DOC023.52.03212.Apr05

LDO

User Manual

HACH LANGE

UNITED FOR WATER QUALITY

DOC023.52.03212.Apr05

LDO

User Manual

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Section 1 Specifications

Specifications are subject to change without notice.

Table 1 LDO Probe Specifications

Components	Corrosion-resistant materials, fully-immersible sensor with 10 m (30 foot) cable
Measuring Range (Dissolved Oxygen)	0 to 20.00 ppm (0 to 20.00 mg/L) or 0 to 200 % saturation
Measuring Range (Temperature)	0 to 50 °C (32 to 122 °F)
Measurement Accuracy	Below 1 ppm: ± 0.1; Above 1 ppm: ±0.2
Temperature Accuracy	±0.2 °C
Repeatability	±0.5 % of span
Response Time	To 90 % in less than 40 seconds To 95 % in less than 60 seconds
Resolution	Below 10 ppm: ±0.07 ppm or mg/L, ±0.1 % saturation Above 10 ppm: ±0.01 ppm or mg/L, ±0.1 % saturation
Interferences	No interferences from the following: H_2S, pH, K^{+1}, Na^{+1}, Mg^{+2}, Ca^{+2}, NH_4^{+1}, Al^{+3}, Pb^{+2}, Cd^{+2}, Zn^{+2}, Cr (tot), Fe^{+2}, Fe^{+3}, Mn^{+2}, Cu^{+2}, Mi^{+2}, Co^{+2}, CN^{-1}, NO_3^{-1}, SO_4^{-2}, S^{-2}, PO_4^{+3}, Cl^{-1}, Anion Active Tensides, Crude Oils, Cl_2^{-1}
Probe Operating Temperature	0 to 50 °C (32 to 122 °F)
Probe Storage Temperature	–20 to 70 °C (–4 to 158 °F); 95 % relative humidity, non-condensing.
Minimum Flow Rate	Non required
Sensitivity	±0.5 % of span
Calibration/Verification	Air Calibration: one point, 100% water saturated air; Sample Calibration: comparison to standard instrument, or comparison to Winkler Titration method
Probe Immersion Depth and Pressure Limits	Submersible to 107 m (350 ft)/1050 kPa (150 psi)
Sensor Interface	Modbus
Sensor Cable	10 m (30 ft) integral cable with quick-disconnect type plug. Additional cable length may be added by using a junction box. Up to 100 m with extension cables. Up to 400 m using the Junction box.
Probe Weight	1,4 kg (3 lb, 2 oz.)
Probe Dimensions	60 x 292 mm (2.4 x 11.5 inch)
Warranties	Sensor Cap: 2 years

Section 2 General Information

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.

DANGER
This product is not acceptable for use in a Hazardous Location.

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 the 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).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For all electrical products (marked or unmarked) which are supplied or produced by Hach-Lange, please contact the local Hach-Lange sales office for instructions for proper disposal.*

2.2 General Sensor Information

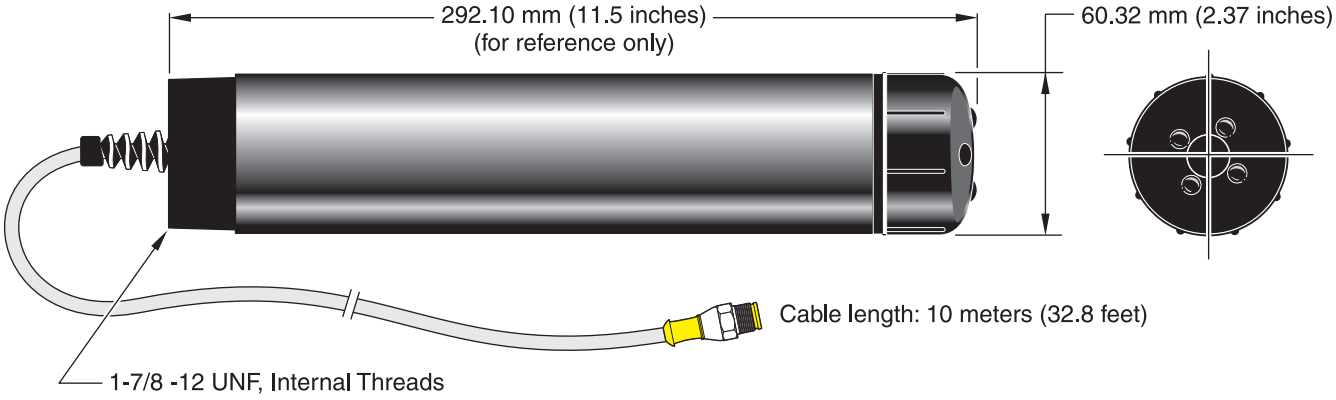
The Luminescent Dissolved Oxygen (LDO) Sensor (Figure 1) allows aqueous samples to be easily and accurately analyzed for dissolved oxygen concentration. Specially designed for municipal and industrial wastewater applications, the system consists of a controller with an integrated display, and a sensor (probe with sensor cap) for in-situ measurement.

