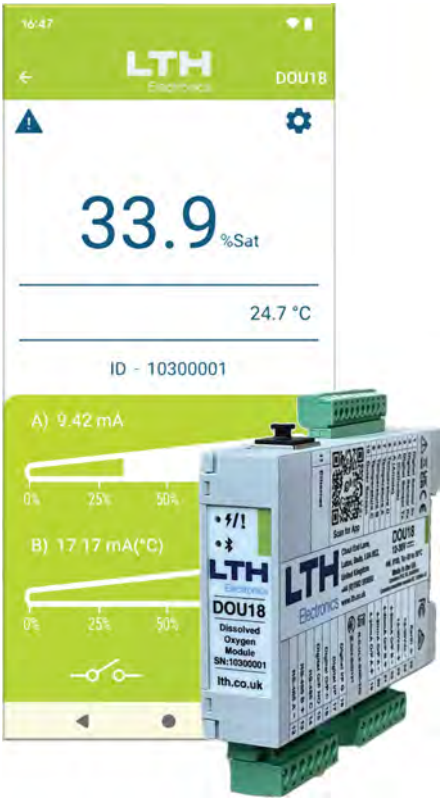
DOU18

Dissolved Oxygen Measurement Module & LTH Discover App



Operation Guide

Preface

Product warranty

The DOU18 Dissolved Oxygen Measurement Module 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 module 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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Manufacturing Standards

Radio Equipment

This product has been designed to comply with the standards and regulations set down by both the United Kingdom RED Regulations S.I. 2017 No. 1206 and the European RED 2014/53/EU using EN IEC 61326-1 : 2021, ETSI EN 300 328 V2.2.2, ETSI EN 301 489-1 V2.2.3, ETSI EN 301 489-17 V3.2.4 and EN IEC 61010-1 : 2010.

Restriction of Hazardous Substances

This module 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 module 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

UK Declaration of Conformity

Chaul End Lane
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United Kingdom

We,	**LTH Electronics Ltd** declare under our sole responsibility that the produce / products
Product identification	**DOU18**

to which this declaration relates is/are in conformity with all essential requirements of the UK statutory requirements relating to:

Radio Equipment Directive	**SI 2017 No. 1206**
Hamonised Standards	**EN IEC 61326-1 : 2021** **ETSI EN 300 328 V2.2.2** **ETSI EN 301 489-1 V2.2.3** **ETSI EN 301 489-17 V3.2.4** **EN IEC 61010-1 : 2010**
RoHS Directive	**SI 2012 No. 3032**
Hamonised Standards / Harmonisierte Normen / Normes Harmonisées	**EN 63000: 2018**
Place and date of issue / Ausstellungort, -datum / Lieu et date d'émission	**Luton, 07th May 2025**

Neil Adams
Managing Director

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de Conformité

Chaul End Lane
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We, / Wir, die, / Nous,	**LTH Electronics Ltd** declare under our sole responsibility that the produce / products erklären in alleiniger Verantwortung, dass dieses Produkt / diese Produkte, déclarons sous notre seule responsabilité que le produit / les produits,
Product identification / Produktbezeichnung / Désignation du produit	**DOU18**

to which this declaration relates is/are in conformity with all essential requirements of the Council Directives relating to:
auf welche(s) sich diese Erklärung bezieht, mit allen wesentlichen Anforderungen der folgenden Richtlinien des Rates übereinstimmen:
auquel/auxquels se réfère cette déclaration est/sont conforme(s) aux exigences essentielles de la Directives du Conseil relatives à:

Radio Equipment Directive / Funkanlagen-Richtlinie / Directive sur les Équipements Radioélectriques	**2014/53/EU**
Hamonised Standards / Harmonisierte Normen / Normes Harmonisées	**EN IEC 61326-1 : 2021** **ETSI EN 300 328 V2.2.2** **ETSI EN 301 489-1 V2.2.3** **ETSI EN 301 489-17 V3.2.4** **EN IEC 61010-1 : 2010**
RoHS Directive / RoHS-Richtlinie / Directive RoHS	**2011/65/EU**
Hamonised Standards / Harmonisierte Normen / Normes Harmonisées	**EN 63000: 2018**
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Neil Adams
Managing Director

Contents

Introduction

The DOU18 is a microprocessor-controlled Dissolve Oxygen measurement module that can be used with both LTH's Digital Optical or traditional Polarographic Amperometric sensors, which enable the measurement of a broad spectrum of solution dissolved oxygen levels. The module is compatible with standard 35mm top-hat DIN rail and is powered by 12-30VDC.

0/4-20mA Outputs
The module features two industry standard, isolated, 0/4-20mA current outputs that features adjustable scaling, selectable on-error states and loop fault detection. Either allows the module to transmit the primary reading or observed process temperature for remote monitoring purposes.

Modbus
Additionally, the module features an optional Modbus interface via either RTU or ASCII over RS-485, or TCP/IP over Ethernet. Using the interface, the module's measurements can be read, status checked, configurations changed, and calibrations performed.

Note, by default the Modbus functionality is locked, and requires an additional purchase to unlock. This can be done at the time of ordering the module or alternatively may be ordered after purchase by supplying LTH or your local distributor the serial number of your module along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the module.

Digital Input & Digital Output
Also present are a single digital input and a single digital output. The digital input features a dry contact input which allows the module to be remotely set to either an offline state that forces the current outputs to a pre-defined state, or to change the whole configuration of the module by switching the setup to a preconfigured state.

The digital output consists of a volt free, single pole, single throw normally open relay, which can be configured to clean the sensor by activating a separate jet spray wash or rotary electrode cleaning system on a timed cycle with adjustable duration, interval and recovery. Alternatively, the output can be used to indicate the module alarm status.

Status LEDs
Finally, two status LEDs on the front of the module indicate the operation status of the of the module and the Bluetooth connection.

Bluetooth
To achieve this all within in a small foot print the module features no display. Instead, a separate mobile app, ***LTH Discover*** that can be downloaded from all major app stores, is used to connect to the module via Bluetooth and display the primary reading and temperature, show operational status and to provide an intuitive means to configure and calibrate the module.

