BOD17

Dissolved Oxygen Monitor

Operation Guide

Preface

Product warranty

The BOD17 Dissolved Oxygen Monitor has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

The foregoing warranty does not cover damage caused by accidental misuse, abuse, neglect, misapplication or modification.

No warranty of fitness for a particular purpose is offered. The user assumes the entire risk of using the product. Any liability of LTH is limited exclusively to the replacement of defective materials or workmanship.

Disclaimer

LTH Electronics Ltd reserves the right to make changes to this manual or the instrument without notice as part of our policy of continued developments and improvements.

All care has been taken to ensure accuracy of information contained in this manual. However, we cannot accept responsibility for any errors or damages resulting from errors or inaccuracies of information herein.

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BOD17 is a trademark of LTH Electronics Ltd

SensorTalk, Hybrid, ProCount are trademarks of the Broadley James Corporation

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by both the United Kingdom EMC Regulations S.I. 2016/1091 and the European EMC Directive 2014/30/EU using BS EN 61326-1: 2013.

Safety

This instrument has been designed to comply with the standards and regulations set down by both the United Kingdom Equipment Safety Regulations S.I. 2016/1101 and the European Low Voltage Directive 2014/35/EU using BS EN 61010-1: 2010.

Restriction of Hazardous Substances

This instrument has been produced to comply with the standards and regulations set down by both the United Kingdom Equipment Restriction of Hazardous Substances Regulations S.I. 2012/3032 and the European Restriction of Hazardous Substances Directive 2011/65/EU using BS EN IEC 63000 : 2018.

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2015. Certificate No: FM 13843

Note: The standards referred to in the design and construction of LTH products are those prevailing at the time of product launch. As the standards are altered from time to time, we reserve the right to include design modifications that are deemed necessary to comply with the new or revised regulations.

Disposal

As per regulation S.I. 2012/3032 and directive 2012/19/EU, please observe the applicable local or national regulations concerning the disposal of waste electrical and electronic equipment.

Declaration of Conformity

DECLARATION OF CONFORMITY

LTH Electronics Ltd

declare, accepting full responsibility, that the product(s)

BOD17, BOD17A, BOD17LV, BOD17LVA

conforms with all relevant United Kingdom regulations:

BS EN 61326-1 : 2013
(Electrical Equipment for Measurement, Control and Laboratory Use)
in accordance with the provisions of
the S.I. 2016/1091 (EMC) regulations.

BS EN 61010-1 : 2010 (Equipment Safety)
in accordance with the provisions of
the S.I. 2016/1101 (Equipment Safety) regulations.

BS EN IEC 63000 : 2018
(Electrical and Electronic Products)
in accordance with the provisions of
the S.I. 2012/3032 (RoHS) regulations.

Issued in the United Kingdom on
18th August 2021 for the company by:

Neil Adams
Managing Director

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the 2014/35/EU (Low Voltage) directive.

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(Electrical and Electronic Products)

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the 2011/65/EU (RoHS) directive.

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Neil Adams
Managing Director

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Introduction

The BOD17 is a microprocessor controlled Dissolved Oxygen measurement instrument that can be used with either the full range of Broadley James SensorTalk Digital and Hybrid Dissolved Oxygen Sensors or traditional Amperometric Sensors. To achieve this, the instrument utilises a multifunction LCD to display the primary reading and temperature, show operational status and to provide an intuitive user interface.

The advanced SensorTalk interface allows for the connection of the new OptaProbe Dissolved Oxygen sensors which use optical (fluorescence) technology to provide long term stability and accuracy without the usual maintenance regime associated with traditional Amperometric sensors.

Other advantages of the interface include the Plug-and-Play functionality of sensors which enables "calibrate here use there". Sensors can be accurately pre-calibrated away from the operation area with the calibration data stored in the sensor, ready for later use. When the sensor is then connected to the instrument the data is auto-loaded and the sensor's calibration values are applied automatically.

As standard, the instrument is a simple to install, IP66 rated, Wall-mount instrument. However, with the addition of a suitable mounting kit it can be installed either as a Panel-mount or Pipe-mount instrument.

The instrument has two on-board volt-free, normally-open relays with adjustable setpoint value and hysteresis. Either one can be set to activate if the process variable or temperature is above or below the setpoint allowing the instrument to be used in a variety of dosing or control applications. Other setpoint functions include activation on alarm, time and pulse proportion, delayed activation, dose alarm timer, and scheduled cleaning, whilst the status of the relays can be seen via the main screen of the instrument.

Additionally, the instrument features up to two industry standard, isolated, 0/4-20mA current outputs that feature adjustable scaling, selectable on-error states and loop fault detection. Either allows the instrument to transmit the primary reading, the observed process temperature or, when using certain sensors, the unfiltered percentage saturation value. Both enable the instrument to be used for remote monitoring purposes.

Dissolved Oxygen Input Specification

Measurement Input	Amperometric (Polarographic / Clark) – 0 to 500.0nA SensorTalk Hybrid or Digital Amperometric SensorTalk OptaProbe (Optical)
Sensor Bias Voltage	User defined -1.000V to +1.000V, ±1mV Resolution, ±3mV Output Accuracy.
Connection Cable	Up to 30 meters
Ranges of Measurement	0 – 199.9 % Saturation 0 – 30.00 ppm Concentration 0 – 9999 mBar pO_2 (Partial Pressure of Oxygen)(Calibration specific) 0 – 999.9 mmHg (Millimetres of Mercury)(Calibration specific) 0 - 30.00 mg/l Milligrams per Litre Sensor Current (nA) (Amperometric only)
Accuracy	±1.0nA (Polarographic Mode) ±0.1% of Range (Optical Mode)
Linearity	± 0.1% of range.
Repeatability	± 0.1% of range.
Calibration	Automatic Zero (offset) and Span (slope) calibration with user entered span calibration. Automatic loading of stored calibration data from pre-calibrated SensorTalk electrodes. All methods feature post-calibration sensor condition indication.
Calibration Timer	Inbuilt calibration countdown timer which will trigger an alarm when the set calibration interval has expired.
Sensor Filter - OptaProbe and Digital Amperometric	Three element bubble and signal-noise filter system for creating advanced transient noise mitigation strategies.
Sensor Input Filter – Amperometric and Hybrid	Adjustable filter that averages the sensor input over a user selectable time (10sec – 5mins).
Temperature Sensor	BJ 22k thermistor input. Up to 30 meters of cable. Temperature sensor can be mounted in the sensor or separately.
Range of Temperature Measurement	-0 °C to +100 °C (32 °F to 212 °F) for full specification.
Temperature Accuracy	± 0.2 °C
Operator Adjustment (Temperature)	± 50 °C or ± 122 °F
Temperature Compensation Type	Either via temperature sensor input or manual entered.
Pressure Compensation	Manually via user entered value.

Salinity Compensation	User Programmable from 0 – 40.0 ppt.
Off-Line Facility	The relays are de-energised and the current output is held at a user defined level.
Ambient Operating Conditions	Temperature -20 to +55°C, Relative Humidity 5 to 95%, non-condensing.
Ambient Temperature Variation	±0.01% of range / °C (typical)
Display	3¾" 240x128 dot LCD Module
Display Backlight	Can be set to flash to indicate the instrument's alarm status.
Buttons	5 tactile feedback micro-switched, silicone rubber
Current Outputs Specification	Single current output as standard with option of two on advance models, selectable 0-20mA or 4-20mA into 750 ohms max, fully isolated to 2kV. Expandable up to 2% of % Saturation range and offset anywhere in that range.
Current Outputs Adjustment	±0.01mA, 3 point 0/4-20 mA for remote monitor calibration.
Setpoints and Control Relays Specification	2 normally open, fully configurable setpoints with volt free contacts for each relay. Rated at 5A @ 30V DC / 5A @ 250V AC.
Setpoint Modes	High, Low, Band, Latch High, Latch Low, Cleaning, Alarm.
	On/Off, Time Proportioning, Pulse Proportioning.
	Delay timer adjustable from 00:00 to 59:59 (mm:ss).
	Hysteresis 0 to 9.99%.
	Dose alarm timer, with supplementary initial charge function. Both adjustable from 00:00 to 59:59 (mm:ss).
	Adjustable cycle time and proportional band in proportional modes.
	Cleaning to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. Adjustable Duration, Interval and Recovery.
	Flash backlight on setpoint trigger.
MicroSD Card Interface	Enables on site upgrading of instrument software. SD, SDHC and SDXC-FAT32 cards supported.
EMC	S.I. 2016/1091 & 2014/30/EU using BS EN 61326-1: 2013.
Safety / Low Voltage Directive	S.I. 2016/1101 & 2014/35/EU using BS EN 61010-1: 2010.
Power Supply	Universal 90-265V AC, 10W max.
	LV Option 12 – 30 V DC, 4W max.
Instrument Housing	UL 94-V0 PC/ABS.
Ingress Protection Rating (IEC 60529 Protection Rating)	IP66.
Weight	Maximum 800 grams (instrument only).
Dimensions	175 x 150 x 119 mm (H, W, D).

Installation – Safety & EMC

This chapter describes how to install the instrument and how to connect the unit to a power source and auxiliary equipment.

Although today's electronic components are very reliable, it should be anticipated in any system design that a component could fail and it is therefore desirable to make sure a system will **fail safe**. This could include the provision of an additional monitoring device, depending upon the particular application and any consequences of an instrument or sensor failure.

Wiring Installation

The specified performance of the instrument is entirely dependent on correct installation. For this reason, the installer should thoroughly read the following instructions before attempting to make any electrical connections to the unit.

CAUTION ! : ALWAYS REMOVE THE MAIN POWER FROM THE SYSTEM BEFORE ATTEMPTING ANY ALTERATIONS TO THE WIRING.   ENSURE THAT BOTH POWER INPUT LINES ARE ISOLATED. MAKE SURE THAT THE POWER CANNOT BE SWITCHED ON BY ACCIDENT WHILE THE UNIT IS BEING CONNECTED. FOR SAFETY REASONS AN EARTH CONNECTION MUST BE MADE TO THE EARTH TERMINAL OF THIS INSTRUMENT.

LOCAL WIRING AND SAFETY REGULATIONS SHOULD BE STRICTLY ADHERED TO WHEN INSTALLING THIS UNIT.   SHOULD THESE REGULATIONS CONFLICT WITH THE FOLLOWING INSTRUCTIONS, CONTACT LTH ELECTRONICS OR AN AUTHORISED LOCAL DISTRIBUTOR FOR ADVICE.

To maintain the specified levels of Electro Magnetic Compatibility (EMC, susceptibility to and emission of electrical noise, transients and radio frequency signals) it is essential that the types of cables recommended within these instructions be used. If the installation instructions are followed carefully and precisely, the instrument will achieve and maintain the levels of EMC protection stated in the specification. Any equipment to which this unit is connected must also have the same or similar EMC control to prevent undue interference to the system.

❖   Terminations at the connectors should have any excess wire cut back so that a minimal amount of wire is left free to radiate electrical pick-up inside or close to the instrument housing.

N.B. The use of CE marked equipment to build a system does not necessarily mean that the completed system will comply with the European requirements for EMC.

Noise suppression

In common with other electronic circuitry, the instrument may be affected by high level, short duration noise spikes arising from electromagnetic interference (EMI) or radio frequency interference (RFI). To minimise the possibility of such problems occurring, the following recommendations should be followed when installing the unit in an environment where such interference could potentially occur.

The following noise generating sources can affect the instrument through capacitive or inductive coupling.

❖ Relay coils
❖ Solenoids
❖ AC power wires, particularly at or above 100V AC
❖ Current carrying cables
❖ Thyristor field exciters
❖ Radio frequency transmissions
❖ Contactors
❖ Motor starters
❖ Business and industrial machines
❖ Power tools
❖ High intensity discharge lights
❖ Silicon control rectifiers that are phase angle fired

The instrument is designed with a high degree of noise rejection built in to minimise the potential for interference from these sources, but it is recommended that you apply the following wiring practices as an added precaution. Cables transmitting low level signals should not be routed near contactors, motors, generators, radio transmitters, or wires carrying large currents.

If noise sources are so severe that the instrument's operation is impaired, or even halted, the following external modifications should be made, as appropriate:

❖ Fit arc suppressors across active relay or contactor contacts in the vicinity.

❖ Run signal cables inside steel tubing as much as is practical.

❖ Use the internal relays to switch external slave relays or contactors when switching heavy or reactive loads.

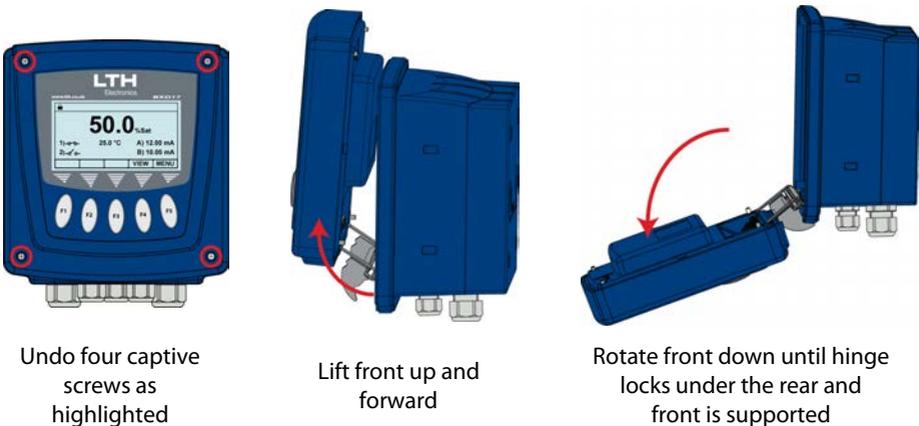❖ Fit an in-line mains filter close to the power terminals of the instrument.

Enclosure

The BOD17 as standard is designed to be mounted on a wall or surface via the two holes located in the rear half of the enclosure. Alternatively, it can be mounted to a panel or a pipe using optional mounting kits.