The LDO sensor can be operated using an sc controller. Refer to Section 4 Operation on page 9 for more information.

Optional equipment, such as mounting hardware for the sensor, is supplied with an instruction sheet for all user installation tasks. Several mounting options are available, allowing the sensor to be adapted for use in many different applications.

Typical applications include aeration basins, nutrient removal in equalization basins, aerobic and anaerobic digesters, effluent streams, rivers, lakes, and fish ponds.

Figure 1 LDO Sensor Dimensions



2.3 Theory of Operation

The sensor in the cap is coated with a luminescent material. Blue light from an LED illuminates the luminescent chemical on the surface of the sensor cap. The luminescent chemical instantly becomes excited and then as the excited chemical relaxes, it releases red light. The red light is detected by a photodiode and the time it takes for the chemical to return to a relaxed state is measured. The higher the oxygen concentration, the less red light is given off by the sensor and the shorter time it takes for the luminescent material to return to a relaxed state. The oxygen concentration is inversely proportional to the time it takes for the luminescent material to return to a relaxed state.

Unlike electrochemical dissolved oxygen sensor technologies, the Luminescent Dissolved Oxygen (LDO) sensor does not consume oxygen. It does not require frequent recalibration or frequent cleaning (except when associated with consumptive slimes), resulting in longer sensor life and more stable and accurate readings. The system is also flow-independent so measurements can be made in applications with low or no flow.

Section 3 Installation

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

The LDO system can be used with any sc controller. Refer to the controller manual for installation instructions.

3.1 Connecting the Sensor to an sc 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 (Figure 2). Retain the connector cap to seal the connector opening in case the sensor must be removed. Optional extension cables may be purchased to extend the sensor cable length. If the total cable length exceeds 100 m (300 ft), a termination box must be installed.

Note: *Use of a load termination box other than Cat. No. 5867000 may result in a hazard.*

Figure 2 Attaching the Sensor using the Quick-connect Fitting

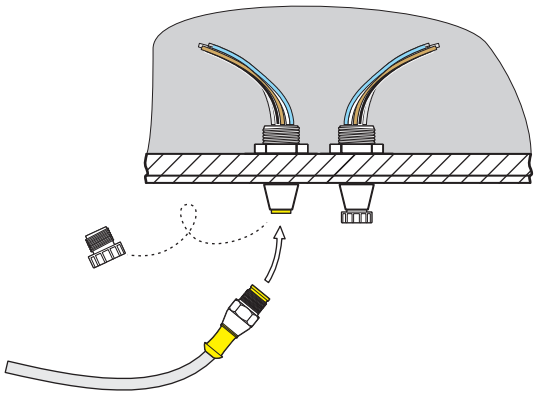
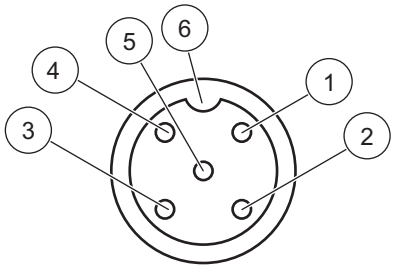