If multiple modules are within range ***LTH Discover*** can display the measurement readings and operation status of all of them within the app's discovery screen.

DOU18 Specification

Measurement Input	Amperometric (Polarographic / Clark) – 0 to 500.0nA FMS22 (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 pO2 (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.
Ambient Temperature Variation	±0.01% of range / °C (typical)
Calibration Methods	Automatic Zero (offset) and Span (slope) calibration with user entered span calibration. Automatic loading of stored calibration data from pre-calibrated digital probes. 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 – Digital Probes	Three element bubble and signal-noise filter system for creating advanced transient noise mitigation strategies.
Sensor Input Filter – Amperometric Probes	Adjustable filter that averages the sensor input over a user selectable time (10sec – 5mins).
Temperature Sensor	Pt1000 or BJ 22K RTD input. Up to 30 meters of cable. Temperature sensor can be mounted in the sensor or separately.
Range of Temperature Measurement	-20 °C to +150 °C (-4 °F to +302 °F) for full specification.
Temperature Accuracy	± 0.2 °C (When using 4 wire PT1000)
Operator Adjustment (Temperature)	Anywhere within range of temperature measurement.
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 current outputs are held at a user defined level.
Digital Input	Dry contact input for remote activation of user defined operations. Can be configured to operate in either normally open or normally closed modes.
Current Outputs Specification	Two current outputs as standard, selectable 0-20mA or 4-20mA into 750 ohms max, the pair of outputs are fully isolated to 2kV from the rest of the module. Expandable to 100% of any operating range and offset anywhere in that range.
Current Outputs Adjustment	3-point 0/4-20 mA for remote monitor calibration.
Digital Output	Volt free, single pole, single throw, normally open, 24v AC/DC max, 750mA max.
Digital Output Mode	Module alarm status Cleaning to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. Adjustable duration, interval and recovery.
Modbus	If optioned, module features Modbus communication over either RS485 or Ethernet. Allowing for remote access to readings, configuration changes and calibration of the module. Can be specified at time of purchase or activated later using a module specific unlock code.
RS-485 Modbus Interface	RTU and ASCII protocol, 300Bps to 38400Bps baud rate, None-Odd-Even parity bits, 1-2 stop bits.
TCP/IP Over Ethernet Interface	Manual or automatic (via DHCP server support) network configuration. Port link and activity status LEDs
Bluetooth	Integrated Bluetooth radio. 25 meters max operating range.
Mobile App	Separate LTH Discover app provides an easy to use and intuitive means of commissioning, monitoring and calibrating the module from mobile devices via the Bluetooth interface. Available to download from major app stores, requires iOS 13.2 and later or Android 6.0 and up.
Radio Equipment Directive	SI 2017 No. 1206 & 2014/53/EU
Power Supply	12-30V DC, 4W max.
Module Housing	PA 6.6-FR (UL 94 V0)
Ingress Protection Rating	IP20.
Ambient Operating Conditions	Temperature -20 to +55°C, Relative Humidity 5 to 95%, non-condensing.
Weight	Maximum 160 grams (module only).
Dimensions	104 x 23 x 111 mm (H, W, D) including connectors.
Mounting	Compatible with 35 x 7.5mm and 35 x 15mm top hat section DIN rail (IEC 60715)

Installation – Safety & EMC

This chapter describes how to install the module 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 a module or sensor failure.

Wiring Installation

The specified performance of the module 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 WHILST THE UNIT IS BEING CONNECTED. FOR SAFETY REASONS AN EARTH CONNECTION MUST BE MADE TO THE EARTH TERMINAL OF THIS MODULE.

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 module 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 module 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 module 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 module 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 module 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 module's operation is impaired, or even halted, the following external modifications should be made, as appropriate:

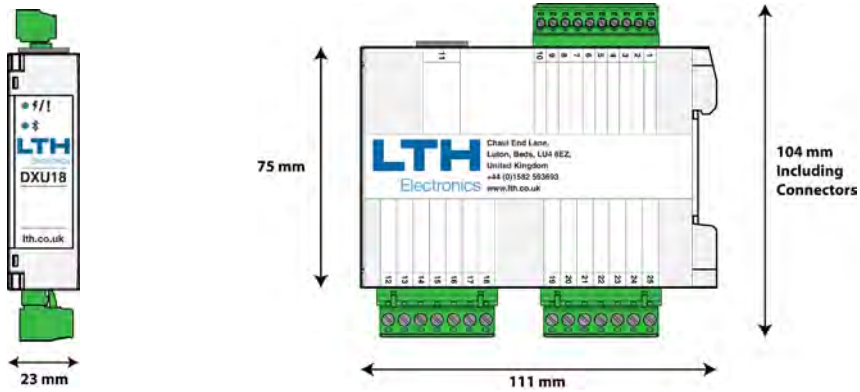
- Fit arc suppressors across active relay or contactor contacts in the vicinity.

- 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 module.

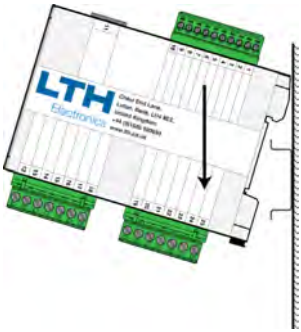
Enclosure



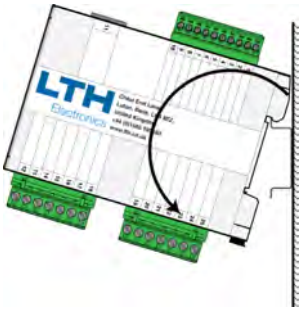
DOU18 Overall Dimensions

The enclosure is designed to attached to standard DIN EN 60715 / TH 35mm DIN-rail.

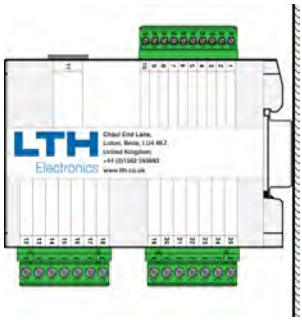
It should be attached to the rail by following the below guide.