BOD17 Overall Dimensions
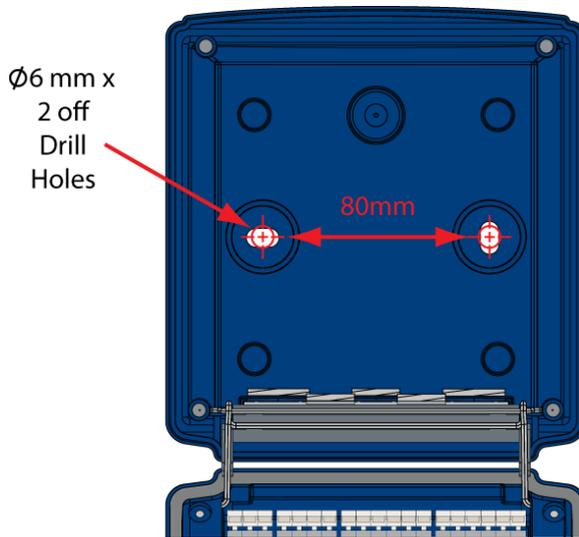
The enclosure should be opened as following.

| Undo four captive screws as highlighted | Lift front up and forward | Rotate front down until hinge locks under the rear and front is supported |

To close repeat process in reverse, folding the hinge into the rear.

Surface-Mounting

Ø6 mm x
2 off
Drill
Holes

80mm

- LTH recommends using No. 10 x 1¼ inch round head screws or similar for mounting.

- Care must be taken when fitting the instrument on uneven walls or surfaces.

- Once installed, make sure accompanying IP protection plugs are installed over the mounting holes on the inside rear of the enclosure.
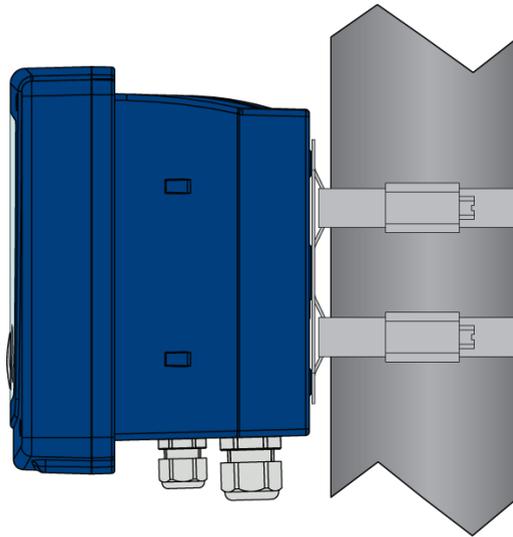
IP Protection
Plugs
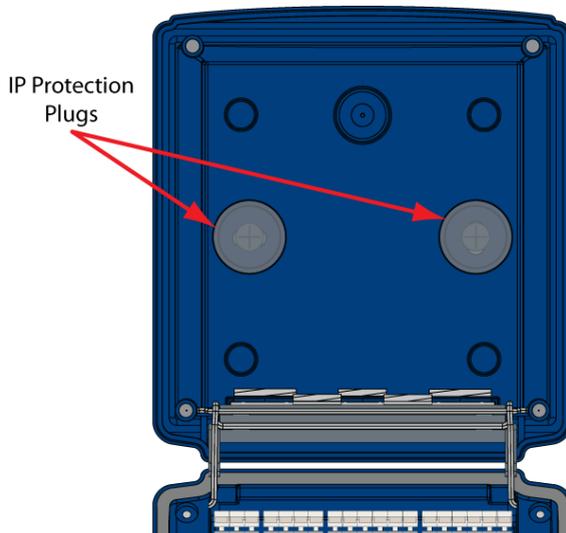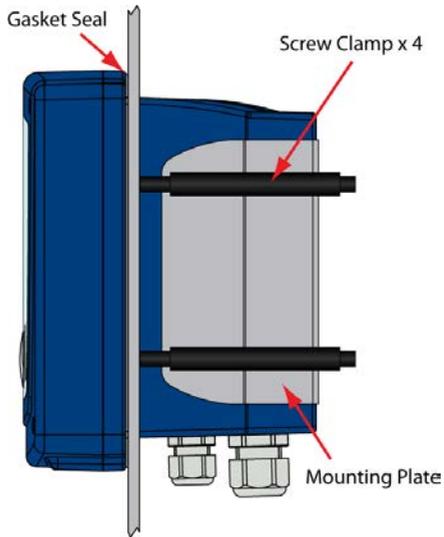
Panel-Mounting

- 138.0mm Square Cut Out

- Uses Kit Part Number 6014.

- Fit the gasket seal into the groove on the back of the instrument front.

- Attach the Mounting Plate to the rear of the case with the supplied screws.

- To pass instrument rear through panel cut out, remove cable glands.

- Use the 4 supplied screw clamps to affix the instrument to the panel.

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Pipe-Mounting

- Fits pipe 50-100mm

- Uses Kit Part Number 6024.

- Attach the Mounting Plate to the rear of the case with the supplied screws.

- Pass supplied mounting straps through plate loops and tighten around pipe as required.

- Fit the accompanying IP protection plugs over the internal mounting holes on the inside rear of the enclosure.

Terminal Operation
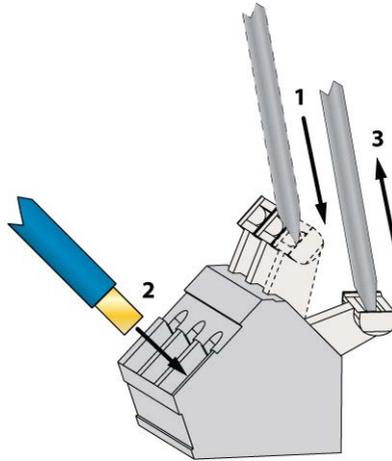
While pushing terminal lever down using a 3.5mm Slotted Screwdriver, insert wire into opening and release level to retain.

Supply Voltage Connections

Depending upon version purchased BOD17 can be powered from either 90-265V AC or 12-30V DC supply voltage. **Refer to the label adjacent to the power supply terminals for the input voltage limits. Exceeding these limits may damage the instrument.**

90-265V AC
Power Connections

12-30V DC
Power Connections
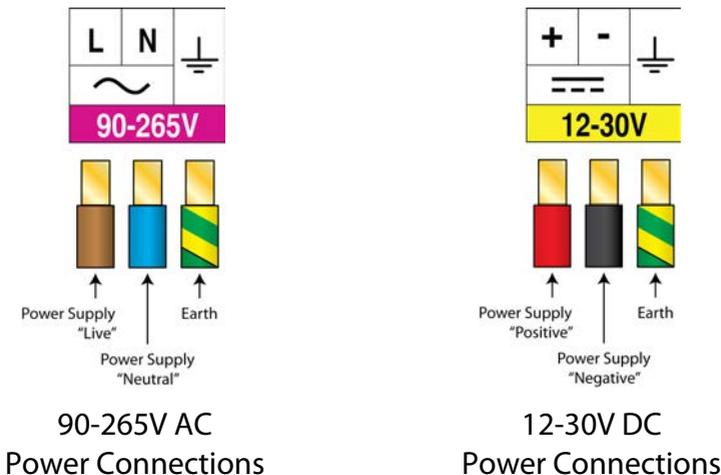
The power supply should be taken from an isolated spur and fused to a maximum of 3 Amps. The incoming Earth connection must be connected to the Earth terminal.

Relay Connections

The BOD17 is supplied with 2 normally open, volt free relays designated 1 & 2. The relay contacts are connected to the terminals only and are electrically isolated from the instrument itself. **They must be connected in series with a 5 Amp fuse.** A contact arc suppressor may be required to prevent excessive electrical noise, depending upon the load. To switch more than 5 Amps will require a slave relay.
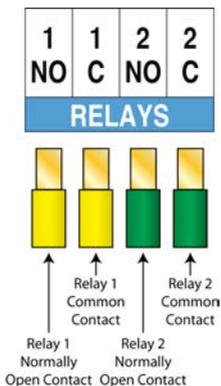

Relays 1 & 2 Connection Details

Current Output Connections

The BOD17 is supplied as standard with a single current output or as an option with two; either can terminate into a load resistance not exceeding 750Ω and are both galvanically isolated from the rest of the instrument. For best noise immunity use a screened twisted pair cable, with the screen connected to Earth at one end. Use a sufficiently large cable to avoid a high resistance in the overall current loop.
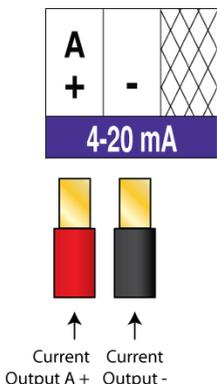
### Basic Instrument Current Output Connection Detail
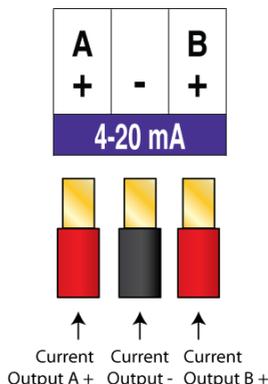
Advanced Instrument Current Output Connection Detail

MicroSD Card Interface

The BOD17 features a MicroSD card interface which is compatible with SD, SDHC and SDXC formatted cards (N.B. SDXC cards may need to be formatted to Fat32 before use). Its primary function is to enable the upgrading of the instrument's operating software

To insert the card, ensure that the side notch is on the right-hand side of the card, and then just push it all the way in to the socket. To remove the card, push it in then release, and the card should then come out of the socket. **N.B.** It may be required to pull the card out of the last bit of the socket.
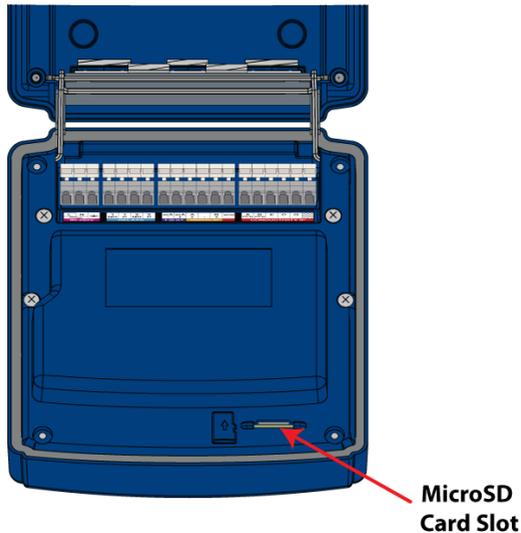
MicroSD Card Slot

Installation and Choice of Dissolved Oxygen Sensors

The Dissolved Oxygen input of the BOD17 Series has been designed to accept a wide variety of Amperometric (Polarographic/Clark) Dissolved Oxygen sensors. Parameters such as membrane correction and bias voltage can be easily programmed into the instrument.

The choice of the correct type of Dissolved Oxygen sensor, and how and where to mount it so that it has a representative sample of solution, are probably the two most important considerations when installing a Dissolved Oxygen system.

The following criteria are of great importance during selection:

- The trade-off between a thin membrane giving quick response times and, depending on the sample, the reduced lifetime of the membrane.
- The use of the correct materials for corrosion resistance.
- The chemical makeup, temperature of the sample.
- Position of the sensor for robustness and service access.
- Ensuring a representative, uncontaminated solution sample.
- The operating range of the process to be measured.
- Does the process suffer from high rates of gas bubbles?

**To ensure correct sensor mounting the following conditions should be observed:**

- The Dissolved Oxygen sensor can only measure what is in the immediate vicinity of the sensing area of the sensor.
- A moderate flow is maintained to provide an "up to date" sample.
- Ensure that the full area of the sensor's membrane is in contact with the sample.
- For Amperometric sensors, install the sensor in an upright position to ensure that the internal electrolyte is in contact with the membrane.
- Avoid points where air can be trapped.
- Avoid points of high turbulence as air bubbles will affect the measurement.
- If the sample has solids present, then a jet wash or equivalent cleaning system may be required to keep the membrane in contact with the sample.

When using an SensorTalk sensor an initial calibration may not be required due to the sensor's calibration data being stored on the probe and loaded when connected to the instrument. However, a validation of the sensor may still be advisable to ensure correct operation.

If using a traditional Amperometric sensor, when the new sensor is first fitted or changed it must be calibrated (see page 36).

All types of sensor will require periodic re-calibration. The BOD17 series provides an inbuilt countdown timer which will trigger an alarm when the calibration interval has expired (see page 44.)

BOD17 Dissolved Oxygen Input Connection Details
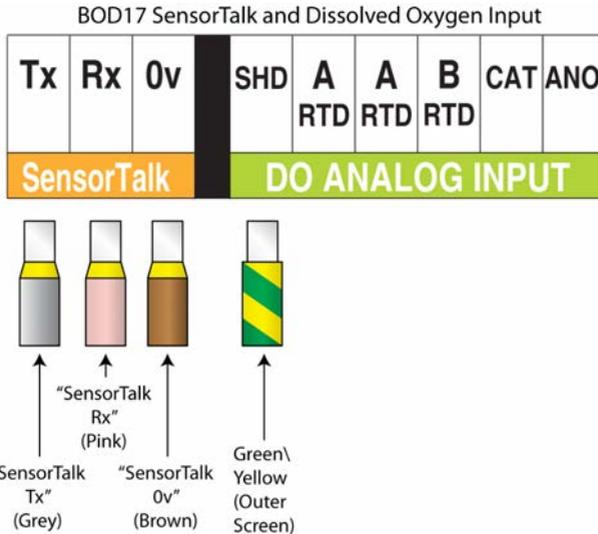
OptaProbe or Digital SensorTalk™ Probe Cable Connection Details

Please note, do not remove the sensor while the "retrieving data" message is on the screen. Also when unplugging an existing sensor from the instrument please wait for the "probe removed" message to appear before attaching a different sensor.
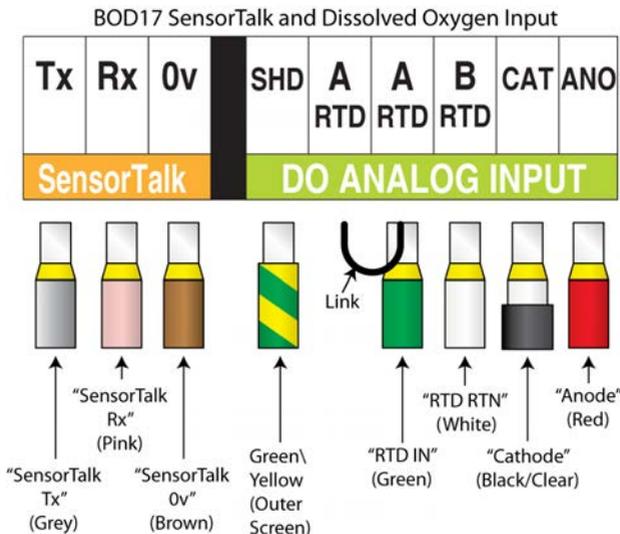
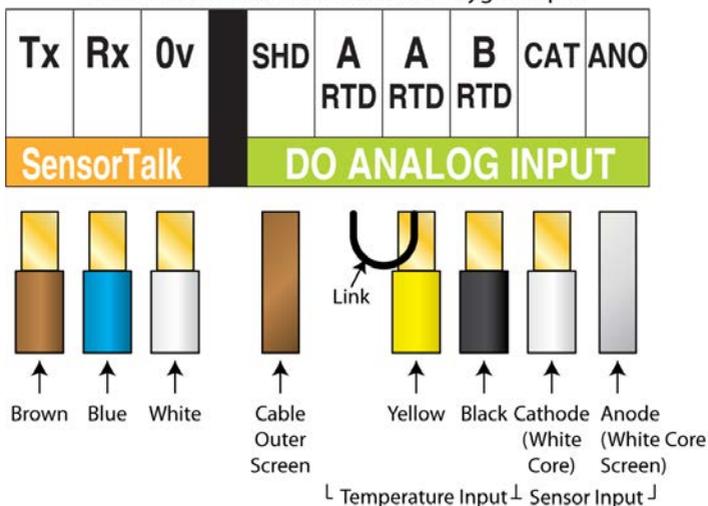**Hybrid™ SensorTalk™ Probe Cable Connection Details**

Please note, do not remove the sensor while the "retrieving data" message is on the screen. Also when unplugging an existing sensor from the instrument please wait for the "probe removed" message to appear before attaching a different sensor.

