measurement session, this meter can record the highest (MAX) and the lowest (MIN) readings for later recall.

1. Press the MAX-MIN button momentarily to access this mode of operation (REC icon appears) the meter is now recording the MAX and MIN readings.
2. Press the MAX-MIN button again to view the current MAX readings (MAX icon appears). The readings on the display are now the highest readings encountered since the REC icon was switched on (when the MAX-MIN button was first pressed).
3. Press the MAX-MIN button again to view the current MIN readings (MIN icon appears). The readings on the display are now the lowest readings encountered since the REC icon was switched on (when the MAX-MIN button was first pressed).
4. To exit the MAX-MIN mode, press and hold the MAX-MIN button for at least 1.5 seconds The meter will beep, the REC-MAX-MIN icons will switch off, the MAX-MIN memory will clear, and the meter will return to the normal operating mode.

Setup Mode

Basic settings at a glance

To view the current configuration of the meter with regard to time, date, and datalogging sampling rate press the SET button momentarily. The meter will now display the configuration in quick succession. Repeat as necessary to observe all the information.

Accessing the Setup mode

1. Press and hold the SET button for at least 1.5 seconds to access the Setup menu.
2. Press the SET button momentarily to step through the available parameters. The parameter type is shown on the bottom of the LCD and the current selection for that type is shown above it.
3. When a parameter is displayed that is to be changed, use the arrow keys to change the setting. Press the ENTER button to confirm a change.
4. Press and hold the SET button for at least 1.5 seconds to exit the Setup mode. Note that the meter automatically switches out of the Setup mode if no key is pressed within 7 seconds.
5. The available Setup parameters are listed below. Additional detailed information is provided below this list:

dAtE	Set the clock (Year/Month/Date; Hours/Minutes/Seconds)
SP-t	Set the datalogger sampling rate (Hours/Minutes/Seconds)
PoFF	Automatic power-off (Enable/disable the auto-power off function)
bEEP	Set the beeper sound ON/OFF
dEC	Set the numerical format; USA (decimal: 20.00) or European (comma: 20,00)
Sd F	Format the SD memory card
t-CF	Select the desired unit of measure for temperature C or F
SALT	%Salt compensation (0 to 50%)
HEIGHT	Altitude compensation (in meters) up to 8900 meters
HEIGHT-F	Altitude compensation (in feet) up to 29300 feet

Setting the Clock Time

1. Access the **dAtE** parameter.
2. Use the arrow keys to change a value
3. Use the ENTER button to step through the selections
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).
5. The clock will keep accurate time even when the meter is switched off. However, if the battery expires the clock will have to be reset after fresh batteries are installed.

Setting the Datalogger Sampling Time (Rate)

1. Access the **SP-t** parameter.
2. The sampling rate can be set from '0' seconds (manual log mode) up to 8 hours, 59 minutes, and 59 seconds.
3. Use the ENTER button to move through the Hours, Minutes, and Seconds digit groups and use the arrow keys to change the digit values.
4. Press the ENTER button to confirm the entry.
5. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Enabling/Disabling the Auto Power OFF Feature

1. Access the **PoFF** parameter.
2. Use the arrow buttons to select ON (enable) or OFF (disable). With the Auto Power OFF feature enabled, the meter will automatically switch OFF after 5 minutes of inactivity.
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Beeper Sound ON or OFF

1. Access the **bEEP** parameter.
2. Use the arrow buttons to select ON (enable) or OFF (disable).
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Numerical Format (comma or decimal)

European and USA numerical formats differ. The meter defaults to USA mode where a decimal point is used to separate units from tenths, i.e. **20.00**; The European format uses a comma, i.e. **20,00** to separate units from tenths. To change this setting:

1. Access the **dEC** parameter.
2. Use the arrow buttons to select USA or EUro.
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

SD Card FORMATTING

1. Access the **Sd F** parameter.
2. Use the arrow buttons to select YES to format the card (select NO to abort). Note that all data on the card will be lost if formatting is attempted.
3. Press ENTER to confirm selection.
4. Press ENTER again to re-confirm.
5. The meter will automatically return to the normal operating mode when formatting is complete. If not, press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode.