Figure 3 Quick-connect Fitting pin assignment

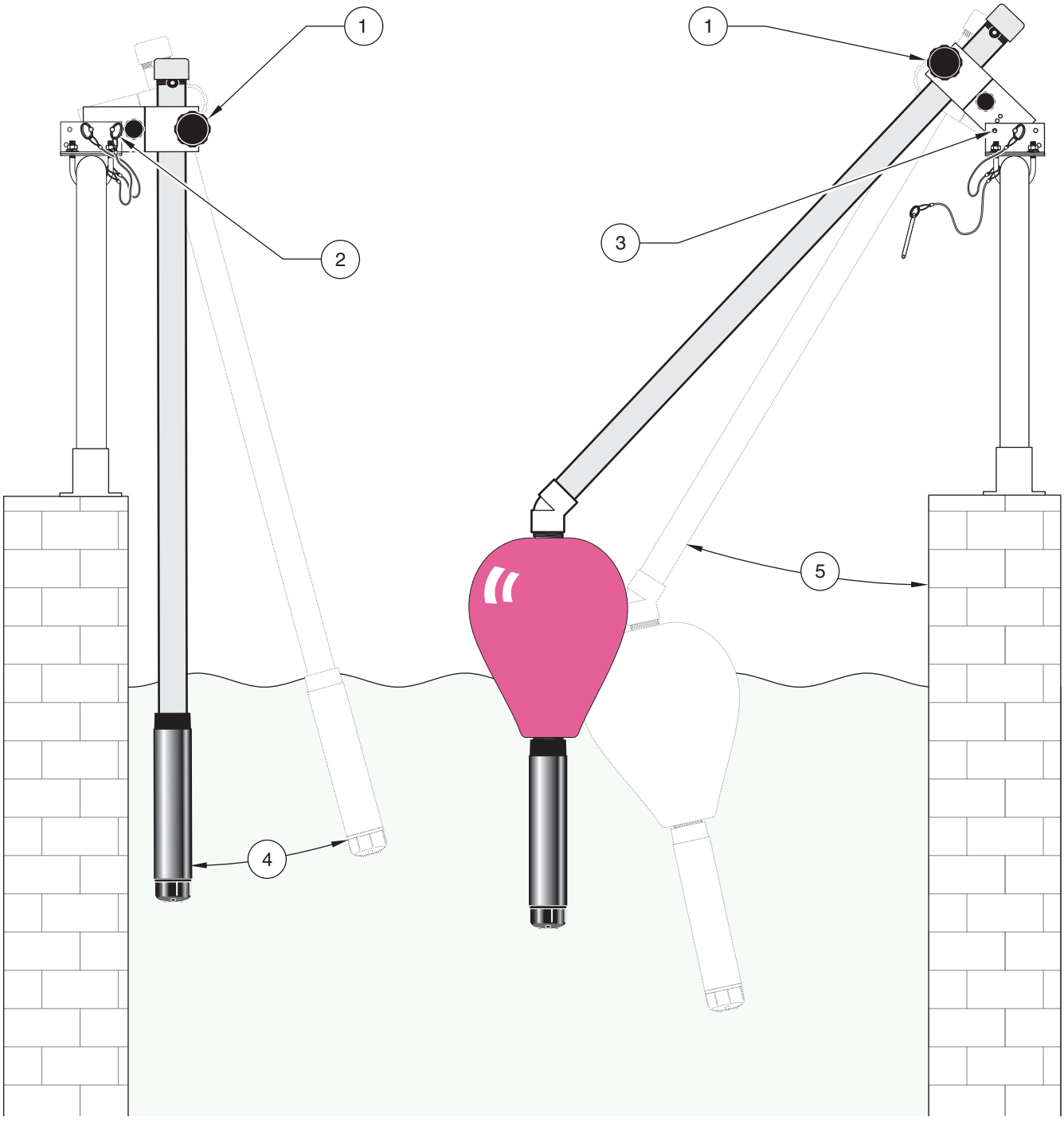


Number	Designation	Wire Color
1	+12 VDC	Brown
2	Circuit Common	Black
3	Data (+)	Blue
4	Data (–)	White
5	Shield	Shield (grey wire in existing quick-disconnect fitting)
6	Groove	

3.2 Installing the Sensor in the Sample Stream

To install the LDO in a sample stream, it is recommended to use the universal mounting hardware LZX914.99.xx100. The optional pole mount or ball float mount are shown in Figure 4. Please refer to the instruction sheets provided with these mounting kits for more detailed information.

Figure 4 Optional Pole Mount (LZX914.99.32100) and Ball Float Mount (LZX914.99.42100) Installation



1. Pipe locking knob	**4.** Position pin removed for float assembly
2. Pipe locking knob	**5.** Adjustable angle (using position pin)
3. Position pin	

Section 4 Operation

4.1 Using an sc Controller

Before using the sensor in combination with an sc controller make yourself familiar with the operating mode of the controller. Refer to the controller user manual and learn how to use and navigate the menu functions.

4.2 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.