Hybrid™ SensorTalk™ 54D Extension Cable Connection Details

Please note, do not remove the sensor while the "retrieving data" message is on the screen. Also when unplugging an existing sensor from the instrument please wait for the "probe removed" message to appear before attaching a different sensor.
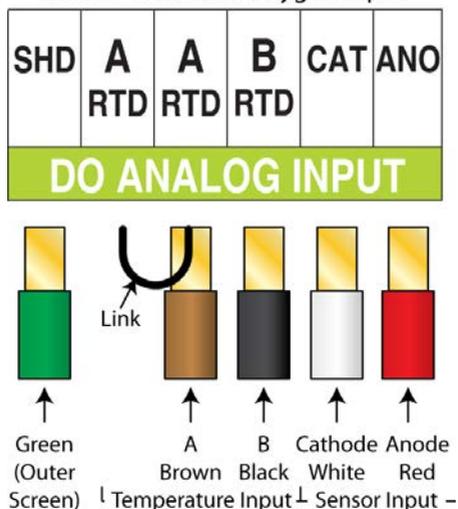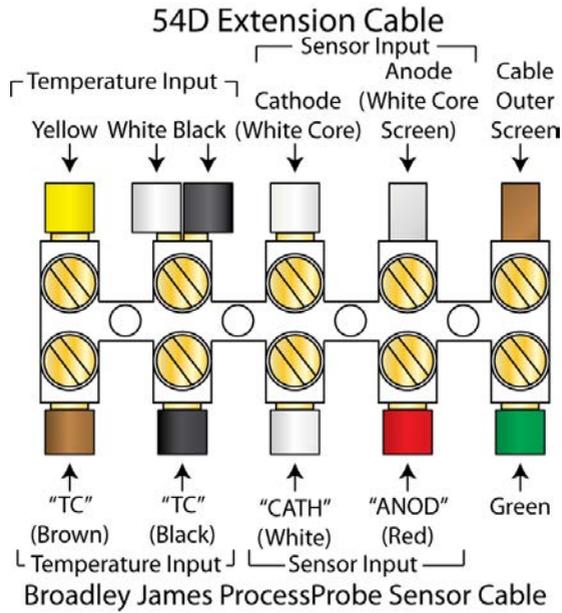

ProcessProbe Amperometric Dissolved Oxygen Sensor Cable Connection Details

ProcessProbe™ **Amperometric** 54D Extension Cable Connection Details

Extension Cable Connections

Hybrid™ SensorTalk™ Probe Cable To 54D Extension Cable Connection Details

**ProcessProbe™ Cable To 54D Extension Cable Connection Details**

User Interface

CAUTION! BEFORE PROCEEDING, ENSURE THAT THE INSTALLATION INSTRUCTIONS HAVE BEEN FOLLOWED CORRECTLY. FAILURE TO DO SO MAY RESULT IN AN ELECTRICALLY HAZARDOUS INSTALLATION OR IRREPARABLE DAMAGE TO THE INSTRUMENT.

The BOD17 uses a 3¾" 240x128 dot LCD Module to display the primary reading and temperature, show operational status, and to provide an intuitive user interface. This is accompanied by 5 control buttons whose function varies depending upon which screen the user is viewing. The button function is indicated by the control section at the bottom of the display.
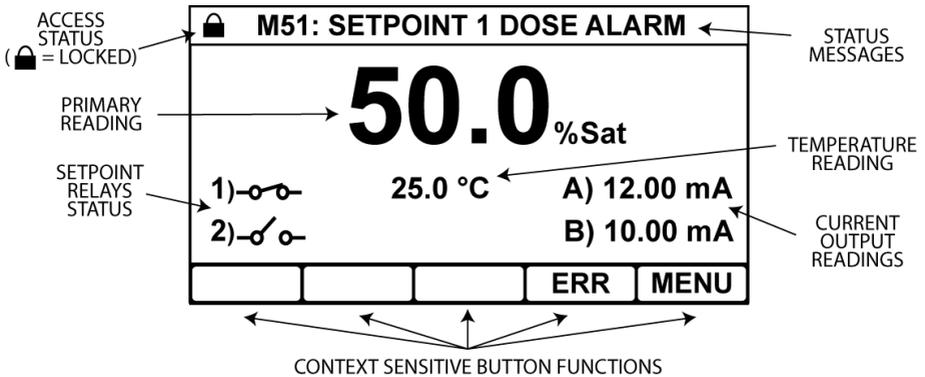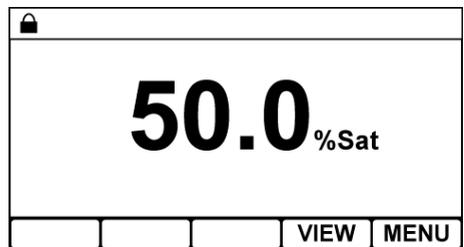

The Front Screen

Pressing the view button on the front screen cycles through 2 additional front screen options, note if an error occurs the instrument will return to the standard front screen.
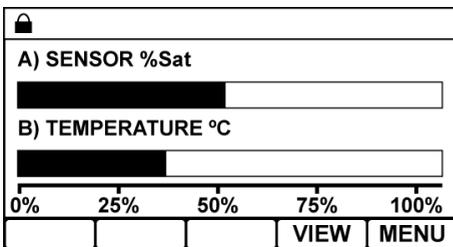
Current Output Bar Graph   Main Reading Only

Additional Front Screens

The instrument configuration is accessible by pressing the menu button on the front screen.
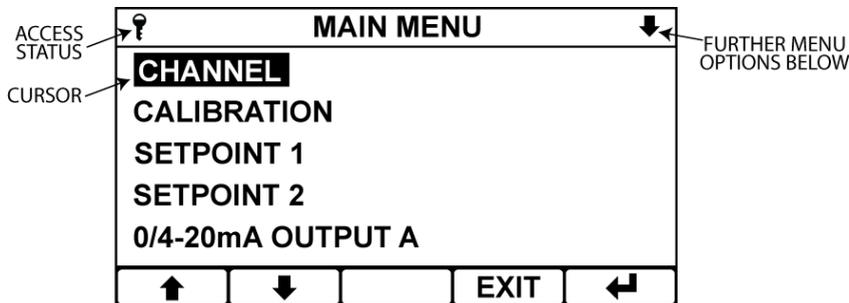
The main menu is split into three main sections: The top shows the menu you are currently in, the access status of the instrument, and whether there are further menu options below; the middle shows the options or settings of the current menu; the bottom section shows the button's function options for that menu. The Exit button is used to return to the previous menu. If no buttons are pressed after 2 minutes the instrument will default back to the front screen

Security Code Access

To protect the instrument setup from unauthorized or accidental tampering, a security access code system is present. This is implemented via the instrument's menu system which operates in two modes: "locked" as indicated by a padlock 🔒 symbol and "unlocked" as indicated by a key 🔑 symbol. The locked mode allows the user to observe the instrument's configuration but without the ability to change it. If the user wishes to change a setting, then the "Security Code" menu will appear that will prompt them to enter the security code, which will then change the instruments mode to "unlocked". Once unlocked, the user can change any setting without having to re-enter the security access code; however, the instrument will automatically lock itself if no further buttons are pressed after 2 minutes 30 seconds.

The user can select their own access code in the Set Access Code function of the configuration menu, or, alternatively they can disable the security system permanently by changing the access code to 0000.

The default security access code is <u>1000</u>
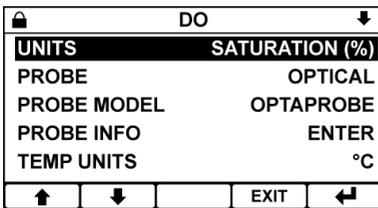
🔒 DO ⬇ **UNITS SATURATION (%)** PROBE OPTICAL PROBE MODEL OPTAPROBE PROBE INFO ENTER TEMP UNITS °C ⬆ ⬇ EXIT ↵	Select the option you wish to change and press enter to bring up the Security Code menu.

⬆/⬇   – Select Option

EXIT   – Cancel

↵   – Choose Option
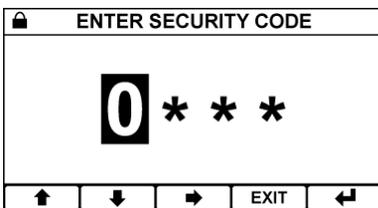
|	
🔒 ENTER SECURITY CODE **0** * * * ⬆ ⬇ ➡ EXIT ↵	Enter the required Access Code. If the code is incorrect, the user will be prompted to try again. If the code is correct, the padlock at the top of the screen will turn to a key and the unit will be unlocked.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Enter Code
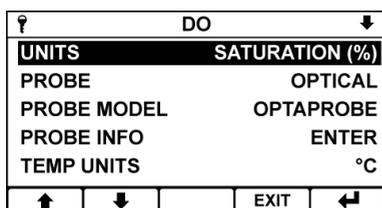

Dissolved Oxygen Input Setup

The Channel's setup menu contains the basic configurations for the sensor's input.
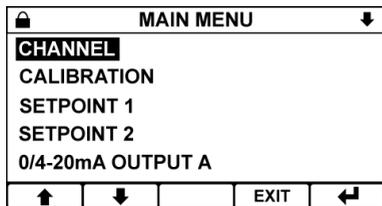
Main Menu

From the front screen press the Menu button to show the main menu options.

⬆/⬇   – Select Option

EXIT   – Return to Front Screen

↵   – Enter Option

Channel Menu

From the main menu highlight "channel" and press the Enter Option button to show the Channel menu options.

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

↵   – Enter Option
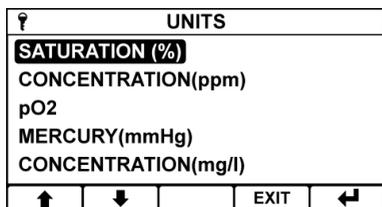
Units

The channel can be configured to display the following primary units:

- % (saturation)
- ppm (concentration)
- pO2 (partial pressure of Oxygen)
- mmHg (millimeters of Mercury)
- mg/l (milligrams per liter)
- Sensor's output current (when using an Amperometric Sensor).

The relationship between these three parameters is determined by several factors including temperature, pressure and the salinity of the solution being measured (see Appendix A - DO Measurement).

⬆/⬇   – Select Option

EXIT   – Cancel
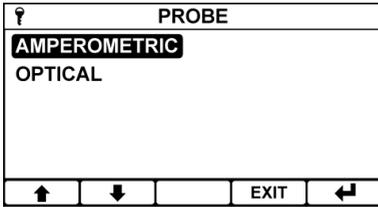
↵   – Save Selection

Probe

Select the type of probe the instrument is using.

Note: when a SensorTalk probe is connected this menu will automatically select the probe type fitted.

⬆/⬇ – Select Option
EXIT – Cancel
⏎ – Save Selection
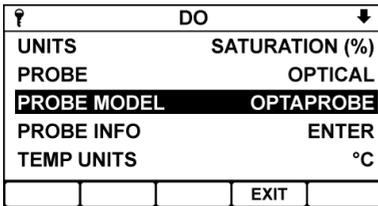
Probe Model

Displays the SensorTalk probe model connected to the instrument

Cannot be edited.
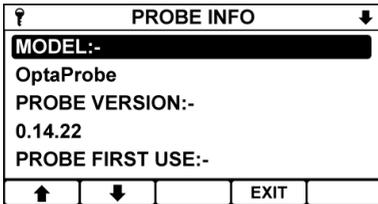
Probe Info

When using a SensorTalk probe this menu can be used to view the probe's model and manufacture information.

The user can also use this menu to add their own name and asset number to the probe.

⬆/⬇ – Select Option
EXIT – Cancel
⏎ – Enter Option
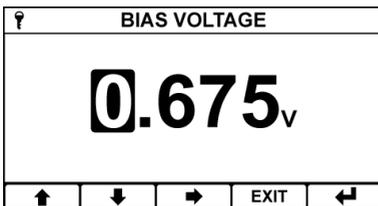
Bias Voltage

For Polarographic sensors, the polarising Bias Voltage can be set using this menu. Only available when using an Amperometric or Hybrid Probe.

⬆/⬇ – Increase / Decrease Digit
➡ – Select Next Digit
EXIT – Cancel
⏎ – Save Value

MEMBRANE CORRECTION

2220

⬆ ⬇ ➡ EXIT ↵

Membrane Correction Factor

The membrane correction factor is specific to each make of sensor and characterises the type and thickness of the membrane material in terms of how its permeability to Oxygen varies with temperature.

The Correction Factor can be set at this menu. Only available when using an Amperometric or Hybrid probe.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

TEMP UNITS

ºC
ºF
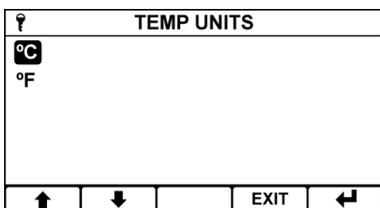
⬆ ⬇ EXIT ↵

Temperature Units

Sets the temperature units used.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

TEMP COMP MODE

PROBE
MANUAL

⬆ ⬇ EXIT ↵
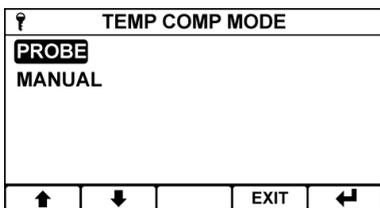
Temperature Compensation Mode

To use temperature compensation from either the probes inbuilt temperature element or manually via a fixed value entry.