Set the Temperature Units of Measure (°C or °F)

1. Access the **t-CF** parameter.
2. Use the arrow keys to select °**C or** °**F**.
3. Press ENTER to confirm setting.
4. Press and hold the SET key for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the %SALT Compensation

1. Access the **SALT** parameter.
2. Use the arrow keys to select the %SALT compensation (0 to 50%)
3. Press ENTER to confirm setting.
4. Press and hold the SET key for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Altitude Compensation (in meters) for DO measurements only

1. Access the **Height** parameter.
2. Use the arrow keys to select the altitude compensation (0 to 8900 meters in 100 meter steps)
3. Press ENTER to confirm setting.
4. Press and hold the SET key for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Altitude (F) Compensation (in feet) for DO measurements only

1. Access the **Height-F** parameter.
2. Use the arrow keys to select the altitude compensation (0 to 29,300 feet in 100 feet steps)
3. Press ENTER to confirm setting.
4. Press and hold the SET key for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

System Reset

If the meter's keys become inoperable or if the display freezes the Reset button can be used to reset the instrument.

1. Use a paper clip or similar item to momentarily press the reset button located on the lower right side of the instrument under the snap-off compartment cover.
2. After pressing the Reset button, switch the instrument ON by pressing and holding the POWER key for at least 1.5 seconds. If using the power adaptor unplug the adaptor and then plug it back in again to power the meter.

Datalogging

Types of Data Recording

- **Manual Datalogging:** Manually log up to 99 readings onto an SD card via push-button press.
- **Automatic Datalogging:** Automatically log data onto an SD memory card where the number of data points is virtually limited only by the card size. Readings are logged at a rate specified by the user.

SD Card Information

- Insert an SD card (from 1G size up to 16G) into the SD card slot at the bottom of the meter. The card must be inserted with the front of the card (label side) facing toward the rear of the meter.
- If the SD card is being used for the first time it is recommended that the card be formatted and the logger's clock set to allow for accurate date/time stamping during datalogging sessions. Refer to the Setup Mode section for SD card formatting and time/date setting instructions.
- European and USA numerical formats differ. The data on the SD card can be formatted for either format. The meter defaults to USA mode where a decimal point is used to separate units from tenths, i.e. **20.00**. The European format uses a comma, i.e. **20,00**. To change this setting, refer to the Setup Mode section.

Manual Datalogging

In the manual mode the user presses the LOG button to manually log a reading onto the SD card.

1. Set the sampling rate to '0' seconds as described in the Setup Mode section.
2. Press and hold the LOG button for at least 1.5 seconds and the DATALOGGER icon will appear on the LCD; the lower portion of the display will show "P N" (N = memory position number 1-99).
3. Momentarily press the LOG button to store a reading. The DATALOGGER icon will flash each time a data point is stored.
4. Use the ▲ and ▼ buttons to select one of the 99 data memory positions in which to record.
5. To exit the manual datalogging mode, press and hold the LOG button for at least 1.5 seconds. The DATALOGGER icon will switch off.

Automatic Datalogging

In automatic datalogging mode the meter takes and stores a reading at a user-specified sampling rate onto an SD memory card. The meter defaults to a sampling rate of one second. To change the sampling rate, refer to the Setup Mode section (the sampling rate cannot be '0' for automatic datalogging):

1. Select the sampling rate in the Setup Mode (refer to Setup Mode section) to a value other than zero.
2. Press and hold the LOG button for at least 1.5 seconds. The meter will flash the DATALOGGER icon at the selected sampling rate indicating that readings are now being automatically recorded to the SD card.
3. If a card is not inserted or if the card is defective, the meter will display EMPTY. In this case, switch the meter OFF and try again with a valid SD card.
4. Pause the datalogger by pressing the LOG button momentarily. The DATALOGGER icon will stop flashing and the sample rate will display for a short time. To resume logging simply press the LOG button again momentarily.
5. To terminate the datalogging session press and hold the LOG button for at least 1.5 seconds.
6. When an SD card is used for the first time a folder is created on the card and named **DOA01**. Up to 99 spreadsheet documents (each with 30,000 readings) can be stored in this folder.
7. When datalogging begins a new spreadsheet document named **DOA01001.xls** is created on the SD card in the DOA01 folder. The data recorded will be placed in the DOA01001.xls document until 30,000 readings are reached.
8. If the measurement session exceeds 30,000 readings, a new document will be created (DOA01002.xls) where another 30,000 readings can be stored. This method continues for up to 99 documents, after which another folder is created (DOA02) where another 99 spreadsheet documents can be stored. This process continues in this same fashion with folders DOA03 through DOA10 (last allowable folder).