Tilt the module and attach the top edge of the module's rail clip to the rail



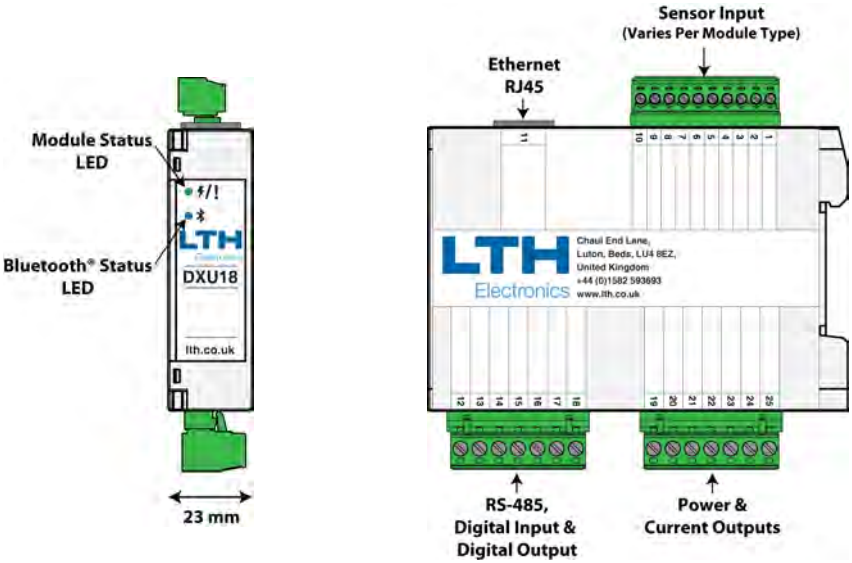
Rotate the module downwards



The spring clip in the bottom of the module's rail clip should click onto the rail

To remove the module from the rail, insert a slotted screwdriver into the module's rear rail clip and pull the clip downwards to disengage the clip from the rail, then follow the above but in reverse.

Module Overview



DOU18 Overview

Status LEDs

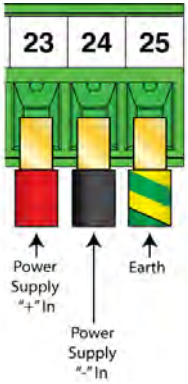
ϟ/!	Module Status LED	
○	Off	Module Unpowered
●	Constant Red	Module Initialising
≋	Flashing Green	Module Running
≋	Flashing Red	Module Error

ᛒ	Bluetooth® Status LED	
○	Off	Module Unpowered
≋	Flashing Blue	Bluetooth Unconnected
●	Constant Blue	Bluetooth Connected

DOU18 LEDs

Supply Voltage Connections

Refer to the label adjacent to the power supply terminals for the input voltage limits. Exceeding these limits may damage the module.

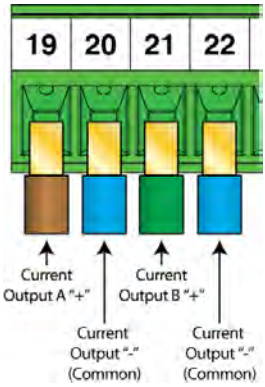


12-30V DC
Power Connections

The incoming Earth connection must be connected to the Earth terminal.

Current Output Connections

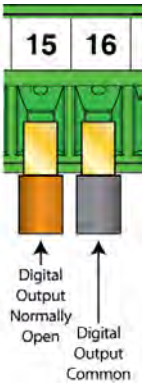
The DOU18 is supplied as standard with two current outputs, either of which can terminate into a load resistance not exceeding 750Ω and are both galvanically isolated from the rest of the module. For best noise immunity use a screened twisted pair cable, with the screen connected to Earth at one end. Use a sufficiently large cable to avoid a high resistance in the overall current loop.



Current Outputs
Connection Detail

Digital Output Connections

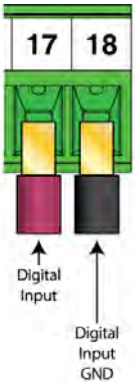
The DOU18 is supplied with a single volt free, single pole, single throw, normally open relay.
Maximum switching voltage of **24v AC/DC**, maximum load **750mA**. To switch a higher voltage or load will require a slave relay.



Digital Output Connection Details

Digital Input Connections

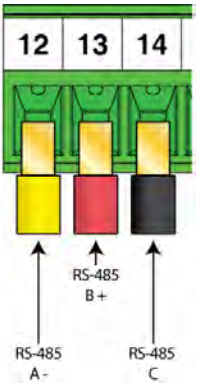
The DOU18 features a single dry contact digital input, which can be used to initiate a user configurable module operation by use of a volt free link, switch or relay. The module can be configured to initiate the appropriate action when the contact either closes or opens.



Digital Input Connection Details

Modbus Connections

The DOU18 features optional Modbus communications over either RS485 or Ethernet. Allowing for remote access to readings, configuration changes and calibration of the module. Note, the module can only be set to use either the RS485 interface or the Ethernet interface, they cannot both be used at the same time.



Modbus RS485 Connection Details

Note, the module does not feature an internal RS485 120Ω terminating resistor.

Modbus TCP/IP Ethernet RJ45 Connection

Ethernet connection uses standard RJ45 connector and termination, remove connector dust cap before use. Integrated ethernet status LEDs – Green – Good link, Yellow – Activity on link.

Installation and Choice of Dissolved Oxygen Sensors

The DOU18 has been designed to accept a wide variety of Polarographic Dissolved Oxygen sensors. Parameters such as membrane correction, bias voltage and temperature sensor type can be easily programmed into the module.

The choice of the correct type of Dissolved Oxygen sensor, 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 life time of the membrane.
- The use of the correct materials for corrosion resistance.
- The chemical make up, temperature of the sample.
- Position of the sensor for robustness and service access.
- Ensuring a representative, uncontaminated solution sample.

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 sensor 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.
- 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.