Manual not available when using digital amperometric or optical probes.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

MANUAL TEMP INPUT

+25.0ºC
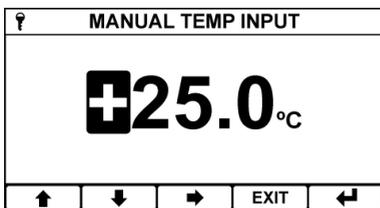
⬆ ⬇ ➡ EXIT ↵

Manual Temp Input

The fixed temperature value used for manual temperature compensation.

Only available when temperature compensation mode is set to "manual".

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

BOD17 Dissolved Oxygen Monitor
Operating Guide

INPUT SALINITY

0̲0.0ₚₚₜ

⬆   ⬇   ➡   EXIT   ⏎
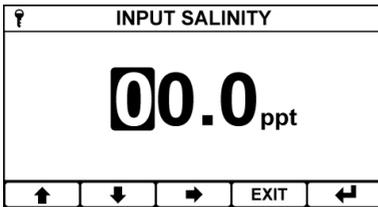
Input Salinity

The Salinity of the solution has a significant effect when converting % Saturation to Concentration.

Using this menu the user can compensate for this by setting the input salinity parameter to the correct level (entered in ppt, parts per thousand).

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

⏎   – Save Value

UNITS   ⬇

Atm
Bar
kPa
mH2O
psi
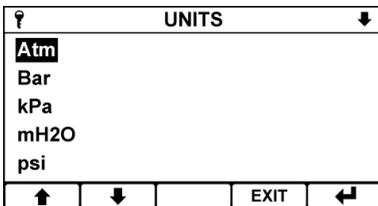
⬆   ⬇   EXIT   ⏎

Pressure Units

Set the units the manual pressure compensation is entered with.

⬆/⬇   – Select Option

EXIT   – Cancel

⏎   – Save Selection

INPUT PRESSURE

0̲1.00ₐₜₘ
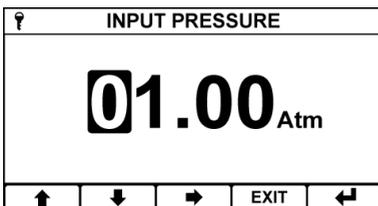
⬆   ⬇   ➡   EXIT   ⏎

Input Pressure

To compensate for the effect pressure has on the solubility oxygen has in water, the user can enter in a manual pressure value.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

⏎   – Save Value

SHOW SECONDARY

NO
CONCENTRATION (ppm)
pO2
MERCURY(mmHg)
CONCENTRATION(mg/l)
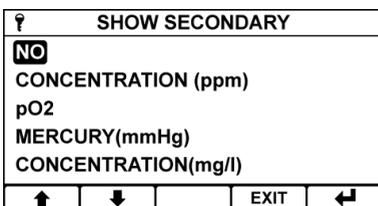
⬆   ⬇   EXIT   ⏎

Show Secondary

Allows the user to display a secondary measurement derived from the sensor. Resultant value is displayed on the front screen in a minor position.

⬆/⬇   – Select Option

EXIT   – Cancel

⏎   – Save Selection

```
┌─────────────────────────────────┐
│ ♀      INPUT FILTER         ↓   │
│ ┌─────┐                         │
│ │ OUT │                         │
│ └─────┘                         │
│  10 SECONDS                     │
│  20 SECONDS                     │
│  40 SECONDS                     │
│  1 MINUTE                       │
│  ┌───┬───┬─────┬──────┬───┐    │
│  │ ↑ │ ↓ │     │ EXIT │ ↵ │    │
│  └───┴───┴─────┴──────┴───┘    │
└─────────────────────────────────┘
```
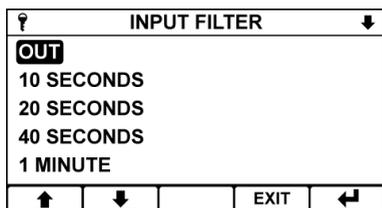
Input Filtering (Averaging)

When very noisy environments are encountered, this function will allow the user to filter the sensor readings by taking a running average over the time period selected (from 10 seconds to 5 minutes). Only available when using Amperometric or Hybrid probes.

↑/↓   – Select Option

EXIT   – Cancel

↵   – Save Selection

Digital SensorTalk Sensor Filters

The OptaProbe™ and Digital DO Smart Sensor employ a powerful collection of bubble and signal-noise filters, each with a wide range of configurable options. These filters built into the sensors provide very simple and straightforward options for creating advanced bubble and signal-noise mitigation strategies.

In total there are three elements to the filter system of the sensors:

Output Filter –   When enabled can be set to either Standard or Lowest and is applied once the signal has passed through any other enabled filter.

Standard – The sensor's reading is filtered based on a percentage, where 100% is the greatest amount of filtering and produces the smoothest signal (with the longest delay in response).

Lowest – The sensor detects the lowest DO %SAT reading and maintains that value for the time period defined in the Lowest Integration Time (0-600s) setting. The time determines the period of reading samples that are evaluated to determine which is currently the lowest.

Bubble Filter –   The Bubble Filter monitors for any rapid changes in the process DO %SAT reading, such as an gas bubble striking or adhering to the sensing surface. If a rapid change does occur, the filter will hold the output reading until the event has passed. When the bubble filter is holding the value a Padlock Symbol 🔒 is shown next to the main reading on the front screen.

Hold Response – A secondary fail-over filter that, if enabled, will engage when the Bubble Filter's maximum hold period has elapsed, and will provide a more aggressive output filtering of the live reading. This allows for dynamically adapting the Output Filter settings to contend with a period of excessive bubble spikes.

In addition to the alternate Output Filter settings this filter offers, it also provides a second means of evaluating the Bubble Filter's Held Output Time in terms of a percentage of the last twenty minutes. Thus, in a scenario where the Bubble Filter may encounter frequent 'hold/release' cycles, those periods may be considered too frequent for good process measurement.

Output Filter

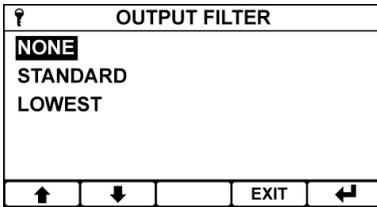Select the Output Filter's operating mode.

Standard – The sensor's reading is filtered based on a percentage, where 100% is the greatest amount of filtering and produces the smoothest signal (with the longest delay in response).

Lowest – The sensor detects the lowest DO %SAT reading during the defined integration time and maintains that value.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

OUTPUT FILTER

NONE
STANDARD
LOWEST
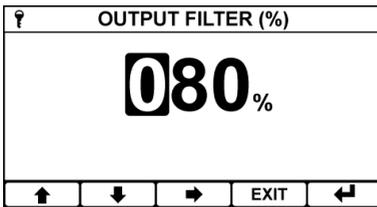
⬆ ⬇ EXIT ↵

Output Filter (%)

Output Filter, Standard mode percentage

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

OUTPUT FILTER (%)

0 80 %

⬆ ⬇ ➡ EXIT ↵

Integration Time

Output Filter, Lowest mode integration time.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

INTEGRATION TIME

2 00 s
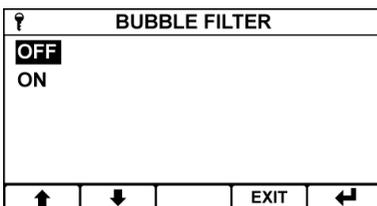
⬆ ⬇ ➡ EXIT ↵

Bubble Filter

Enable the Bubble Filter.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

BUBBLE FILTER

OFF
ON
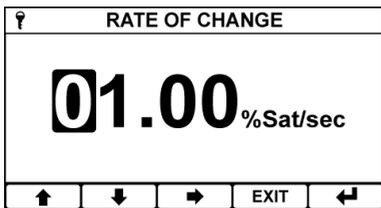
⬆ ⬇ EXIT ↵

Rate of Change

Absolute %SAT Rate-of-Change (RoC) threshold that, when exceeded, activates the Bubble Filter's "Hold Output".

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Save Value

Delay Hold

Duration of time required without the Bubble Filter's rate of change threshold being exceeded before the release of the held output.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Save Value
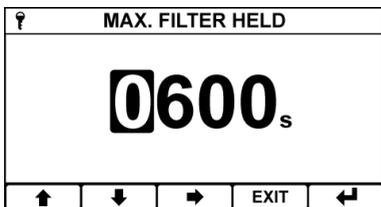
Maximum Filter Held

The maximum time limit in seconds (up to 3600) that the Bubble Filter can continually hold an output value. Once exceeded the output is immediately released from hold, and either the DO %SAT returns to a live reading or, if enabled, is passed to the Hold Response Filter.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Save Value
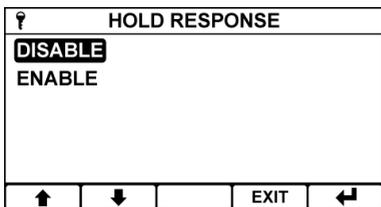
Hold Response

Enable the Hold Response Filter.

⬆/⬇   – Select Option

EXIT   – Cancel

↵   – Save Selection

HOLD TIME LIMIT

[0]10 %
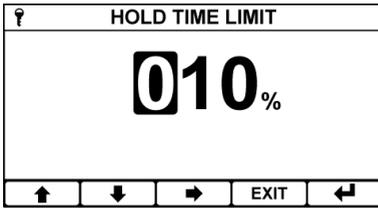
⬆ ⬇ ➡ EXIT ↵

Hold Time Limit

The percentage of time, over the last 20 minutes, which the output is allowed to be held by the Bubble Filter.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value


HOLD FILTER

STANDARD
LOWEST

⬆ ⬇ EXIT ↵
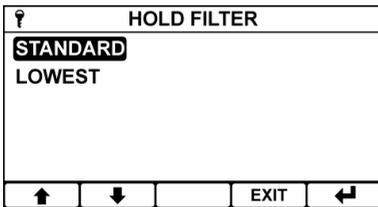
Hold Filter

Select the Hold Filter's operating mode.

Standard - The sensor's reading is filtered based on a percentage, where 100% is the greatest amount of filtering and produces the smoothest signal (with the longest delay in response).

Lowest – The sensor detects the lowest DO %SAT reading during the defined integration time and maintains that value.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

HOLD FILTER (%)

[0]80 %
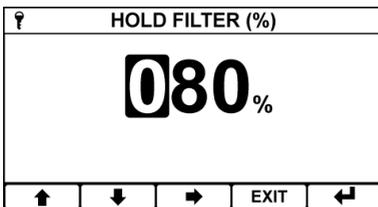
⬆ ⬇ ➡ EXIT ↵

Hold Filter (%)

Holder Filter, Standard mode percentage

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

HOLD TIME

[0]0200 ms
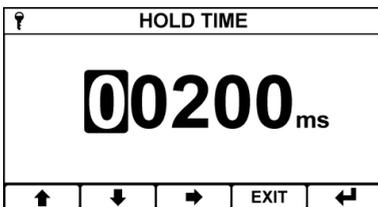
⬆ ⬇ ➡ EXIT ↵

Hold Time

Hold Filter, Lowest mode integration time.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value
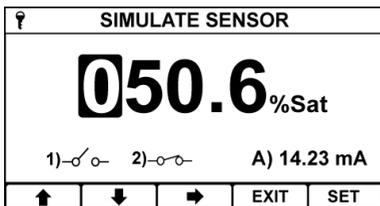
Simulate Sensor

To help in commissioning of the instrument the user can use this menu to manually set the sensor reading and test the operation of the setpoints and current output.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

SET   – Use Entered Value
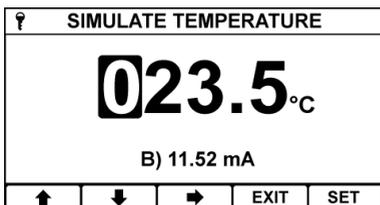
Simulate Temperature

To help in commissioning of the instrument the user can use this menu to manually set the temperature reading and test the operation of the current output. Only available on advanced instruments.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

SET   – Use Entered Value

Calibration

Calibration Procedures

Normal good practices should be observed when calibrating DO systems. When the instrument is first connected to the oxygen sensor, i.e. when the unit is first installed, or whenever the oxygen sensor is changed or the membrane is replaced, the user should at least perform a span calibration and at best a combined zero and span calibration of the system using the following procedure. If necessary the user can use a span calibration other than 100% by simply setting the span calibration level in the "Span Calibration Point" item in the Calibration menu.

Notes.

- As an aid to stable air calibration, a partially covered bucket can be used to shield the sensor from the temperature variations which arise from exposure to the wind and sunlight.

- Approximate Amperometric sensor current is 60nA at 100% Saturation.

- Approximate Optical sensor PA (Phase Angle) is 25° at 100% Saturation and 50° at 0% Saturation

- If using a manually temperature compensated sensor an accurate calibration solution temperature is required to compensate for the effects of temperature. The manual calibration temperature can be entered in to the "Calibration Manual Temperature Input" menu item in the input channel's Calibration menu.

- In a system where the pressure can vary over a wide range, ensure that the correct pressure level is entered in to the "Calibration Manual Pressure Input" menu item.

- When a Amperometric sensor is connected to the instrument and the system is first turned on, a polarization voltage is applied across the sensor. Initially the sensor current will be very high as oxygen is depleted from the internal electrolyte. After a few hours it should have fallen off to a steady state. So it is recommended that an Amperometric sensor is allowed to fully stabilize before calibration is started. Alternatively, the sensor is connected either to a polarizing unit or a powered instrument when not in use.

Span Calibration

- The frequency of this check depends upon the application or required accuracy, but should be made generally once a month.

- Wash off any process chemicals or water from the sensor. Use de-mineralised water or follow the manufacturer's cleaning instructions as necessary.

- It is recommended that % saturation is used as the calibration unit.

- Stabilise the sensor by leaving it in the process solution for up to 10 minutes. This will allow the temperature compensator networks to reach equilibrium.

- Lift the sensor so that it is just above the process solution, and therefore as close to the temperature of that solution as possible.

- Select Sensor Span Calibration item in the calibration menu, observe the instrument readings and wait until the output stabilises.

- Once stable press the "ENTER" key and the unit will correct the span calibration to the user selected span calibration point.

Full Sensor Calibration – Zero Calibration Step in a De-Oxygenated Environment

- Prepare either a fresh solution of approximately 2% wt/vol. of sodium sulphite in de-mineralised water or a vessel filled with flowing inert gas such as nitrogen.

- Wash off any process chemicals or water from the sensor, which may contaminate the solution. Use de-mineralized water or follow the manufacturer's cleaning instruction as necessary.