4.3 Sensor Data Logging

The sc controller provides one data log and one event log for each sensor. The data log stores the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, warning conditions, etc. The data log and the event log can be read out in a CSV format. For downloading the logs please refer to the controller user manual.

4.4 Sensor Status Menu

SELECT SENSOR
ERROR LIST—See section 6.1 on page 17.
WARNING LIS—See section 6.2 on page 17.

4.5 Sensor Setup

SELECT SENSOR (if more than one sensor is attached)
CALIBRATE
AIR CAL
Perform an air calibration of the sensor (slope calibration). See section 4.7.1 on page 12.
SAMPLE CAL
Enter a value for the DO concentration as determined by another sensor or independent method. The instrument performs an offset calibration based on the entered value. See section 4.7.3 on page 13.
SET CAL DEFLT
Restores the gain and offset values to 1.0 and 0.0, respectively, and restores the sensor code to default.
CONFIGURE
EDIT NAME

4.5 Sensor Setup (continued)

	Enter up to a 10-digit name in any combination of symbols and alpha or numeric characters.
ALT/PRESS UNITS	
	Choose pressure units in feet, meters, mm Hg, or torr.
ALT/PRESS	
	Enter either altitude or air pressure. Correlates to the pressure units setting. Range: -5000–15000 ***Note:*** *The Alt/Press setting must be correct for proper measurement of % saturation and proper operation of air calibration.*
CONFIGURE (continued)	
TEMP UNITS	
	Select Celsius or Fahrenheit.
MEAS UNITS	
	Select the appropriate measurement units to display. Choose from: mg/L, ppm, or percent.
SALINITY	
	User-entered value. Range: 0.00–250.0 parts per thousand salinity
SENSOR CODE	
	Enter the unique code supplied with each sensor cap. The code ensures the preprogrammed factory calibration is adjusted for each sensor cap. The code consists of either 10-digits or 3-digits followed by a period. The period following the three digit code must be entered to complete the code entry.
SET DEFAULTS	
	Resets the sensor software to default settings.
SIGNAL AVE	
	Averages readings over a specified time interval. Default is 60 sec. Increase response by decreasing the time interval. Fastest response is at 0 sec.
LOG SETUP	
	Allows user to select data logging interval of DO and temperature readings.
DIAG/TEST	
SOFTWARE VERS.	
	Displays the software version number
DRIVER VERS	
	Displays the software driver version number.
GAIN CORR	
	User Editable—to change the calibration gain. Range: 0.000–3.0
OFFSET CORR	
	User Editable—to change the calibration offset. Range: -3.0–3.0
PHASE DIAG	
	Information only—updated once per second
AMPL DIAG	
	Information only—updated once per second
SERIAL NUMBER	
	Serial number of the sensor

4.6 Pressure and Elevation

Note: *If the barometric pressure from Table 2 is entered in the meter, the altitude entered in combination with this value must be 0 feet.*

Table 2 can be used to estimate the true barometric pressure at certain elevations. The correspondence is based on the assumption that at sea level the barometric pressure is 760 mm Hg (1013 hPa). After determining the barometric pressure from the table or obtaining it from a local weather service, enter this value into the instrument.

Table 2 Elevation Barometric Pressure

Elevation in feet (m)	Barometric pressure in mm Hg (hPa)	Elevation in feet (m)	Barometric pressure in mm Hg (hPa)
0	760 (1013)	6000 (1829)	613 (817)
500 (152)	746 (995)	6500 (1981)	601 (801)
1000 (305)	733 (977)	7000 (2134)	590 (787)
1500 (457)	720 (960)	7500 (2286)	579 (772)
2000 (610)	708 (944)	8000 (2438)	568 (757)
2500 (762)	695 (927)	8500 (2591)	559 (745)
3000 (914)	683 (911)	9000 (2743)	548 (731)
3500 (1067)	671 (895)	9500 (2896)	538 (717)
4000 (1219)	659 (879)	10000 (3048)	527 (703)
4500 (1372)	647 (863)	10500 (3200)	517 (689)
5000 (1524)	635 (847)	11000 (3353)	506 (675)
5500 (1676)	624 (832)		

1 mm Hg (Torr) = 133,3224 Pa (N/m^2)
1 Pa = 7,50062 10^{-3} mm Hg

4.6.1 Selecting Atmospheric Pressure

1. Select Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Select the appropriate sensor if more than one is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select AIR PRESS/ALT UNITS. Select the appropriate units from the list. Confirm the selection.
6. Select AIR PRESS/ALT. Change the value and confirm the selection.