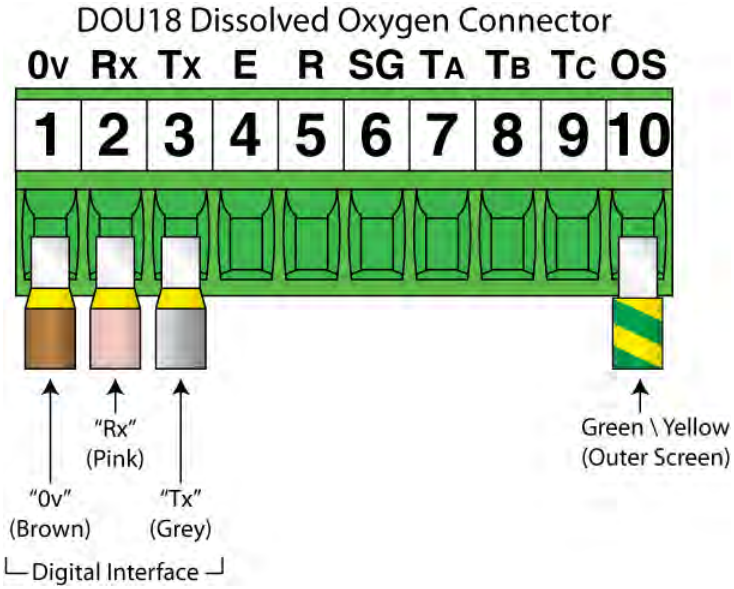
When a new dissolved oxygen sensor is first fitted or changed it must be calibrated (see page 37). Due to the nature of polarographic dissolved oxygen sensors it will also need periodic re-calibration, the module provides an inbuilt count down timer which will trigger an alarm when the calibration interval has expired (see page 41).

Digital Sensor Interface

The digital sensor connection of the module is capable of interfacing with FMS22 optical dissolved oxygen sensors. This type of dissolved oxygen sensor utilises optical (fluorescence) technology to provide long term stability and accuracy without the usual maintenance regime associated with traditional polarographic sensors.

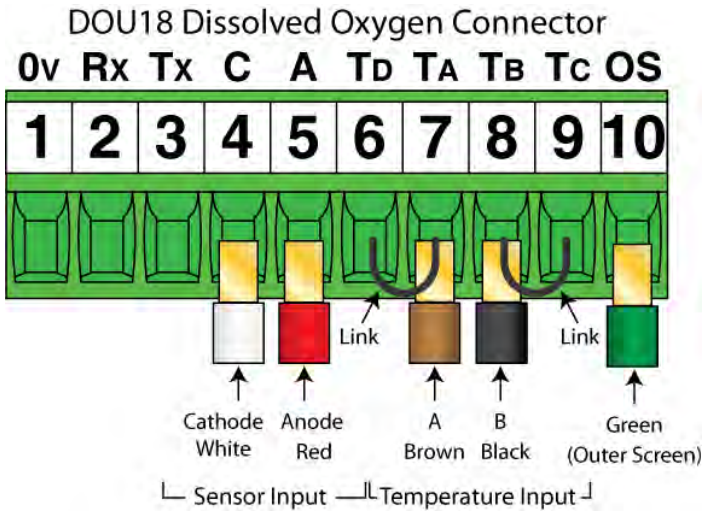
The Plug-and-Play nature of the of the interface enables “calibrate here use there” functionality. Sensors can be accurately pre-calibrated away from the operation area with the calibration data stored in the sensor, ready for later use. When the sensor is connected to the BOD18 the module auto-loads and applies the sensor’s calibration values.

DOU18 Dissolved Oxygen Input Connection Details

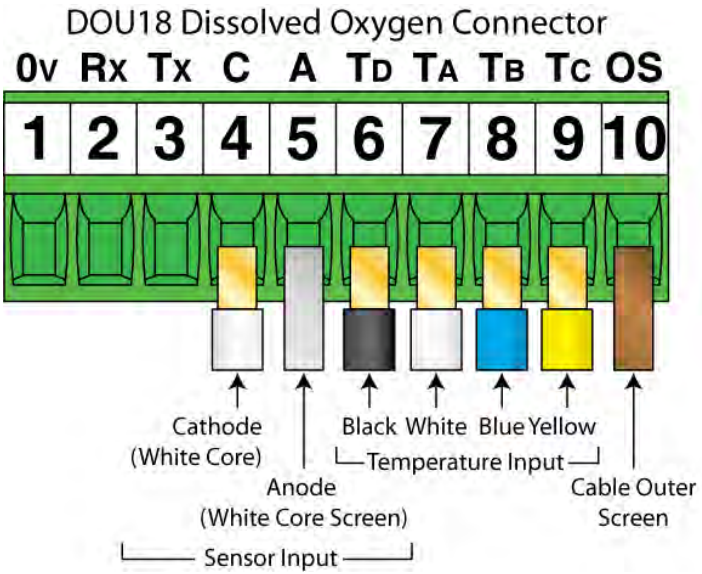


FMS22 Optical Dissolved Oxygen Probe Cable Connection Details

Please note, when unplugging an existing sensor from the instrument please wait for the "Sensor Removed" message to appear before attaching a different sensor.

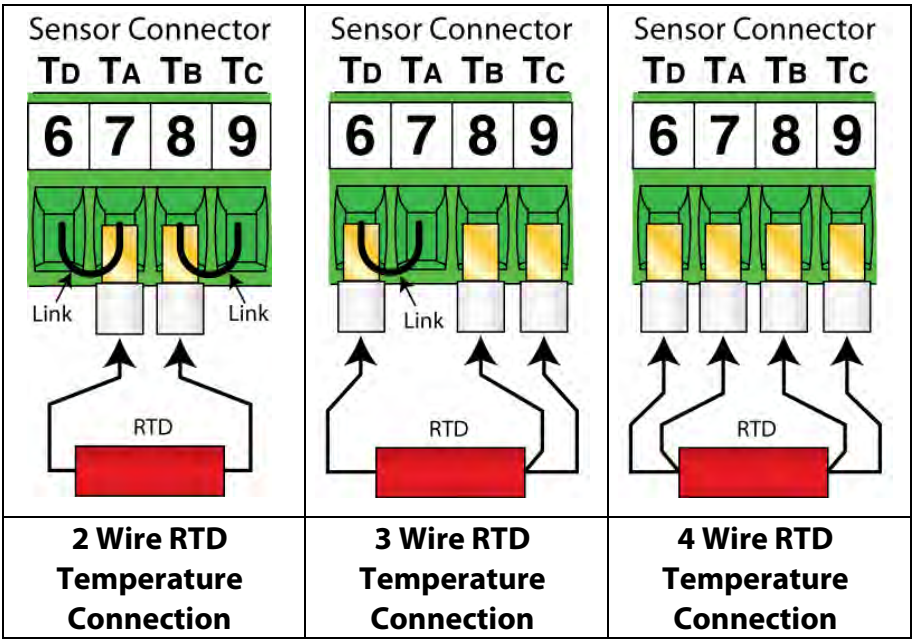


E-1822 ProcessProbe Polarographic Dissolved Oxygen Sensor Cable Connection Details