- It is recommended that % saturation is used as the calibration units.

- Allow the output to settle in air at (or close to) 100% saturation.

- Select the "Full Sensor Calibration" item in the calibration menu and place the sensor in the sodium sulphite solution or vessel and observe the current / PA reading. The reading should drop below 10% of the air saturated reading within 35 seconds for Amperometric sensors.

- For Amperometric sensors, if this time is exceeded, cycle the sensor between the free air and the solution to improve the speed of the response. If cycling it 3 or 4 times does not improve the response significantly, store the sensor overnight in the solution and then re-test it with a fresh solution the following day. If it still does not respond within the specified time, the cartridge's membrane should be checked and replaced if necessary, otherwise the electrolyte will have to be replaced.

- If the sensor responds quickly enough, check that within another 3 minutes the current reading has fallen to virtually zero. Then press the Enter button at the zero calibration screen to calibrate the new zero point.

- Once the Zero point has been calibrated, the instrument will automatically progress on to the Span Calibration menu and the user should follow the above Span Calibration steps.

Calibration Menu

The calibration menu provides the ability to adjust the sensor inputs to the system in which it is operating.

The default security access code is 1000

MAIN MENU

CHANNEL
CALIBRATION
SETPOINT 1
SETPOINT 2
0/4-20mA OUTPUT A

⬆ ⬇ EXIT ↵

Main Menu

From the front screen press the menu button to show the main menu options.

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option

CALIBRATION

MODE ONLINE
HEAT CYCLES 5
CALIBRATION UNITS %Sat
MANUAL PRESSURE 1.00Atm
SPAN CAL POINT 100.0%Sat

⬆ ⬇ EXIT ↵

Calibration Menu

From the main menu highlight "calibration" and press the enter option button to show the channel menu options.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

MODE

ONLINE
OFFLINE

⬆ ⬇ EXIT ↵

Mode

Selecting off-line causes any setpoints to de-energise and current outputs to go to their off-line state. Useful for when commissioning or calibrating the instrument.

When the instrument is placed in an off-line state "off-line" will appear on the front screen.

⬆/⬇ – Select Option
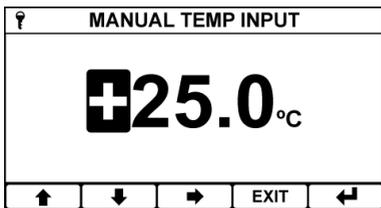
EXIT – Cancel

↵ – Save Selection

CALIBRATION

MODE ONLINE
HEAT CYCLES 5
CALIBRATION UNITS %Sat
MANUAL PRESSURE 1.00Atm
SPAN CAL POINT 100.0%Sat

⬆ ⬇ EXIT ↵

Heat Cycles

Displays the combined number of steam in place and autoclave cycles the sensor has experienced.

Function only available on certain SensorTalk sensors.

Cannot be edited.

MANUAL TEMP INPUT

+25.0°C

↑ | ↓ | ➡ | EXIT | ↵

Calibration Manual Temperature Input

This setting allows a different fixed temperature value to be used when calibrating. Makes it easier to calibrate a standard solution at a different temperature to the process. Only available when the temperature compensation mode has been set to Manual in the Channel Setup menu.

↑/↓ — Increase / Decrease Digit

➡ — Select Next Digit

EXIT — Cancel

↵ — Save Value

MANUAL PRESSURE

01.00 Atm

↑ | ↓ | ➡ | EXIT | ↵
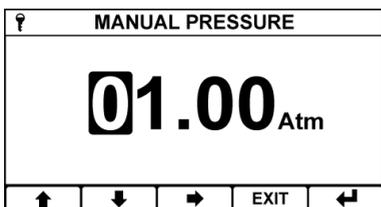
Calibration Manual Pressure Input

This setting allows a different fixed pressure value to be used when calibrating. Makes it easier to calibrate a standard solution at a different pressure to the process.

↑/↓ — Increase / Decrease Digit

➡ — Select Next Digit

EXIT — Cancel

↵ — Save Value

SPAN CAL POINT

100.0%Sat
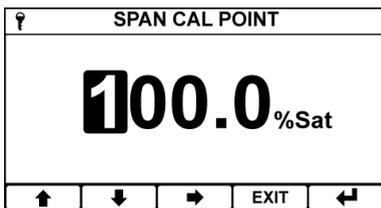
↑ | ↓ | ➡ | EXIT | ↵

Span Calibration Point

Set the calibration point that the span calibration is calculated to.

↑/↓ — Increase / Decrease Digit

➡ — Select Next Digit

EXIT — Cancel

↵ — Save Value

Sensor Span Calibration

To start the Dissolved Oxygen sensor's span calibration select the "Sensor Span Cal" item from the calibration menu and press enter.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

⏎ – Enter Sensor Span Calibration

Place Sensor In Free Air

Place the sensor in free air and press enter to begin sampling.

Once the calibration has finished the instrument will give an update on the sensor's operating condition. Press enter to finish the calibration

EXIT – Return to Main Menu

⏎ – Begin Sensor Span Calibration

Full Sensor Calibration

To start the Dissolved Oxygen sensor's full calibration select the "Full Sensor Cal" item from the calibration menu and press enter.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

⏎ – Enter Sensor Span Calibration

Purge Oxygen From Sensor

Place the sensor in a 0% saturated environment and press Enter to begin sampling.

Once the calibration has finished successfully it will automatically progress on to the Sensor Span Calibration

EXIT – Return to Main Menu

⏎ – Begin Sensor Zero Calibration

Place Sensor In Free Air

Place the sensor in free air and press Enter to begin sampling.

Once the calibration has finished the instrument will give an update on the sensor's operating condition. Press Enter to finish the calibration

EXIT – Return to Main Menu

⏎ – Enter Sensor Span Calibration

Sensor Condition

The BOD17 is capable of analysing the result of Amperometric sensor span and zero calibration and indicate to the user the condition the sensor is in.

- Good – The sensor is operating within set parameters.
- Fault – The sensor's output is too high at zero calibration. See Fault Finding Section for assistance.
- Refill – The sensor's output is too low at span calibration and will likely need replenishing. See Fault Finding section for assistance.
- Span High – The sensor's output is too high at span calibration. See Fault Finding section for assistance.

Cannot be edited. Not available when using optical dissolved oxygen sensors.

CALIBRATION

FULL SENSOR CAL   ENTER
  CONDITION   GOOD
SENSOR nA ZERO CAL   ENTER
  ZERO OFFSET VALUE   +0.0nA
TEMP OFFSET CAL   ENTER
                        EXIT

Sensor nA Zero Calibration

To start the Dissolved Oxygen sensor's nA Zero calibration select the "Sensor nA Zero Cal" item from the calibration menu and press enter.

Allows the user the ability to re-zero the nA input reading.

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

↵   – Enter Sensor Span Calibration

SENSOR nA ZERO CAL

PURGE OXYGEN FROM PROBE

SENSOR OUTPUT: 0.4nA

PRESS '↵' TO START
                        EXIT

Purge Oxygen From Probe

Place the sensor in a 0% saturated environment to produce a 0nA reading and press Enter to begin sampling.

Once the calibration has finished press enter to continue.

EXIT   – Return to Main Menu

↵   – Begin Sensor Span Calibration

CALIBRATION

FULL SENSOR CAL   ENTER
  CONDITION   GOOD
SENSOR nA ZERO CAL   ENTER
  ZERO OFFSET VALUE   +0.0nA
TEMP OFFSET CAL   ENTER
                        EXIT

Zero Offset Value

The nA zero offset value currently being used. The value will change depending on the result of the sensor nA zero calibration.

Cannot be edited.

Temperature Offset Calibration

The temperature offset calibration enables the user to adjust the temperature reading to match a known input.

The current temperature reading is shown and is adjusted by pressing the up and down arrows. When the reading is correct press the Enter button to store the calibration. The calculated offset is shown in the next menu entry.

Only available when using Amperometric or Hybrid Dissolved Oxygen sensors

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

⤶ – Save Calibration
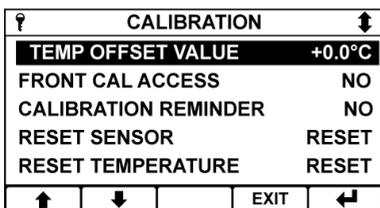
Temp Offset Value

The temperature offset value currently being used. The value will change depending on the result of the temperature offset calibration.

Cannot be edited.
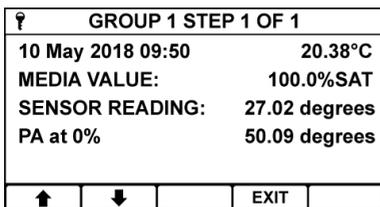
Calibration History

The Calibration History page provides a record of all Zero and Span calibrations carried out.

The data includes the date and time of the calibration, the calibration span point, the measured sensor current or phase angle and the temperature compensation reading.

SensorTalk sensors only.

⬆/⬇ – Browse records

EXIT – Exit back to calibration menu

FRONT CAL ACCESS

YES
NO

EXIT
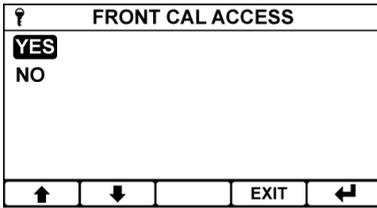
Front Screen Calibration Access Enable

When enabled front calibration access allows direct entry into the calibration menu from the front screen by pressing the "CAL" button.

It also disables the security access system within the calibration menu enabling the use of the calibration functions without having to enter the security access code.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

CALIBRATION REMINDER

YES
NO

EXIT
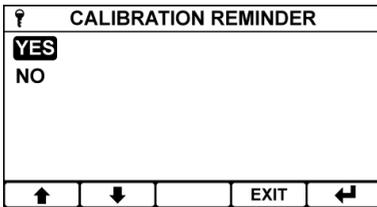
Calibration Reminder

By enabling the Calibration Reminder the user can configure a calibration interval, which, when expired, will activate an alarm and message on the front screen.

On the completion of a successful sensor calibration the next calibration date will be automatically incremented by calibration interval.

Not available when using Optical Dissolved Oxygen sensors.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

CALIBRATION INTERVAL

060DAYS

EXIT

Calibration Interval

Sets the interval time for the calibration alarm.

The Next Cal Date will update to show the date of the next calibration alarm.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

NEXT CALIBRATION DATE

01 MAR 2018

⬆ | ⬇ | ➡ | EXIT | ↵

Next Calibration Date

Sets the exact date of the next calibration alarm.

The Calibration Interval will update to show the number of days to the next calibration date.

⬆/⬇ – Increase / Decrease Digit or Text

➡ – Select Next Item

EXIT – Cancel

↵ – Save Value

CALIBRATION ⬆

CAL. INTREVAL   60 DAYS
NEXT CAL. DATE   11 MAR 18
DEFER CAL. DATE   7 DAYS
RESET SENSOR   RESET
RESET TEMPERATURE   RESET

⬆ | ⬇ | | EXIT | ↵

Defer Calibration Date

Turns off the alarm and increases the calibration interval by an extra 7 days.

Only appears once the calibration interval has expired.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

CALIBRATION ⬆

NEXT CAL. DATE   11 MAR 18
DEFER CAL. DATE   7 DAYS
CUSTOM BUFFER   ENTER
RESET SENSOR   RESET
RESET TEMPERATURE   RESET

⬆ | ⬇ | | EXIT | ↵

Reset Sensor

Reset any sensor calibration that may have been performed.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

CALIBRATION ⬆

NEXT CAL. DATE   11 MAR 18
DEFER CAL. DATE   7 DAYS
CUSTOM BUFFER   ENTER
RESET SENSOR   RESET
RESET TEMPERATURE   RESET

⬆ | ⬇ | | EXIT | ↵

Reset Temperature

Reset any user temperature calibration that may have been performed.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

Setpoints

The BOD17 is be fitted with two "Normally Open" setpoint relays designated Setpoint 1 and Setpoint 2. The Setpoint menu contains all of the necessary setup functions to configure the setpoint. The instrument indicates the status of the relay by means of a symbol on the front screen.

Indicates that the relay contact is open

Indicates that the relay contact is closed (if flashing, indicates that a dose alarm has occurred).
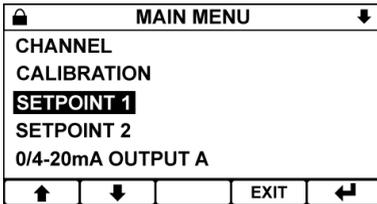
Main Menu

From the front screen press the Menu button to show the main menu options and select the setpoint you wish to configure.

⬆/⬇ – Select Option

EXIT – Return to Front Screen
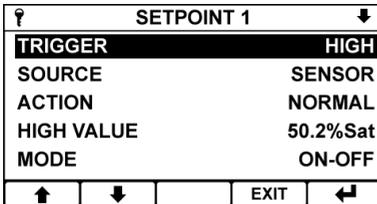
↵ – Enter Option

Setpoint Menu

Select the Setpoint function you wish to configure.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option
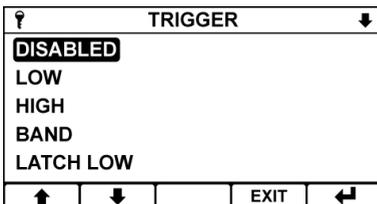
Trigger

The setpoints can be configured to trigger in the following ways:

- Low
- High
- Band
- Latch Low
- Latch High
- Cleaning
- Alarm

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Low
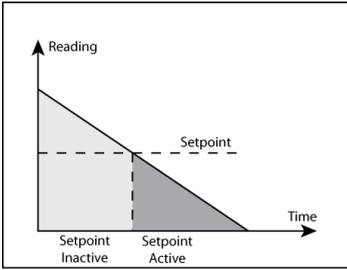
The setpoint will activate when the sensor reading becomes less than the setpoint level.
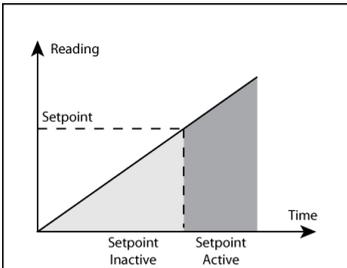
High

The setpoint will activate when the sensor reading becomes greater than the setpoint level.
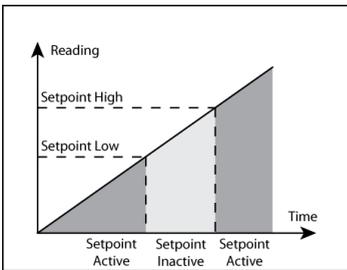
Band

The setpoint will activate when the sensor reading is either greater than the setpoint High level or less than the setpoint Low level.
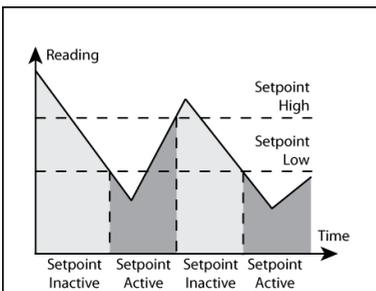
Latch Low

The setpoint will activate when the sensor reading is less than the setpoint low level and will remain active until the reading rises above the setpoint high level. It will then remain inactive until the reading level falls below the setpoint low level.
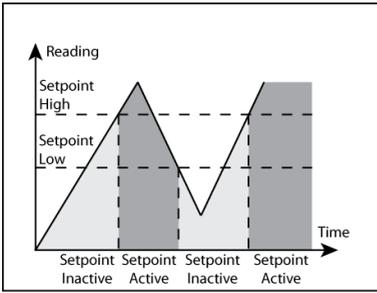
Latch High

The setpoint will activate when the sensor reading is greater than the setpoint high level and will remain active until the reading falls below the setpoint low level. It will then remain inactive until the reading rises above the setpoint high level.