Note: *AirPress/Alt must be correct for proper measurement of % saturation and operation of air calibration.*

4.7 Calibration

The dissolved oxygen sensor has been calibrated at the factory to the specifications listed on Specifications on page 3. Due to the inherent accuracy and stability of the luminescent dissolved oxygen technology, sensor calibration is seldom or never necessary. The calibration procedures will result in an instrument offset or gain correction and may be performed if required by regulatory agencies. The air calibration is the most accurate method. The calibration by comparison method is the least accurate and is therefore not recommended.

For continued accuracy and repeatability, the manufacturer recommends replacing the sensor cap after two years of operation.

4.7.1 Calibration in Air

1. Remove the sensor from the process stream and wipe with a wet cloth to remove debris and biological growth.
2. Place the sensor in the supplied Calibration Bag, add a small amount of water (25–50 mL) and secure the bag to the sensor body.
3. Lay the bagged probe on a flat surface where it will not be exposed to a heat source.
4. Select Main Menu.
5. From the Main Menu, select SENSOR SETUP and confirm.
6. Select the appropriate sensor if more than one is attached and confirm.
7. Select CALIBRATE and confirm.
8. Select AIR CAL. Select the available Output Mode (Active, Hold, or Transfer) from the list and confirm.
9. “Move the sensor to air” will be displayed if the sensor is moved to air (in the calibration bag).
10. The Air Calibration procedure will begin and “Wait to Stabilize” will be displayed. The current DO and temperature readings will be displayed.
11. The calibration will automatically occur when the reading stabilizes or when you confirm the current DO and temperature readings. Two to three minutes for the reading to stabilize is typical, however, if it has not stabilized after 45 minutes, the display will ready “Unable to Calibrate”. After calibration, one of the responses in Table 3 on page 14 will be displayed.
12. Follow the prompts to return the sensor to the process.

4.7.2 Sample Cal—Calibration by Comparison to a Winkler Titration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select SAMPLE CAL. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.

Note: *An output that has been placed in Hold or Transfer status will be automatically released when the calibration is complete.*

5. Remove the sensor from the process stream and gently wipe with a wet cloth to remove all debris and biological growth. Remaining debris will affect the Winkler Method of analysis.
6. Measure 1000 mL of deionized water. Allow the water to come to the thermal and dissolved oxygen equilibrium (approximately 20 minutes).
7. Fill a standard BOD bottle and then place the sensor in a beaker containing the remainder of the deionized water.
8. Perform the Winkler Tritration using Cat. No. 1469-00 Winkler Test Kit on the deionized water in the BOD bottle while waiting for the process sensor to stabilize.
9. Move the sensor to the sample.
10. The display will show “Press Enter when Stabilized” and the current DO and temperature readings. When confirmed or when the reading has been accepted as stable, the display will change to an entry screen. If not confirmed, the sensor will determine when the reading is stable. Two to three minutes for the reading to stabilize is typical, however, if it has not stabilized after 45 minutes, the display will show “Unable to Calibrate”.
11. When a stable reading has been accepted, the display will show “Sample Cal” and an area for entry of the value obtained from the comparison method. When the entry screen is displayed, enter the value from the hand-held or winkler titration and confirm.
12. After calibration, one of the responses in Table 3 on page 14 will be displayed.

4.7.3 Sample Cal—Calibration by Comparison to a Hand-held DO Analyzer

1. Place the dissolved oxygen sensor as close to the LDO sensor as possible.
2. Wait for the hand-held DO analyzer to stabilize.
3. Select Main Menu.
4. From the Main Menu, select SENSOR SETUP and confirm.
5. Select the appropriate sensor if more than one is attached and confirm.
6. Select CALIBRATE and confirm.
7. Select SAMPLE CAL. Select the available Output Mode (Active, Hold, or Transfer) from the list and confirm.

8. The display will show “Press Enter when Stabilized” and the current DO and temperature readings. When confirmed or when the reading has been accepted as stable, the display will change to an entry screen. If not confirmed, the sensor will determine when the reading is stable. Two to three minutes for the reading to stabilize is typical, however, if it has not stabilized after 45 minutes, the display will show “Unable to Calibrate”.

9. When a stable reading has been accepted, the display will show “Sample Cal” and an area for entry of the value obtained from the Winkler Titration.