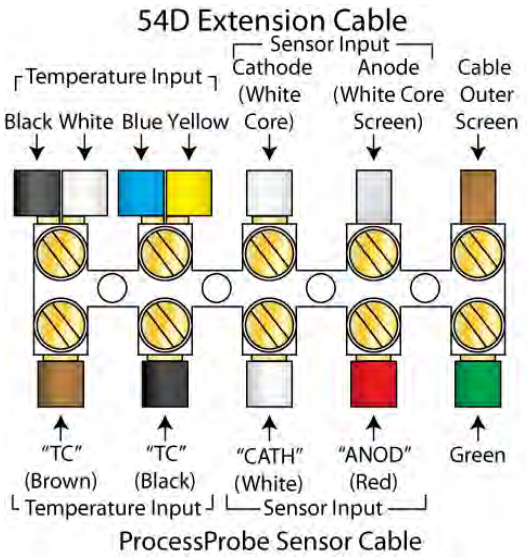
E-1822 ProcessProbe 54D Extension Cable Connection Details

Temperature Sensor Connections



2 Wire RTD Temperature Connection	3 Wire RTD Temperature Connection	4 Wire RTD Temperature Connection

Extension Cable Connections



E-1822 ProcessProbe Cable to 54D Extension Cable Connection Details

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 MODULE.

LTH Discover App

Complementing the DOU18 module is a separate mobile app, ***LTH Discover*** which can be downloaded from all major app stores.

LTH Discover App

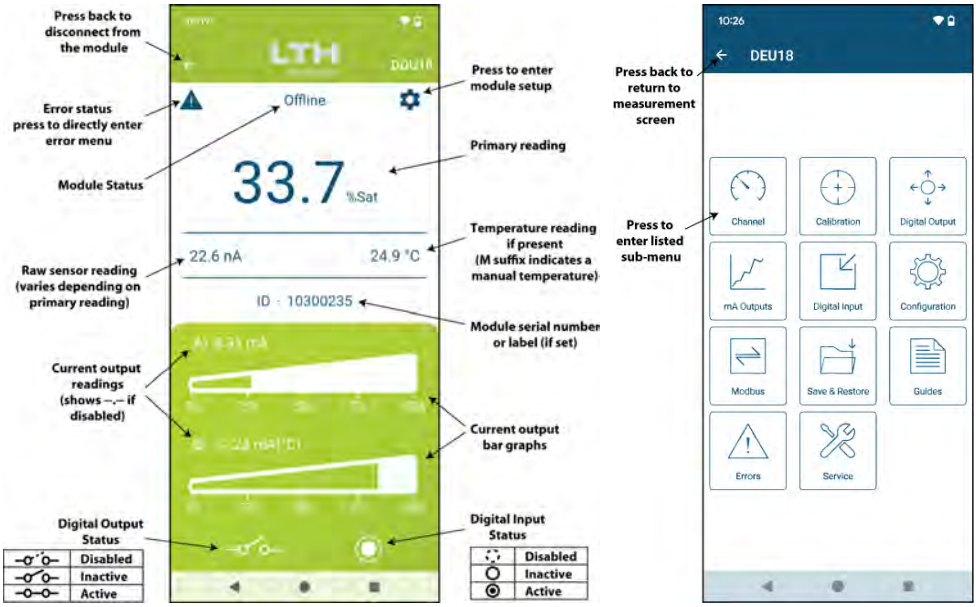
The app can be used to connect to the module via Bluetooth and display the primary reading and temperature, show operational status and to provide an intuitive means to configure and calibrate the module.

Opening Screen

Discovery Screen

On opening the app press the Discover Module button to enter the discovery screen. The discovery screen shows all the modules within in range along with their current sensor and temperature readings, error status, the model type, and either the serial number or if set the module's label. Click on the desired module to connect.

Note, during connection the app will check if the module is running the latest firmware to ensure compatibility between the app and the module, if not the user is given the optional ability to update it.



Measurement Screen

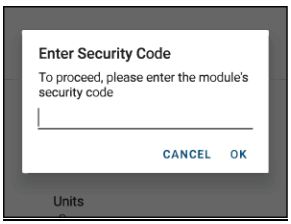
Module Setup Screen

Once connected the app shows the Measurement screen which can be used to view the primary, temperature, and raw sensor readings; module, digital input, digital output and error statuses; and current output readings. Pressing the gear icon enters the module setup screen from which the user can configure and calibrate the module. Note, if the Modbus menu is greyed out then the interface requires unlocking on the connected module, see 70 page for more details.

Security Code Access

To protect the module setup from unauthorised or accidental tampering when using the app, a security access code system is present. This is implemented via the module's menu system which operates in two modes, "locked" and "unlocked". The locked mode allows the user to observe the module'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 module's mode to "unlocked". Once unlocked, the user can change any setting without having to re-enter the security access code whilst the app remains connected to the module, however the module will automatically lock itself if the app disconnects.

The user can change the module's access code in the security code section of the configuration menu, or alternatively they can disable the module's security system permanently by changing the access code to 0000.



The default security code is <u>1000</u>

Main Measurements

In addition to using the mobile app, the module's main measurements can be accessed using the Modbus interface and the registers as listed below. See Modbus section (page 72) for further details about the using the interface.