Alarm

The setpoint will activate by one of the following sources.

- Sensor Error – When a sensor related error is detected.
- Dose Alarm – When the dose alarm activates.
- Calibration – When a calibration is in progress.
- Offline – When the instrument is taken offline.
- Any Error – When any error is detected.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Source

Select the source for the setpoint. Note the Temperature option is only available when the temperature compensation mode has been set to probe in the channel setup menu.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Action

Set the setpoint to work in the Normal mode or Reverse mode, which is akin to a normally closed relay except it will fall open if the power to the instrument is removed.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection
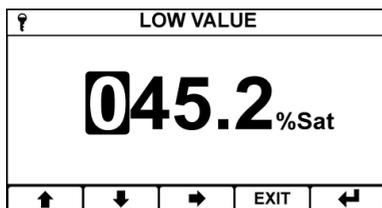
Low Value

The Setpoint Low value.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel
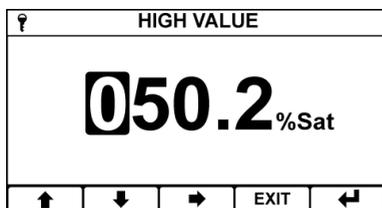
⏎ – Save Value

High Value

The Setpoint High value.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

⏎ – Save Value
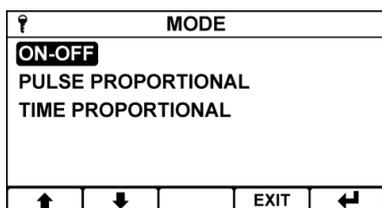
Mode

The Setpoints can operate in one of three modes.

On-Off Mode – The setpoint energises when the setpoint is activated and de-energises when the setpoint is de-activated.

Pulse Proportional – See Setpoint proportional Mode Section.

Time Proportional – See Setpoint proportional Mode Section.

Menu only available when trigger is set to either high or low

⬆/⬇ – Select Option

EXIT – Cancel

⏎ – Save Selection

Delay

In order to prevent short duration changes at the input affecting the setpoint operation, a delay can be set before the setpoint is energized. If the input is still the same after the delay, then the setpoint will be energised.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

⏎ – Save Value
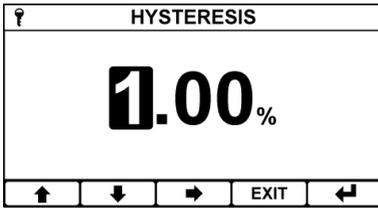
Hysteresis

A facility to apply hysteresis to the setpoint level allows the user to avoid setpoint "Chatter" when the reading level approaches the setpoint level.

"Chatter" is caused when the reading is sufficiently close to the setpoint value and noise on the signal repeatedly crosses the setpoint level, thus causing the relay to switch on and off rapidly.

The hysteresis level should therefore be set to be greater than the input noise level.

The Hysteresis value is a percentage of the setpoint value applied both + and − to the setpoint. For example, if the setpoint was 10.00 and the Hysteresis was 1% then the hysteresis band would operate from 9.90 to 10.10.

Hysteresis operates as follows:

Trigger High – The setpoint is inactive until the reading is greater than the Setpoint High + (Setpoint High X Hysteresis %). It remains active until it goes below Setpoint High – (Setpoint High X Hysteresis %).

Trigger Low – The setpoint is inactive until the reading is less than the Setpoint Low – (Setpoint Low X Hysteresis %). It remains active until it goes above Setpoint Low + (Setpoint Low X Hysteresis %).

Trigger Band – The setpoint uses both High and Low.

Note: Hysteresis is only available when setpoint trigger is set to High, Low or Band.

⬆/⬇ – Increase / Decrease Digit
➡ – Select Next Digit
EXIT – Cancel
⏎ – Save Value

Setpoint Trigger: High – Hysteresis

Setpoint Trigger: Low – Hysteresis
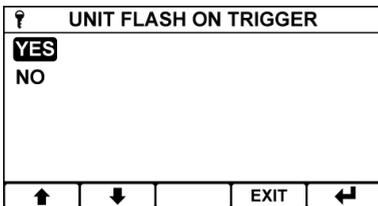
Unit Flash on Trigger

When enabled the backlight of the unit will flash when the setpoint has been triggered.

⬆/⬇ – Select Option
EXIT – Cancel
⏎ – Save Selection

Setpoint Dose Alarm

The Dose Alarm timer can be used to prevent overdosing under many different fault conditions, such as sensor failure or application problems.

Dose Alarm

Enable the Dose Alarm for the selected setpoint.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Alarm Time

Sets the time, for which, if the setpoint is active for longer than, causes the Dose Alarm to activate.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

Dose Alarm Active

When the Dose Alarm activates the following happens:-
● The setpoint will de-energise.
● The associated front screen setpoint symbol will flash.
● The Dose Alarm error message will appear at the top of the front screen.
● ACK will appear as a function to acknowledge the setpoint on the front screen – press to clear the alarm.

Note: If, once cleared, the setpoint again remains energised for the length of the dose alarm timer, then the Dose Alarm will once again activate. If this problem persists then a dosing problem will need to be investigated.

ACK 1 – Clear Setpoint 1 Dose Alarm

ACK 2 – Clear Setpoint 2 Dose Alarm

Menu – Access Main Menu

INITIAL CHARGE

YES
NO

EXIT
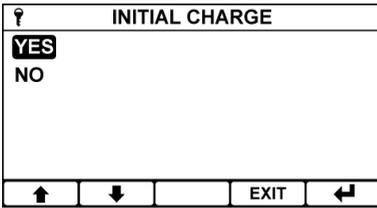
Initial Charge

This allows the user to have a onetime override of the Dose Alarm to use, for example, when filling a tank for the first time.
The user enters a charge time and then initiates the charge time. The instrument will then disable the dose alarm until either the relay becomes inactive because the setpoint has been reached, or the charge timer reaches zero in which event the instrument will automatically enter the Dose Alarm state.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

CHARGE TIME

10.00 mm:ss

EXIT

Charge Time

Sets the initial charge time.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

CHARGE ACCESS

YES
NO
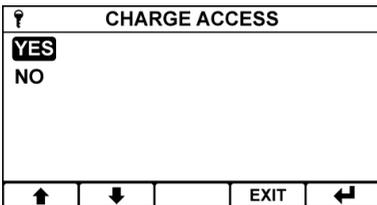
EXIT

Charge Access

Enabling this allows the user to initialise the initial charge by means of a button on the front screen.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

SETPOINT 1

START CHARGE   START
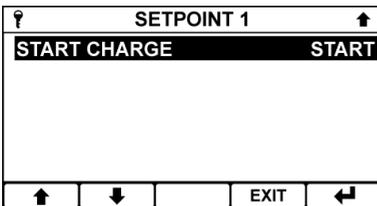
EXIT

Start Initial Charge

The user can also start the initial charge via this option in the setpoint menu.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Setpoint Cleaning Mode

The Setpoints can be configured to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. Its purpose is to prevent accumulation of particulate matter on the active surfaces of the sensor. Note when cleaning is active the input will be taken offline; this will prevent any undesired control actions resulting from spraying cleaning solution onto the sensor.

TRIGGER DISABLED LOW HIGH BAND CLEANING ⬆ ⬇ EXIT ↵	**Trigger** If available select Cleaning from the list of options. ⬆/⬇ – Select Option **EXIT** – Cancel ↵ – Save Selection
CLEAN DURATION **1**0.00 mm:ss ⬆ ⬇ ➡ EXIT ↵	**Clean Duration** Enter the duration of the cleaning operation. ⬆/⬇ – Increase / Decrease Digit ➡ – Select Next Digit **EXIT** – Cancel ↵ – Save Value
CLEAN INTERVAL **1**2.00 hh:mm ⬆ ⬇ ➡ EXIT ↵	**Clean Interval** Enter the time between cleaning operations. ⬆/⬇ – Increase / Decrease Digit ➡ – Select Next Digit **EXIT** – Cancel ↵ – Save Value

CLEAN RECOVERY

0̲0.30 mm:ss

Clean Recovery

The user can introduce an additional post cleaning delay before coming back "On-line". This provides the sensor a period to stabilise after the cleaning has finished.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

⏎ – Save Value

CLEAN DELAY

YES
NO
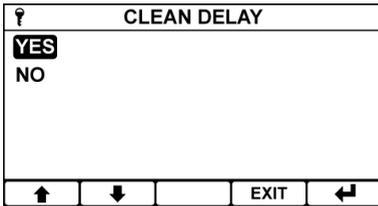
Clean Delay

If enabled, this causes the clean cycle to wait if any other control setpoints are active. This is shown by a clean delayed message on the front screen.

⬆/⬇ – Select Option

EXIT – Cancel

⏎ – Save Selection

SETPOINT 1

CLEAN DELAY   NO
MANUAL CLEAN   START
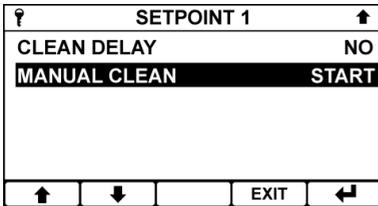
Manual Clean

This manually starts a clean cycle.

⬆/⬇ – Select Option

EXIT – Cancel

⏎ – Save Selection

Setpoint Proportional Mode

In addition to On/Off mode the instrument also provides two forms of pseudo proportional control, which can be used to control the levels to a defined value when used in conjunction with a pump or valve. When the reading deviates from the programmed set point level the relay pulses at a rate proportional to that deviation. Note – Only available when Setpoint Trigger is set to either High or Low.

Pulse Proportional Mode

The Pulse Proportional mode is intended to drive solenoid type dosing pumps which have the facility to accept an external pulse input. The setpoint relay operates by producing a pulse of 0.25 seconds in duration and with a maximum period of one pulse per 30 seconds. The pulse rate increases as the measurement moves further from the set point, until it reaches the minimum period of one pulse per 0.5 seconds at the limit of the proportional band.
For example if the user sets a proportional band of 1.00, the setpoint trigger to LOW, and a setpoint value of 10.00. When the reading falls just below 10.00 the setpoint will begin to pulse at its longest period of once per 30 seconds. As the reading falls further from the setpoint the period will decrease until it reaches its minimum of one pulse every 0.5 seconds at the limit of the proportional band. (See Setpoint Pulse Rate – Pulse Proportional Mode section on the diagram below.)

Time Proportional Mode

Time Proportional Mode allows a user defined cycle time to control any on/off device such as a solenoid valve or dosing pump over a user set proportional band.
For example if the user sets a proportional band of 1.00, the setpoint trigger to LOW, and a setpoint value of 10.00. When the reading falls below 9.00 the setpoint would be energised 100% of the cycle time. As the input rises and approaches the set point the setpoint starts to cycle on and off with the on time reducing and the off time increasing, respectively until it reached the setpoint and would be off for 100% of the cycle time. The cycle time is adjustable and is the sum of the on and off times. (See Setpoint Cycle Time – Time Proportional Mode section on the diagram below.)
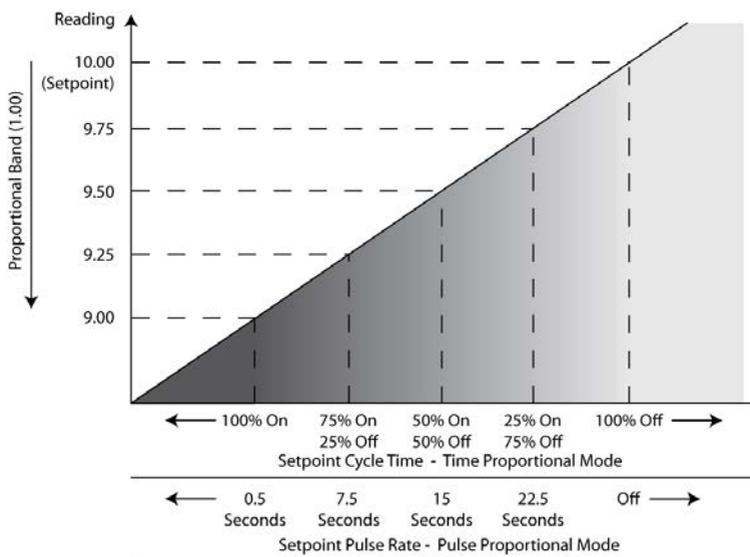
Cycle Time

Sets the cycle time (sum of both On and Off periods)

Only available when Mode is set to Time Proportional.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel
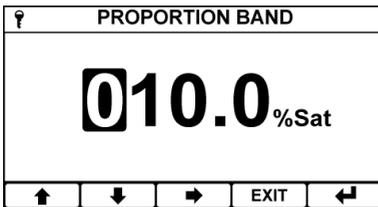
↵   – Save Value

Proportion Band

Enter the size of the Proportion Band.

Only available when Mode is set to Pulse or Time Proportion.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Save Value

0/4-20mA Output

The BOD17 is fitted with up to two current outputs, either which can be used for the transmission of the primary variable, process temperature or if using a digital dissolved oxygen sensor, the unfiltered %Saturation value. The current output menu contains all of the necessary setup functions to configure the current output sources. The instrument will display the status of the current output on the front screen, where " --.--mA " indicates that the output is disabled.

MAIN MENU ⬇
CHANNEL
CALIBRATION
SETPOINT 1
SETPOINT 2
0/4-20mA OUTPUT A
⬆ ⬇ EXIT ↵

Main Menu

From the front screen press the Menu button to show the main menu options and select 4-20mA Output.