10. Change the displayed reading to match the hand-held DO analyzer memory.

11. After calibration, one of the responses in Table 3 on page 14 will be displayed.

4.7.4 Concurrent Calibration of Two Sensors

1. Begin a calibration on the first sensor and proceed when “Wait to Stabilize” is displayed.

2. Select the BACK arrow, then LEAVE. The display will return to the Main Measurement screen.

3. Begin the calibration for the second sensor and continue until “Wait to Stabilize” is displayed.

4. Select the BACK arrow, then LEAVE. The display will return to the Main Measurement screen and the reading for both sensors will be flashing.

5. To return to the calibration of either sensor, select the Main Menu. Select SENSOR SETUP and confirm. Select the appropriate sensor and confirm.

6. The calibration in progress will be displayed. Continue with the calibration.

Table 3 Calibration Response

Calibration Response	Explanation
Cal Complete	Indicates the Calibration is complete.
Cal Fail, Offset HIgh	Indicates the air calibration has failed due to an excessively high calculated gain value. Repeat the calibration.
Cal Fail, Offset Low	Indicates the air calibration has failed due to too low of a calculated gain value. Repeat the calibration.
Cal Fail, Unstable	Indicates the air calibration has failed because the readings did not stabilize during the maximum allowed calibration time interval. Repeat the calibration.

Section 5 Maintenance

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

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

5.1 Maintenance Schedule

Maintenance Task	90 days	Annually
Clean the sensor[1]	**x**	
Inspect sensor cap for damage	**x**	
Calibrate Sensor (if required by regulatory agency)	**Per the schedule mandated by your regulatory agency.**	

[1] Cleaning frequency is application dependent. More or less frequent cleaning will be appropriate in some applications.

5.2 Cleaning the Sensor

Clean the exterior of the sensor with a soft, wet cloth. If the sensor cap is removed from the sensor body, do not leave the interior of the cap exposed to sunlight. Sun exposure to the interior of the cap can adversely affect the performance of the sensor. Degradation from sunlight is only an issue if the sensor cap is off the sensor body and the interior of the sensor cap is exposed to sunlight.

Section 6 Troubleshooting

6.1 Error Codes

Possible sensor errors will be displayed by the controller. The following conditions will cause an sensor error: Sensor calibration, Relay timer washing cycle, Loss of communication. Clear the error cause and confirm the displayed error.

Errors are defined in Table 4.

Table 4 Error Codes

Displayed Error	Definition	Resolution
RED AMPL LOW[1]	Sensor cap not installed or not installed correctly. Light path is blocked inside the sensor cap. Sensor not operating properly.	Remove and reinstall sensor cap. Check for blockage inside the sensor cap. Ensure red LED is flashing. Contact the Service Department.
BLUE AMPL LOW	Sensor not operating properly.	Remove and reinstall sensor cap. Check for blockage inside the sensor cap. Ensure blue LED is flashing. Contact the Service Department.

[1] To determine the amplitude values:
a. Start from the main menu, highlight Sensor Setup and confirm.
b. Highlight the correct sensor and confirm.
c. Highlight Diag/Test and confirm.
d. Highlight Ampl Diag and confirm. The Amplitude of the red and blue LEDs are shown. The LEDs transmit light onto the inner surface of the sensor cap and the light is reflected back down to the detector inside the sensor. The amplitude increases as more light is reflected. Typical values are from 0.1 to 0.5. The alarm/warning occurs at 0.01/0.03.

6.2 Warnings

Sensor warnings will be displayed by the controller. Clear the warning cause and confirm the displayed warning.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning. Warnings are defined in Table 5.

Table 5 Warning Codes

Displayed Warning	Definition	Resolution
EE SETUP ERR	The EEPROM was corrupted. Values have been set to factory defaults.	Contact the Service Department.
EE RSRVD ERR	The EEPROM was corrupted. Values have been set to factory defaults.	Contact the Service Department.
TEMP < 0 C	The sensed temperature is below 0 °C (32 °F).	Increase process temperature or discontinue use until the process temperature is above 0 °C (32 °F).
TEMP > 50 C	The sensed temperature is above 50°C (120 °F).	Decrease process temperature or discontinue use until the process temperature is below 50 °C (120 °F).
RED AMPL LOW	Sensor cap not installed or not installed correctly. Sensor not operating properly.	Remove and reinstall sensor cap. Contact the Service Department.
RED AMPL HIGH	Sensor cap not installed or not installed correctly. Sensor not operating properly.	Remove and reinstall sensor cap. Contact the Service Department.
BLUE AMPL LOW	Sensor cap not installed or not installed correctly. Sensor not operating properly.	Remove and reinstall sensor cap. Contact the Service Department.
BLUE AMPL HIGH	Sensor cap not installed or not installed correctly. Sensor not operating properly.	Remove and reinstall sensor cap. Contact the Service Department.