Description	Register/s	Type	Access	Option	Value
Module Type	2000	Int	Read	Dissolved Oxygen	4

Description	Register/s	Type	Access	Option	Value
Main Reading Status	2001	Int	Read	Analogue Probe Mode	0
				Optical Probe Mode	1

Description	Register/s	Type	Access	Format	Units
Main Reading Value	2002	Float	Read	See register 2004	See register 2004

Description	Register/s	Type	Access	Option	Value
Main Reading Format and Units	2004	Int	Read	XXX.X %Sat	0
				XX.XX ppm	1
				XXXX mBar	2
				XXX.X mmHg	3
				XX.XX mg/l	4
				XXX.X nA	5

Description	Register/s	Type	Access	Option	Value
Secondary Reading Status	2005	Int	Read	Disabled	0
				Enabled	1

Description	Register/s	Type	Access	Format	Units
Secondary Reading Value (Returns 0 if secondary reading is disabled)	2006	Float	Read	See register 2008	See register 2008

Description	Register/s	Type	Access	Option	Value
Secondary Reading Format and Units (Returns 0 if secondary reading is disabled)	2008	Int	Read	XXX.X %Sat	0
				XX.XX ppm	1
				XXXX mBar	2
				XXX.X mmHg	3
				XX.XX mg/l	4
				XXX.X nA	5

Description	Register/s	Type	Access	Option	Value
Temperature Status	2009	Int	Read	Auto Mode	1
				Manual Mode	2

Description	Register/s	Type	Access	Format	Units
Temperature Reading Value (Returns 0 if temperature is disabled)	2010	Float	Read	+/- XXX.X	See register 2012

Description	Register/s	Type	Access	Option	Value
Temperature Reading Units (Returns 0 if temperature is disabled)	2012	Int	Read	°C	0
				°F	1

Description	Register/s	Type	Access	Option	Value
Current Output A Status	2013	Int	Read	Disabled	0
				Enabled – Source Sensor	1
				Enabled – Source Temperature	2

Description	Register/s	Type	Access	Format	Units
Current Output A Value (Returns 0 if current output A is disabled)	2014	Float	Read	00.00 to 24.00	mA

Description	Register/s	Type	Access	Format	Units
Current Output A Percentage (Returns 0 if current output A is disabled)	2016	Int	Read	000 to 100	%

Description	Register/s	Type	Access	Option	Value
Current Output B Status	2017	Int	Read	Disabled	0
				Enabled – Source Sensor	1
				Enabled – Source Temperature	2

Description	Register/s	Type	Access	Format	Units
Current Output B Value (Returns 0 if current output B is disabled)	2018	Float	Read	00.00 to 24.00	mA

Description	Register/s	Type	Access	Format	Units
Current Output B Percentage (Returns 0 if current output B is disabled)	2020	Int	Read	000 to 100	%

Description	Register/s	Type	Access	Option	Value
Digital Output Status	2021	Int	Read	Disabled	0
				Inactive	1
				Active	2

Description	Register/s	Type	Access	Option	Value
Digital Input Status	2022	Int	Read	Disabled	0
				Inactive	1
				Active	2

Description	Register/s	Type	Access	Option	Value
Module Status	2023	Int	Read	Normal	0
				Offline	1
				Cleaning	2
				Cleaning – Recovery	3
				Digital Input – Offline	4
				Digital Input - Interlock	5
				Digital Input – Flow Switch	6
				Digital Input – Tank Level	7

Description	Register/s	Type	Access	Option	Value
Module Error Status	2024	Int	Read	No Error Present	0
				Error Present	1

Description	Register/s	Type	Access	Format	Units
Custom Solution Units (Returns 0 if not using custom solution)	2025	ASCII 4 Bytes	Read	7 Characters (2 Characters per Register) Each Register Read as (Upper Byte << 8 | Lower Byte << 0) Unused characters return 0	N/A

Description	Register/s	Type	Access	Option	Value
Optical Probe Status	2035	Int	Read	Sensor Removed	0
				Sensor Connecting	1
				Sensor Connected	2

Dissolved Oxygen Input Setup

The Channels Setup menu contains the configuration for the sensor's input.

The default security access code is 1000

Sensor

Units

The channel can be configured to measure in 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 on page 87).

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2101	*Int*	*Read / Write*	*None*	*Saturation (%Sat)*	*0*	*None*
				Concentration (ppm)	*1*	*None*
				Partial Pressure of Oxygen (mBar)	*2*	*None*
				Millimeters of Mercury (mmHg)	*3*	*None*
				Concentration (mg/l)	*4*	*None*
				Current (nA)	*5*	*Probe (2136) set to Amperometric (0)*

Probe

Select the type of probe the instrument is using.

Note: Whilst the module will automatically set the probe type to optical when fitted, if using the app whilst this happens the user may need to exit back to the main module setup screen and then back into the required menu for the shown settings to update.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2136	*Int*	*Read / Write*	*None*	*Amperometric*	*0*	*None*
				Optical	*2*	*None*

Bias Voltage

For Polarographic sensors, the polarising Bias Voltage can be set using this menu.

Only available when using an Amperometric probe.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2102	*Float*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*-1.000 to +1.000*	*V*

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.

Only available when using an Amperometric probe.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2104	*Float*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*0 to 9999*	*None*

Probe Model

The model type of the optical probe connected to the module.

Note: shows disconnected when no optical probe is present

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2136	*ASCII 10 Bytes*	*Read*	*None*	*20 Characters - ASCII Codes 0x20 to 0x7E* *(2 Characters per Register)* *Each Register Read as (Upper Byte << 8 | Lower Byte << 0)* *Unused characters set to 0*	*None*

Probe Info

View additional information including first use date and operation time for the connected optical probe.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Display Secondary Reading

Allows the user to calculate a secondary measurement derived from the sensor.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2106	*Int*	*Read / Write*	*None*	*No*	*0*	*None*
				Saturation (%Sat)	*1*	*Units (2101) not set to Saturation (%Sat) (0)*
				Concentration (ppm)	*2*	*Units (2101) not set to Concentration (ppm) (1)*
				Partial Pressure of Oxygen (mBar)	*3*	*Units (2101) not set to Partial Pressure of Oxygen (mBar) (2)*
				Millimeters of Mercury (mmHg)	*4*	*Units (2101) not set to Millimeters of Mercury (mmHg) (3)*
				Concentration (mg/l)	*5*	*Units (2101) not set to Concentration (mg/l) (4)*
				Current (nA)	*6*	*Probe (2136) set to Amperometric (0) and Units (2101) not set to Current (nA) (5)*
				Unfiltered Value	*7*	*Probe (2136) set to Optical (2)*
				Phase Angle	*8*	*Probe (2136) set to Optical (2)*

Temperature

Input

Select the module's temperature measurement sensor type for use with the measurement's automatic temperature compensation system. If the input is set to disabled a manual temperature compensation value must be set.