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option

0/4-20mA OUTPUT A ⬇
OUTPUT MODE   4-20mA
SOURCE   SENSOR
ZERO (4mA)   0.0%Sat
SPAN (20mA)   200.0%Sat
ON ERROR   NO ACTION
⬆ ⬇ EXIT ↵

0/4-20mA Output Menu

Select the 0/4-20mA function you wish to configure.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

OUTPUT MODE
DISABLED
0-20mA
4-20mA
⬆ ⬇ EXIT ↵

Output Mode

Enable the current output by selecting its output mode, either 0 – 20mA or 4 – 20mA.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

SOURCE
SENSOR
TEMPERATURE
UNFILTERED VALUE
⬆ ⬇ EXIT ↵

Source

Select the source for the current output. Note, the Temperature option is only available when the temperature compensation mode has been set to Probe in the channel setup menu. Unfiltered Value is only available when using a digital dissolved oxygen sensor.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

ZERO (4mA)

0 0 0 . 0 %Sat

⬆ ⬇ ➡ EXIT ↵
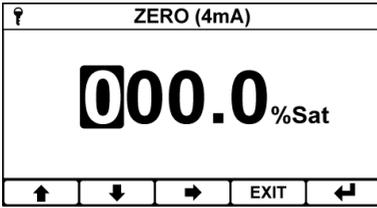
Zero (0mA) / Zero (4mA)

Enter the desired sensor value to be represented by 0mA or 4mA (depends on current output mode). An inverse relationship can be achieved by setting the Zero greater than the Span.

If the sensor reading falls outside this or the span value, an error will be activated.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Save Value

SPAN (20mA)

3 0 0 . 0 %Sat

⬆ ⬇ ➡ EXIT ↵
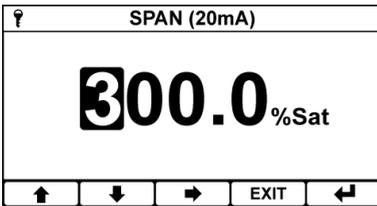
Span (20mA)

Enter the desired sensor value to be represented by 20mA. An inverse relationship can be achieved by setting the Span less than the Zero.

If the sensor reading falls outside this or the zero value, an error will be activated.

⬆/⬇   – Increase / Decrease Digit

➡   – Select Next Digit

EXIT   – Cancel

↵   – Save Value

ON ERROR

NO ACTION
DRIVE TO 0mA
DRIVE TO 4mA
DRIVE TO 22mA
HOLD LEVEL

⬆ ⬇   EXIT ↵
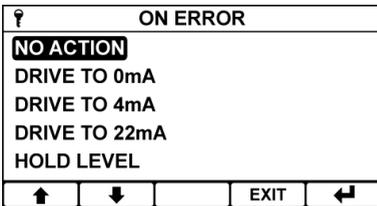
On Error

The current outputs can be programmed to output 0mA, 4mA, 22mA, or Hold their value when an error is detected on the input source (i.e. Sensor Fault, Temperature Fault), to provide remote warning of error conditions or to ensure fail safe operation.

⬆/⬇   – Select Option

EXIT   – Cancel
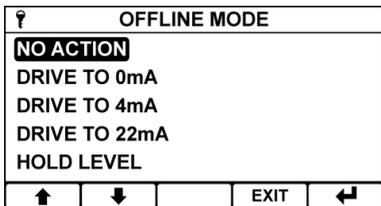
↵   – Save Selection

Offline Mode

The current outputs can be programmed to output 0mA, 4mA, 22mA, or Hold their value when the instrument is put in an offline state.

⬆/⬇   – Select Option

EXIT   – Cancel

◄┘   – Save Selection
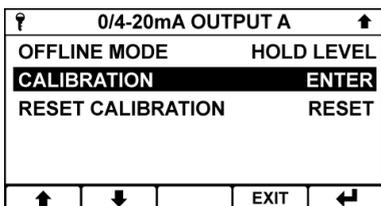
Calibration

Enter Menu to calibrate the 0/4-20mA

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

◄┘   – Enter Option
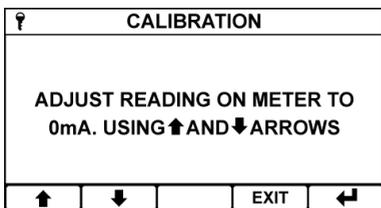
Adjust 0mA Output

Using the ⬇ and ⬆ buttons adjust the current output until it reads the desired value on your current meter. Please keep in mind that the current output cannot go below 0mA.

Only used when the mode is set to 0-20mA

⬆/⬇   – Adjust Output

EXIT   – Cancel
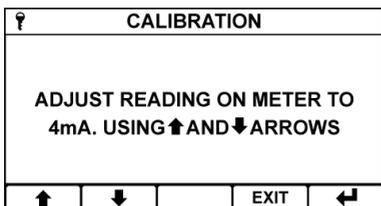
◄┘   – Save Adjustment

Adjust 4mA Output

Using the ⬇ and ⬆ buttons adjust the current output until it reads the desired value on your current meter.

Only used when the mode is set to 4-20mA

⬆/⬇   – Adjust Output

EXIT   – Cancel

◄┘   – Save Adjustment

BOD17 Dissolved Oxygen Monitor
BOD17 Dissolved Oxygen Monitor
Operating Guide
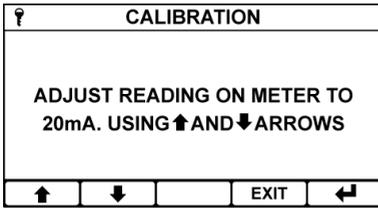
Adjust 20mA Output

Using the ⬇ and ⬆ buttons adjust the current output until it reads the desired value on your current meter.

⬆/⬇   – Adjust Output

EXIT   – Cancel

↵   – Save Adjustment
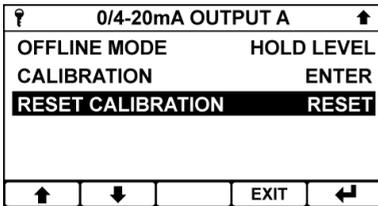
Reset Calibration

Used to reset any user calibration applied to the 0/4-20mA Output

⬆/⬇   – Select Option

EXIT   – Return to Calibration

↵   – Enter Option

Configuration

The Configuration menu enables the user to configure the basic operating parameters of the instrument.
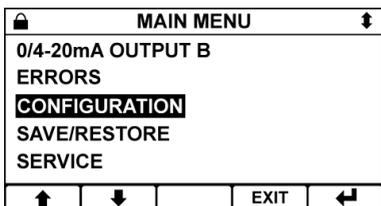
Main Menu

From the front screen press the Menu button to show the main menu options and select Configuration.

↑/↓ – Select Option

EXIT – Return to Front Screen
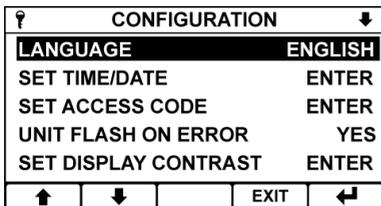
↵ – Enter Option

Configuration Menu

Select the function you wish to configure.

↑/↓ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option
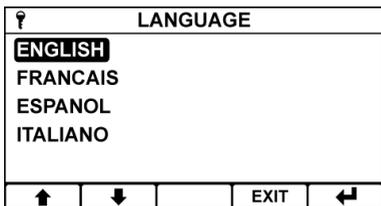
Language

The BXD17 Series has the ability to support multilingual menus. The language of choice can be selected from this menu.

↑/↓ – Select Option

EXIT – Cancel

↵ – Save Selection

Set Time/Date

Sets the instrument's time and date.

↑/↓ – Increase / Decrease Digit / Item

➡ – Select Next Digit / Item

EXIT – Cancel

↵ – Save Time

SET NEW ACCESS CODE

0000
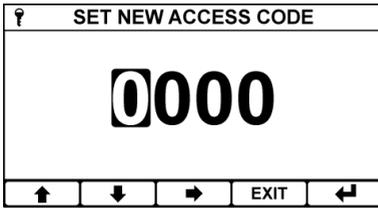
⬆ ⬇ ➡ EXIT ↵

Set Access Code

Sets the access code used by the instrument to prohibit changes to configuration by unauthorised personnel.

⬆/⬇ – Increase / Decrease Digit / Item

➡ – Select Next Digit / Item

EXIT – Cancel

↵ – Save Time

UNIT FLASH ON ERROR

YES
NO
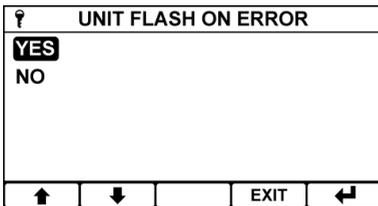
⬆ ⬇ EXIT ↵

Unit Flash On Error

Enables the flashing of the display backlight in the event of an instrument error.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

SET DISPLAY CONTRAST

50%

SET CONTRAST BY USING
⬆AND ⬇ARROWS
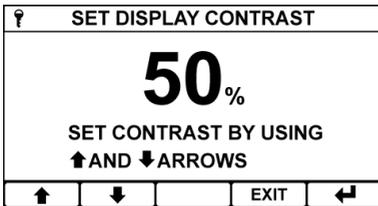
⬆ ⬇ EXIT ↵

Set Display Contrast

This allows the user to adjust the contrast of the display to compensate for environmental conditions that may affect the readability of the display.

⬆/⬇ – Adjust Contrast

EXIT – Return to Configuration Menu

↵ – Enter Option

CONFIGURATION ⬆

SOFTWARE VERSION V1.00
SERIAL NUMBER 3000000
CONTACT INFORMATION ENTER
UPDATE SOFTWARE ENTER
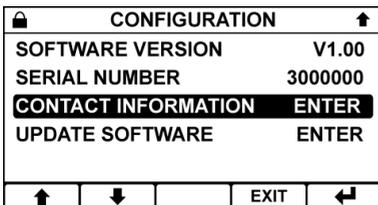
⬆ ⬇ EXIT ↵

Software Version

Displays the instrument's current software version number.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

CONFIGURATION
SOFTWARE VERSION   V1.00
SERIAL NUMBER   3000000
CONTACT INFORMATION   ENTER
UPDATE SOFTWARE   ENTER
⬆   ⬇   EXIT   ↵

Serial Number

Displays the instrument's serial number.

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

↵   – Enter Option

CONFIGURATION
SOFTWARE VERSION   V1.00
SERIAL NUMBER   3000000
CONTACT INFORMATION   ENTER
UPDATE SOFTWARE   ENTER
⬆   ⬇   EXIT   ↵

Contact Information

Displays the contact information.

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

↵   – Enter Option

Update Software

The BOD17 operating software can be upgraded by saving the latest version from LTH onto a micro SD card, inserting it into the instrument and following the instructions below. All three files must be present on the SD card for the update to work. The instrument supports SDHC and SDXC cards; however, they must be formatted to FAT32 which can be accomplished using a personal computer.

```
   🔒        CONFIGURATION          ⬍
   SOFTWARE VERSION            V1.00
   SERIAL NUMBER             3000000
   CONTACT INFORMATION        ENTER
   UPDATE SOFTWARE            ENTER

    ⬆      ⬇           EXIT      ↵
```

Update Software

Select the update software option from within the configuration menu.

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

↵   – Enter Option

```
   📍       UPDATE SOFTWARE
   ENSURE THE SD CARD REMAINS
   INSERTED & POWER TO THE
   UNIT IS NOT INTERRUPTED
   DURING THIS PROCESS.

   PRESS ENTER TO START
                        EXIT      ↵
```

Update Software

If the instrument has verified that all of the required software is present on the micro SD card, press Enter to begin the update.

During the update the display will indicate the progress of the update.

Once finished the instrument will restart automatically.

EXIT   – Return to Update Software Menu

↵   – Begin Update

Save, Restore & Reset

The BOD17 features the ability to save and restore the current configuration of the channel, setpoints and current outputs to one of two stores "A and B".

The Save and Restore menu also features the ability to reset the whole instrument back to its factory settings.
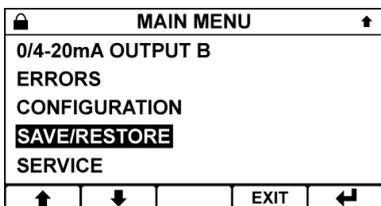
```
🔒        MAIN MENU         ↑
0/4-20mA OUTPUT B
ERRORS
CONFIGURATION
SAVE/RESTORE
SERVICE
   ↑      ↓          EXIT    ↵
```

Main Menu

From the front screen press the Menu button to show the main menu options and select Save/Restore.

↑/↓   – Select Option

EXIT   – Return to Front Screen

↵   – Enter Option

```
🔒       SAVE/RESTORE
SAVE SETUP
RESTORE SETUP
DELETE SETUP
DEFAULT INSTRUMENT

   ↑      ↓          EXIT    ↵
```
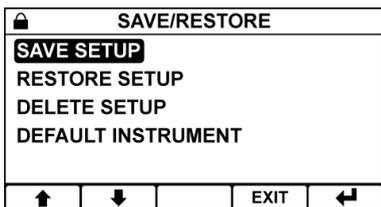
Save / Restore Menu

Select the operation you wish to carry out.

↑/↓   – Select Option

EXIT   – Return to Main Menu

↵   – Enter Option

```
🔒       SAVE/RESTORE
SAVE SETUP
RESTORE SETUP
DELETE SETUP
DEFAULT INSTRUMENT

   ↑      ↓          EXIT    ↵
```
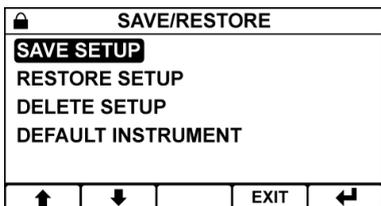
Save Setup

Save the current instrument setup to either of the two stores.

SAVE/RESTORE
SAVE SETUP
RESTORE SETUP
DELETE SETUP
DEFAULT INSTRUMENT

↑   ↓   EXIT   ↵
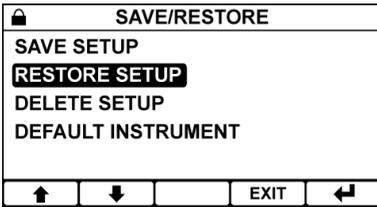
Restore Setup

Restore the previously saved setup.