Section 7 Replacement Parts and Accessories

Replacement Items

Description	QTY	Cat. No.
LDO Probe with one sensor cap and 5 calibration bags	each	57900-00
Sensor cap, replacement	each	57911-00
Instruction manual, LDO	each	DOC023.52.03212

Accessories

Description	QTY	Cat. No.
Air blast cleaning system, 115 V	each	57951-00
Air blast cleaning system, 230 V (non-hazardous locations only)	each	57952-00
High Output Air Blast Cleaning System, 250 V	each	61701-00
Calibration bags	5 bags	57966-00
Cable, sensor extension, 0,35 m	each	LZX847
Cable, sensor extension, 5 m	each	LZX848
Cable, sensor extension, 10 m	each	LZX849
Cable, sensor extension, 15 m	each	LZX850
Cable, sensor extension, 20 m	each	LZX851
Cable, sensor extension, 30 m	each	LZX852
Cable, sensor extension, 50 m	each	LZX853
Load termination box	each	58670-00
Mounting hardware kit, pipe	each	57944-00
Mounting hardware kit, ball float	each	57943-00
Plug, sealing, conduit opening	each	58687-00
Strain relief, Hayco	each	16664
Winkler titration kit	each	1469-00

Section 8 Warranty, liability and complaints

HACH LANGE GmbH warrants that the product supplied is free of material and manufacturing defects and undertakes the obligation to repair or replace any defective parts at zero cost.

The warranty period for instruments is 24 months. If a service contract is taken out within 6 months of purchase, the warranty period is extended to 60 months.

With the exclusion of the further claims, the supplier is liable for defects including the lack of assured properties as follows: all those parts that can be demonstrated to have become unusable or that can only be used with significant limitations due to a situation present prior to the transfer of risk, in particular due to incorrect design, poor materials or inadequate finish will be improved or replaced, at the supplier's discretion. The identification of such defects must be notified to the supplier in writing without delay, however at the latest 7 days after the identification of the fault. If the customer fails to notify the supplier, the product is considered approved despite the defect. Further liability for any direct or indirect damages is not accepted.

If instrument-specific maintenance and servicing work defined by the supplier is to be performed within the warranty period by the customer (maintenance) or by the supplier (servicing) and these requirements are not met, claims for damages due to the failure to comply with the requirements are rendered void.

Any further claims, in particular claims for consequential damages cannot be made.

Consumables and damage caused by improper handling, poor installation or incorrect use are excluded from this clause.

HACH LANGE GmbH process instruments are of proven reliability in many applications and are therefore often used in automatic control loops to provide the most economical possible operation of the related process.

To avoid or limit consequential damage, it is therefore recommended to design the control loop such that a malfunction in an instrument results in an automatic change over to the backup control system; this is the safest operating state for the environment and the process.

8.1 Compliance

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) Electrostatic Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electromagnetic 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 Electromagnetic 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

Section 9 Contact

HACH LANGE GmbH

Willstätterstraße 11
D-40549 Düsseldorf
Tel. +49 (0) 211- 52 88 - 0
Fax +49 (0) 211- 52 88 - 143
info@hach-lange.de
www.hach-lange.de

HACH LANGE LTD
Pacific Way
Salford
Manchester, M50 1DL
Tel. +44 (0)161 8 72 14 87
Fax +44 (0)161 8 48 73 24
info@hach-lange.co.uk
www.hach-lange.co.uk

HACH LANGE
HACH SAS
33, Rue du Ballon
F-93165 Noisy Le Grand
Tél. +33 (0)1 48 15 8080
Fax +33 (0)1 48 15 80 00
info@hach-lange.fr
www.hach-lange.fr

DR. BRUNO LANGE
GES. MBH
Industriestraße 12
A-3200 Obergrafendorf
Tel. +43 (0) 2747 - 74 12
Fax +43 (0) 2747 - 42 18
info@hach-lange.at
www.hach-lange.de