If a temperature sensor is not connected to the module this menu item should be set to disabled, else temperature input error messages will be shown.

Note. When using an optical probe, the menu will be locked to the Probe setting.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2107	*Int*	*Read / Write*	*None*	*Disabled*	*0*	*Probe (2136) set to Amperometric (0)*
				PT1000	*1*	*Probe (2136) set to Amperometric (0)*
				BJ22K	*2*	*Probe (2136) set to Amperometric (0)*

				Probe	*3*	*Probe (2136) set to Optical (2)*

Units

Select the units for the module's temperature measurement and compensation system.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2108	*Int*	*Read / Write*	*None*	*°C*	*0*	*None*
				°F	*1*	*None*

Compensation Mode

To use temperature compensation from a measured input select "Auto", else select "Manual" to enable a fixed value entry. Only Available when probe set to Amperometric.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2109	*Int*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*Manual*	*0*	*None*
				Auto	*1*	*None*

Manual Input

The fixed temperature value used for manual temperature compensation.

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

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2110	*Float*	*Read / Write*	*Compensation Mode (2109) set to Manual (0)*	*-20.0 to 150.0 Units (2108) set to °C (0)*	*°C*
				-4.0 to 302.0 Units (2108) set to °F (1)	*°F*

Salinity

Compensation Input

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).

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2112	*Float*	*Read / Write*	*None*	*0.0 to 40.0*	*ppt*

Pressure

Units

Set the units the manual pressure compensation is entered with.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2114	*Int*	*Read / Write*	*None*	*Atm*	*0*	*None*
				Bar	*1*	*None*
				kPa	*2*	*None*
				mH_2O	*3*	*None*
				psi	*4*	*None*
				mmHg	*5*	*None*

Compensation Input

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

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2115	*Float*	*Read / Write*	*None*	*0.00 to 99.99 Units (2114) set to Atm (0)*	*Atm*
				0.00 to 00.00 Units (2114) set to Bar (1)	*Bar*
				0 to 9999 Units (2114) set to kPa (2)	*kPa*
				0.0 to 999.9 Units (2114) set to mH_2O (3)	*mH_2O*
				0.0 to 999.9 Units (2114) set to psi (4)	*psi*
				00 to 9999 Units (2114) set to mmHg (5)	*mmHg*

Filter

Input

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), alternatively to disable the filter by setting it to out. Only available when using Amperometric probes.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2117	*Int*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*Out*	*0*	*None*
				10 Seconds	*1*	*None*
				20 Seconds	*2*	*None*
				40 Seconds	*3*	*None*
				1 Minute	*4*	*None*
				3 Minute	*5*	*None*
				5 Minute	*6*	*None*

FMS18 Optical Dissolved Oxygen Probe Filters

The FMS18 Optical Dissolved Oxygen probe employs a powerful collection of bubble and signal-noise filters, each with a wide range of configurable options. These filters built into the probe 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 probes:

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 probe'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 probe detects the lowest dissolved oxygen %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 dissolved oxygen %Sat reading, such as a 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.

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

Select the Output Filter's operating mode.

Standard – The probe'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 dissolved oxygen %Sat reading during the defined integration time and maintains that value.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2148	*Int*	*Read / Write*	*Probe (2136) set to Optical (2)*	*None*	*0*	*None*
				Standard	*1*	*None*
				Lowest	*2*	*Bubble (2152) set to Off (1)*

Integration Time

Output Filter, Lowest mode integration time.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2149	*Uint*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Lowest (2)*	*0 to 600*	*Seconds*

Output (%)

Output Filter, Standard mode percentage

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2150	*Float*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1)*	*0 to 100*	*%*

Bubble

Enable the Bubble Filter.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2152	*Int*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1)*	*On*	*0*	*None*
				Off	*1*	*None*

Rate of Change

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

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2153	*Float*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0)*	*0.000 to 9.999*	*%Sat/sec*

Delay Hold

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

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2155	*Uint*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0)*	*0 to 1200*	*Seconds*

Max. 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 dissolved oxygen %Sat returns to a live reading or, if enabled, is passed to the Hold Response Filter.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2156	*Uint*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0)*	*0 to 1200*	*Seconds*

Hold Response

Enable the Hold Response Filter.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2157	*Int*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0)*	*Disable*	*0*	*None*
				Enable	*1*	*None*

Hold Time Limit

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

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2158	*Float*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0) and Hold Response (2157) set to Enable (1)*	*0 to 100*	*%*

Hold Filter Type

Select the Hold Filter's operating mode.

Standard - The probe'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 probe detects the lowest dissolved oxygen %Sat reading during the defined integration time and maintains that value.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2160	*Int*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0) and Hold Response (2157) set to Enable (1)*	*Standard*	*0*	*None*
				Lowest	*1*	*None*

Hold %

Holder Filter, Standard mode percentage

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2161	*Float*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0) and Hold Response (2157) set to Enable (1) and Hold Filter Type (2160) set to Standard (0)*	*0 to 100*	*%*

Hold Time

Hold Filter, Lowest mode integration time.

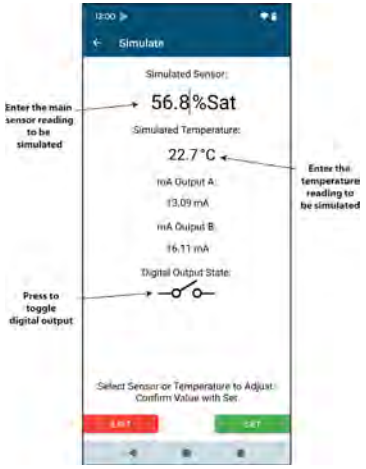
Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2163	*Uint*	*Read / Write*	*Probe (2136) set to Optical (2) and Filter Output (2148) set to Standard (1) and Bubble (2152) set to On (0) and Hold Response (2157) set to Enable (1) and Hold Filter Type (2160) set to Lowest (1)*	*0 to 600*	*Milliseconds*

Simulate

Sensors

Assists the user in commissioning the module by simulating the main sensor and temperature readings which in turn drive the current outputs as per their configuration. User can also toggle the status of the digital output.