SAVE/RESTORE
SAVE SETUP
RESTORE SETUP
DELETE SETUP
DEFAULT INSTRUMENT

↑   ↓   EXIT   ↵
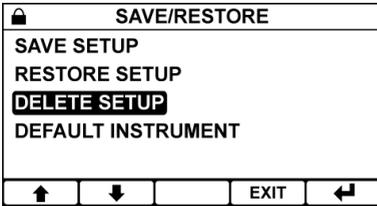
Delete Setup

Delete the previously saved setup.

SAVE/RESTORE
SAVE SETUP
RESTORE SETUP
DELETE SETUP
DEFAULT INSTRUMENT

↑   ↓   EXIT   ↵
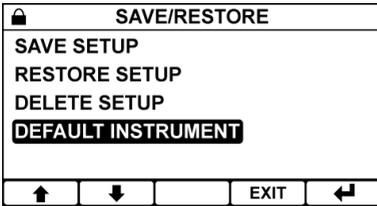
Default Instrument

Reset the whole instrument back to its factory settings.

Service

The BOD17 features a Service Reminder system that will inform the user when the instrument is due its service.

```
         🔒         SERVICE
SERVICE REMINDER              YES
SERVICE INTERVAL         365 DAYS
NEXT SERVICE DATE       01 JAN 19
DEFER SERVICE DATE        7 DAYS

   ⬆      ⬇              EXIT    ↵
```

Service Alarm

Service alarm configuration:

- Service Reminder – Turn the service alarm on or off. Requires service security code prior to use.

- Service Interval – Set the Service Interval. Requires service security code prior to use.

- Next Service Date – Sets the exact service date. Requires service security code prior to use.

- Defer Service Date – Only appears once the service interval has expired. Increases the service interval by an extra 7 days. Requires standard security code prior to use.

⬆/⬇   – Select Option

EXIT   – Return to Main Menu

↵   – Edit Option

Appendix A - DO Measurement

Sensor Interface

The output signal from a Dissolved Oxygen sensor is in the form of a constant DC current which is proportional to the partial pressure of the liquid being measured. In a 100% saturated solution at room temperature and pressure, the output from a Galvanic sensor will be of the order of hundreds of micro-amps (10^{-6} Amps), whereas the output from a Polargraphic sensor will be of the order of hundreds of nano-amps (10^{-9} Amps).

In addition, Polargraphic sensors require a bias voltage to be applied between the cathode and anode of the DO cell to excite an output.

The equation for converting current input to % saturation is as follows:

$$\% \text{ Saturation} = (I/I_o) \times P_c \times M \times 100$$

Where: I   = Measured Input Current
I_o = 100% Saturation Current
P_c = Pressure Correction Term
M   = Membrane Correction Term

The pressure correction term compensates for the effect that pressure has on the solubility of oxygen in water. This is almost directly proportional, i.e. a 10% variation in pressure will lead to a 10% variation in the solubility and therefore saturation of the liquid.
The pressure correction term is defined as follows:

$$P_c = \frac{P_o - P_{vapor(To)}}{P - P_{vapor(T)}}$$

Where: Po   = Pressure at 100% Calibration
$P_{vapor(T)}$ = Saturation Vapour Pressure at T
P   = Pressure
T   = Temperature
To   = Temperature at 100% Calibration

Membrane Correction

The membrane correction term is defined as follows:

$$M = e^{A([1/T]-[1/To])}$$

Where: A   = Membrane Correction Factor
         T   = Temperature (in °K)
         To   = Temperature at calibration (in °K)

The membrane correction factor is specific to each make of sensor and characterises the type and thickness of the membrane material in terms of how its permeability to Oxygen varies with temperature. From this, it can be seen that the membrane correction term can contribute a variation in the saturation value of as much as 3% for each degree of change in temperature (for a typical membrane correction factor of 2220).

The above equations demonstrate the benefits of having active temperature and pressure measurement when an accurate reading is required.   For systems where active pressure or temperature measurement is not available, manual compensation is available.

Oxygen Solubility

The Oxygen solubility is easily defined as: % Saturation X Maximum Theoretical Solubility of Oxygen in water. The maximum theoretical solubility is heavily dependant on the temperature, pressure and salinity of the measured liquid. Tables of data for Oxygen solubility are readily available from a number of sources such as BS EN 25814, ISO 5814.

The following solubility table gives the variation of oxygen concentration in ppm (mg/litre) across a temperature range of 0 - 39°C in pure water a equilibrium with water vapour saturated air at 1 atmosphere standard pressure (= 760 mm Mercury).

Solubility of Oxygen in Pure water									
Temp	ppm O_2		Temp	ppm O_2		Temp	ppm O_2		Temp	ppm O_2
0	14.62		10	11.29		20	9.09		30	7.56
1	14.22		11	11.03		21	8.91		31	7.43
2	13.83		12	10.78		22	8.74		32	7.31
3	13.46		13	10.54		23	8.58		33	7.19
4	13.11		14	10.31		24	8.42		34	7.07
5	12.77		15	10.08		25	8.26		35	6.95
6	12.45		16	9.87		26	8.11		36	6.84
7	12.14		17	9.66		27	7.97		37	6.73
8	11.84		18	9.47		28	7.83		38	6.62
9	11.56		19	9.28		29	7.69		39	6.51

Partial Pressure of Oxygen (pO2)

The concentration of a gas dissolved in a solution at equilibrium is proportional to the partial pressure of the gas in contact with the solution (Henry's Law). The partial pressure of the gaseous component of the air in contact with the solution remains proportional to the total pressure of the air sample.
The partial pressure of Oxygen in air at atmospheric pressure of 1 Bar (1000mBar) is 210mBar (air is 21% Oxygen), so if a solution of pure water were 100% saturated with Oxygen at atmospheric pressure the partial pressure of Oxygen in solution would be 210mBar. e.g. 20% saturation at a pressure of 1 Bar gives a reading of 42mBar, 50% saturation at a pressure of 3 Bar gives a reading of 315mBar.

Sensor Parameters

The following table gives the necessary configuration data for a number of Dissolved Oxygen Sensors.

Sensor Type	Temperature Sensor Type	Membrane Correction Factor	Bias Voltage
LTH OE15	1K Thermistor	3965	N/A
BJ ProcessProbe™	22k Thermistor	2220	+0.675
Hamilton Oxysens™	22k Thermistor	2700	+0.670

Appendix B - Temperature Data

The table below lists approximate resistance values of temperature sensors that may be used with the BOD17.

Temperature (°C)	BJ 22K Thermistor
0	64.88 kΩ
10	41.34 kΩ
20	26.97 kΩ
25	22.00 kΩ
30	18.03 kΩ
40	12.30 kΩ
50	8.57 kΩ
60	6.07 kΩ
70	4.38 kΩ
80	3.21 kΩ
90	2.39 kΩ
100	1.80 kΩ

Appendix C - Pressure Conversions

The following table provides conversions between all the common pressure units.

	Atm	Bar	kPa	m H_2O	Psi	mm Hg
Atm	1	1.0133	101.33	10.33	14.696	760
Bar	0.987	1	100	10.20	14.504	750
kPa	0.00987	0.01	1	0.102	0.145	7.50
m H_2O	0.0968	0.0981	9.81	1	1.422	73.36
Psi	0.061	0.069	6.895	0.703	1	51.72
mm Hg	0.00132	0.00133	0.133	0.0136	0.0194	1

Appendix D - Error Messages

Switch On Diagnostic Errors

E01	Read/Write Error
	Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may need to be returned for repair.

E02	Data Error
	The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists use the Default Instrument function in the Save/Restore menu or consult with your supplier, as this unit may require a repair.

E03	Storage Error
	The Save Setup configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists use the Delete Setup function in the Save/Restore menu or consult with your supplier, as this unit may require a repair.

E04	Factory Error
	The factory configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may need to be returned for repair.

E05	User Cal Error
	The instrument user calibration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists use the Default Instrument function in the Save/Restore menu or consult with your supplier, as this unit may require a repair.

Sensor Input Errors

E23	Sensor Over Range
	The sensor reading is greater than the specified upper limit. Check channel settings, sensor condition and connections. If the message persists please consult with your supplier.

E24	Sensor Under Range
	The sensor reading is less than the specified lower limit. Check channel settings, sensor condition and connections. If the message persists please consult with your supplier.

E25	Probe Removed
	The SensorTalk probe has been removed. If this is not the case then an error may have occurred with operation of the probe. Try switching the instrument off and then on again. If the message persists, consult with your supplier.

E31	Temperature Over Range
	The temperature reading is greater than the specified upper limit. Check channel settings, sensor condition and connections. If the message persists please consult with your supplier.

E32	Temperature Under Range
	The temperature reading is less than the specified lower limit. Check channel settings, sensor condition and connections. If the message persists please consult with your supplier.

Setpoint Status

M51	**Setpoint 1 Dose Alarm**
M52	**Setpoint 2 Dose Alarm**
	The dose alarm for the setpoint is active.
M90	**Setpoint 1 Triggered**
M91	**Setpoint 2 Triggered**
	The setpoint has been triggered. (Only shows when setpoint flash on trigger is enabled.)

Current Output Errors

E61	**Output A Hardware**
E71	**Output B Hardware**
	The current output circuit has detected an error in the current output loop; this is most commonly due to either a broken loop or too large a load resistor.
E62	**Sensor < OP A Zero**
E72	**Sensor < OP B Zero**
	The sensor input level is below that set for the current output zero.
E63	**Sensor > OP A Span**
E73	**Sensor > OP B Span**
	The sensor input level is greater than that set for the current output span.
E64	**Sensor > OP A Zero**
E74	**Sensor > OP B Zero**
	The sensor input level is greater than that set for the current output zero.
E65	**Sensor < OP A Span**
E66	**Sensor < OP B Span**
	The sensor input level is below that set for the current output span.

Service Messages

M80	**Service Due**
	The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
M81	**Calibration Due**
	The user entered calibration interval has expired.

M82	Service Mode Active
	The unit is currently in service mode, the setpoints and current outputs may not respond as configured. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.

SensorTalk Messages

M100	LED Temperature Exceeded
	The sensor's temperature has exceeded the LED operating temperature (default 50°C). The LED's are now turned off; the sensor will return its last good reading.

M101	CIP Temperature Exceeded
	The sensor's temperature has exceeded the Clean In Place operating temperature (default 60°C). The sensor's analog circuitry is now turned off; the sensor will return its last good reading.

M102	SIP Temperature Exceeded
	The sensor's temperature has exceeded the Steam In Place operating temperature (100°C). The sensor is now turned off. Readings will return once the sensor's temperature has fallen below the LED activation temperature.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The BOD17 has been designed to include a wide range of self-diagnostic tests, some of which are performed at switch on, and some on a continuous basis. This guide aims to provide a route to diagnosing and correcting any faults that may occur during normal operation. The table shown previously in this section gives a list that the BOD17 generates, along with their probable causes. If after these checks the fault has not been cleared, contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable quick diagnosis and correction of the problem:

- Serial number of the instrument.
- The approximate date of purchase.
- Details of the program settings and application.
- Electrical environment and supply details.
- Circumstances under which the fault occurred.
- The nature of the fault or faults.
- Any error messages that are displayed.
- The sensor type, cable length and cable type.
- Current output configuration.
- Relay connection configuration.

It is often worthwhile to check the measurement by an independent method, for example using a handheld meter.

The Instrument Appears Dead
Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the BOD17 allows the unit to accept from 90 to 265V AC. Check that the power cable is securely and correctly attached. There are no user serviceable fuses fitted within this unit.

The Access Code Does Not Work
It is probable that the access code has either been changed or the operator does not recall the code correctly. Contact LTH or your local distributor should this problem arise.

The Optical Sensor Output Is Incorrect
- Ensure that all sensor protective caps have been removed.

- Check that the black measuring patch is not damaged or missing from the tip of the sensor.

- Heavily contaminated measuring patch. Gently clean with a soft clean cloth or tissue wetted with distilled or D.I. water. Consider installing a sensor spray wash system.

- If using manual pressure and temperature compensation, ensure that the correct values have been entered.

- Possible faulty sensor connector. Check to see if sensor connector pins are covered with liquid or dirt. If the connector appears clean, try a new cable or a different sensor.

- Possible faulty cable or junction boxes. Check the cable with a multimeter for any open or short circuits.

The Amperometric Sensor Output Is Incorrect

- Ensure that the sensor and temperature input is correctly connected (see Installation section) and that the sensor is not faulty or damaged.
- Check that the probe type, bias voltage and membrane correction factor have been set correctly in the instrument.
- Ensure all sensor protective caps have been removed.
- If using manual pressure and temperature compensation, ensure that the correct values have been entered.
- Possible faulty sensor connector. Check to see if sensor connector pins are covered with liquid or dirt. If the connector appears clean, try a new cable or a different sensor.
- Possible faulty cable or junction boxes. Check the cable with a multimeter for any open or short circuits.
- Membrane body is not filled with sufficient electrolyte. Refill if possible.
- Heavily contaminated or defective membrane. Gently clean the membrane surface with a soft clean cloth or tissue wetted with distilled or D.I. water, or replace the cartridge.

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached (see Installation section).
- Where practical check the temperature sensor resistance against the table on page 71.

Current Output is Incorrect or Noisy

- Check that the maximum load for the current loop has not been exceeded (750Ω).
- Check that the terminals have been wired correctly.
- Check that the cable screen is attached to Earth at one end and that the cable does not pass too close to a power cable.
- Check that the current output has been configured properly.

Relays Appear to Malfunction

- Check that the unit is "On-Line" (Page 24).
- Check that the setpoint has been configured properly.
- If the relays are vibrating or "chattering" as they pass the setpoint, check the hysteresis setting and increase if necessary.
- Ensure that the relays are connected properly and that the voltage/current levels are not exceeding 5A @ 30V DC or 5A @ 250V AC.
- Check that the instrument input cables are not picking up excessive noise.

Guarantee and Service

Products sold by LTH Corporation are guaranteed against faulty workmanship and materials for a period of three years from the date of despatch, except for finished goods not of LTH manufacture, which are subject to a separate agreement.

All sensors made by LTH are thoroughly tested to their published specification before despatch. As LTH has no control over the conditions in which their sensors are used, no further guarantee is given, although any complaints concerning their operation will be carefully investigated.

Goods for attention under guarantee (unless otherwise agreed) must be returned carriage paid and, if accepted for free repair, will be returned to the customer's address free of charge. Arrangements can also be made for repair on site, in which case a charge may be made for the engineer's time and expenses.

If any services other than those covered by the guarantee are required, please contact LTH direct.

N.B. Overseas users should contact their LTH nominated representative. Special arrangements will be made in individual cases for goods returned from overseas.

Blank

BOD17 Dissolved Oxygen Monitor
Operating Guide

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