DR. BRUNO LANGE AG

Juchstrasse 1
CH-8604 Hegnau
Tel. +41 (0)1- 9 45 66 10
Fax +41 (0)1- 9 45 66 76
info@hach-lange.ch
www.hach-lange.ch

HACH LANGE SA

Motstraat 54
B-2800 Mechelen
Tél. +32 (0)15 42 35 00
Fax +32 (0)15 41 61 20
info@hach-lange.be
www.hach-lange.be

DR. LANGE NEDERLAND B.V.
Laan van Westroijen 2a
NL-4003 AZ Tiel
Tel. +31(0)3 44 63 11 30
Fax +31(0)3 44 63 11 50
info@hach-lange.nl
www.hach-lange.nl

HACH LANGE AB
Vinthundsvägen159A
S-128 62 Sköndal
Tel. +46 (0)8 7 98 05 00
Fax +46 (0)8 7 98 05 30
info@hach-lange.se
www.hach-lange.se

HACH LANGE A/S
Åkandevej 21
DK-2700 Brønshøj
Tel. +45 36 77 29 11
Fax +45 36 77 49 11
info@hach-lange.dk
www.hach-lange.dk

HACH LANGE S.L.U.
C/Araba 45, Apdo. 220
E-20800 Zarautz/Guipúzcoa
Tel. +34 9 43 89 43 79
Fax +34 9 43 13 02 41
info@hach-lange.es
www.hach-lange.es

HACH LANGE SP.ZO.O.
ul. Opolska 143 a
PL-52-013 Wroclaw
Tel. +48 71 3 42 10-81
Fax +48 71 3 42 10-79
info@hach-lange.pl
www.hach-lange.pl

HACH LANGE S.R.L.
Via Riccione, 14
I-20156 Milano
Tel. +39 02 39 23 14-1
Fax +39 02 39 23 14-39
info@hach-lange.it
www.hach-lange.it

HACH LANGE S.R.O.
Lešanská 2a/1176
CZ-141 00 Praha 4
Tel. +420 272 12 45 45
Fax +420 272 12 45 46
info@hach-lange.cz
www.hach-lange.cz

HACH LANGE S.R.O.
Sabinovská 10
SK-821 02 Bratislava
Tel. +421 2 4820 9091
Fax +421 2 4820 9093
info@hach-lange.sk
www.hach-lange.com

Appendix A Modbus Register Information

Table 1: Sensor Modbus Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Units (U)	Range
Measurements	Oxygen Concentration	40001	Float	2	R	ppm	0..20
Measurements	Percent Saturation	40003	Float	2	R	Percent	0..300
Measurements	Temperature	40005	Float	2	R	Celsius/ Fahrenheit	-5.1..60 / 0..150
Diagnostics	Total Phase Shift	40007	Float	2	R	degrees	-360..360
Diagnostics	Blue Phase Shift	40009	Float	2	R	degrees	-360..360
Diagnostics	Red Phase Shift	40011	Float	2	R	degrees	-360..360
Diagnostics	Blue Amplitude	40013	Float	2	R	none	0..1
Diagnostics	Red Amplitude	40015	Float	2	R	none	0..1
Diagnostics	Version	40017	Float	2	R	none	0..99.0
Settings	Altitude/ Pressure	40041	Float	2	R/W	see Alt Press Units	0.15000 ft, 0-5000 m, 0..1000 torr, 0..1000 mmHg
Settings	Salinity	40043	Float	2	R/W	none	0..500
Calibration	Offset Corr	40045	Float	2	R/W	see Conc Units	-5.00..5.00
Calibration	Slope Corr	40047	Float	2	R/W	none	0.5..1.5
Calibration	Calib Value	40037	Float	2	R/W	see Conc Units	0..20
Settings	Conc Units	40091	Integer	1	R/W	enumerated	ppm=2, mg/l=0, Percent = 10
Settings	Alt Press Units	40092	Integer	1	R/W	enumerated	feet=43, meter=13, torr=47, mmHg=45
Settings	Temp Units	40093	Integer	1	R/W	enumerated	Celsius=25, Fahrenheit=26
Settings	Sensor Code	40094	String	5	R/W	none	Calibration Code
Settings	Sensor Name	40099	String	6	R/W	none	User Name
Settings	Signal Avg	40105	Integer	1	R/W	seconds	0..1000
Diagnostics	Serial Number	40114	String	6	R	none	Production Code

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