SD Data Card to PC Data Transfer

1. Complete a datalogging session as detailed in above in the previous sections. Hint: For the first few tests, simply record a small amount of test data. This is to ensure that the datalogging process is well understood before committing to critical, large scale datalogging.
2. With the meter switched OFF, remove the SD Card.
3. Plug the SD Card directly into a PC SD card reader. If the PC does not have an SD card slot, use an SD card adaptor (available at most outlets where computer accessories are sold).
4. Power the PC and run a spreadsheet software program. Open the saved documents in the spreadsheet software program (see example spreadsheet data screen below).

Spreadsheet data example

	A	B	C	D	E	F	G
1	Position	Date	Time	Ch1_Value	Ch1_Unit	Ch2_Value	Ch2_Unit
2	1	7/29/2011	13:38:00	7.8	mg/L	20.9	Degree_C
3	2	7/29/2011	13:38:01	7.8	mg/L	20.9	Degree_C
4	3	7/29/2011	13:38:02	7.8	mg/L	20.9	Degree_C
5	4	7/29/2011	13:38:03	7.8	mg/L	20.9	Degree_C
6	5	7/29/2011	13:38:04	7.8	mg/L	20.9	Degree_C
7	6	7/29/2011	13:38:05	7.8	mg/L	20.9	Degree_C
8	7	7/29/2011	13:38:06	7.8	mg/L	20.9	Degree_C
9	8	7/29/2011	13:38:07	7.8	mg/L	20.9	Degree_C
10	9	7/29/2011	13:38:08	7.8	mg/L	20.9	Degree_C
11	10	7/29/2011	13:38:09	7.8	mg/L	20.9	Degree_C
12	11	7/29/2011	13:38:10	7.8	mg/L	20.9	Degree_C

RS-232/USB PC Interface

For streaming of data to a PC via the RS232 Output jack, the optional 407001-USB kit (RS232 to USB cable and driver CD) along with the 407001 software (available free at www.extech.com/sdl150) are required.

AC Power Adaptor

This meter is normally powered by six (6) 1.5V 'AA' batteries. An optional 9V power adaptor is available. When the adaptor is used, the meter is permanently powered and the power button will be disabled.

Battery Replacement and Disposal

When the low battery icon appears on the LCD, the batteries must be replaced. Several hours of accurate readings are still possible in this condition; however batteries should be replaced as soon as possible:

1. Remove the two (2) Phillips screws from the rear of the meter (directly above the top of the tilt stand).
2. Remove and safely place the battery compartment and screws where they will not be damaged or lost.
3. Replace the six (6) 1.5V 'AA' batteries, observing polarity.
4. Replace the battery compartment cover with the two (2) Phillips screws.

All EU users are legally bound by the battery ordinance to return all used batteries to collection points in your community or wherever batteries / accumulators are sold! Disposal in the household garbage is prohibited!

Specifications

General Specifications

Display	52 x 38mm (2 x 1.5") Backlit LCD
Status indicators	Out-of-range (----) and low battery
Probe type	Polarographic type oxygen probe with temperature measurement
Measurement Units	DO (Dissolved Oxygen) in mg/L units
	O2 (Oxygen) in air in percent units
	Temperature in °C/°F units
Datalogger Sampling Rate	AUTO LOGGING: From 1 second to 8 hours 59 minutes and 59 seconds. Note that a one (1) second sampling rate can cause some data loss on slower computers
	Memory Card: SD Cards 1G to 16GB
Display update rate	Approx. 1 second.
Data Output	RS-232 / USB PC computer interface
Operating Temperature	0 to 50°C (32 to 122°F)
Operating Humidity	85% R.H. max.
Auto Power OFF	After 10 minutes of inactivity (can be disabled)
Power Supply	Six (6) 1.5 VDC batteries (optional 9V AC adaptor)
Power Consumption	Normal operation (backlight and datalogger OFF): approx. 14mAdc
	With backlight OFF and datalogging ON: approx. 37mAdc
	With backlight ON add approx. 12mAdc
Weight	362g (0.79 lbs.) meter only
Cable Length	4m (13.1ft)
Dimensions	Main instrument: 182 x 73 x 47.5mm (7.1 x 2.9 x 1.9")
	Probe: 190 x 28 mm (7.5 x 1.1") diameter

Electrical Specifications (ambient temperature 23°C ± 5°C)

Measurement	Range	Resolution	Accuracy
Dissolved Oxygen (DO)	0 to 20.0 mg/L	0.1 mg/L	± 0.4mg/L
Oxygen in air	0 to 100.0%	0.1% O2	± 0.7% O2
Temperature	0 to 50°C (32 to 122°F)	0.1°C/°F	± 0.8°C (1.5°F)

Probe Compensation Adjust	Salt	0 to 50%
	Height (Altitude)	0 to 8900m (29,300 ft)