Available options depend on current output and digital output configurations.



Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Calibration

Calibration Procedures

Normal good practices should be observed when calibrating dissolved oxygen systems. When the instrument is first connected to the dissolved oxygen probe, i.e. when the unit is first installed, or whenever the probe 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 probe current is 66nA at 100% Saturation.
- Approximate Optical probe PA (Phase Angle) is 25° at 100% Saturation and 50° at 0% Saturation
- If using a manually temperature compensated probe 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 probe is connected to the instrument and the system is first turned on, a polarization voltage is applied across the sensor. Initially the probe 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 probe is allowed to fully stabilize before calibration is started. Alternatively, the probe is connected either to a polarizing unit or a powered instrument when not in use.

Calibration Menu

The calibration menu provides the facility to adjust the probe inputs to the system in which it is operating.

The default security access code is <u>1000</u>

Module

Mode

Selecting off-line causes any current outputs to go to the value stated in their "Offline Mode" menu, useful for when commissioning or calibrating the module.

When the unit is placed in an off-line state "off-line" will appear in the messages section on the measurement screen.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2201	*Int*	*Read/ Write*	*None*	*Online*	*0*	*None*
				Offline	*1*	*None*

Calibration

Manual Temperature Input

This setting allows a different fixed temperature value to be used when calibrating.

Only available when the channel temperature compensation mode has been set to manual.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2202	*Float*	*Read / Write*	*Compensation Mode (2109) set to Manual (0)*	*-20.0 to 150.0 Units (2108) set to °C (0)*	*°C*
				-4.0 to 302.0 Units (2108) set to °F (1)	*°F*

Manual Pressure Input

This setting allows a different fixed pressure value to be used when calibrating.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2204	*Float*	*Read / Write*	*None*	*0.00 to 99.99 Units (2114) set to Atm (0)*	*Atm*
				0.00 to 00.00 Units (2114) set to Bar (1)	*Bar*
				0 to 9999 Units (2114) set to kPa (2)	*kPa*
				0.0 to 999.9 Units (2114) set to mH_2O (3)	*mH_2O*
				0.0 to 999.9 Units (2114) set to psi (4)	*psi*
				00 to 9999 Units (2114) set to mmHg (5)	*mmHg*

Sensor

Calibration Units

The calibration can be performed using different units compared to the main reading.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2206	*Int*	*Read/ Write*	*None*	*Saturation (%Sat)*	*0*	*None*
				Concentration (ppm)	*1*	
				Partial Pressure of Oxygen (mBar)	*2*	

				Millimeters of Mercury (mmHg)	*3*	
				Concentration (mg/l)	*4*	

Span Calibration Point

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

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2207	*Float*	*Read / Write*	*None*	*0.0 to 300.0 Calibration Units (2206) set to %Sat (0)*	*%Sat*
				0.00 to 20.00 Calibration Units (2206) set to ppm (1)	*ppm*
				0.0 to 999.9 Calibration Units (2206) set to mBar (2)	*mBar*
				0.0 to 999.9 Calibration Units (2206) set to mmHg (3)	*mmHg*
				0.00 to 20.00 Calibration Units (2206) set to mg/l (4)	*mg/l*

Span Calibrate

Enter the dissolved oxygen probe span calibration routine.

See Span Calibration on page 44 for further information.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
App Only						

Full Calibrate

Enter the dissolved oxygen probe full calibration routine.

See Full Probe Calibration on page 49 for further information.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
App Only						

Condition

The module 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.
- 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.
- Fault – The sensor's output is too high at zero calibration.

For further guidance on the above results see Fault Finding section on page 92.

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2216	*Int*	*Read*	*Probe (2136) set to Amperometric (0)*	*Good*	*0*	*None*
				Refill	*1*	
				Span High	*2*	
				Fault	*3*	

Temperature

Offset - Calibrate

Enter the temperature offset calibration screen. See Temperature Calibration on page 56 for further details

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Offset Value

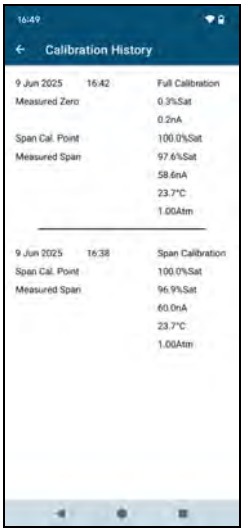
The temperature offset value currently being used. The value will change depending on the result of the temperature offset calibration. Cannot be edited

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2220	*Float*	*Read*	*Temperature Input (2107) not set to Disabled (0)*	*-50.0 to +50.0 Units (2108) set to °C (0)*	*°C*
				-122.0 to +122.0 Units (2108) set to °F (1)	*°F*

History

Records

Shows a log of the sensor calibration. Including time and date, calibration method and results.



Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Clear

Clear the sensor calibration history.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Reminder

Set

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2224	*Int*	*Read / Write*	*None*	*No*	*0*	*None*
				Yes	*1*	*None*

Interval

Sets the interval time for the calibration alarm.

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

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2225	*Int*	*Read / Write*	*Reminder Set (22120 set to Yes (1)*	*1 to 999*	*Days*

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.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2226	*Int*	*Read / Write*	*Reminder Set (22120 set to Yes (1)*	*1 to 31*	*Day*
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2227	*Int*	*Read / Write*	*Reminder Set (22120 set to Yes (1)*	*1 to 12*	*Month*
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2228	*Int*	*Read / Write*	*Reminder Set (22120 set to Yes (1)*	*2000 to 3000*	*Year*

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.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2229	*Int*	*Read / Write*	*Calibration Due Set (3208 Bit 2 = 1)*	*Done*	*0*	*None*
				Defer	*1*	*None*

Reset

Sensor Calibration

Reset the sensor user calibration to its default state.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2230	*Int*	*Read / Write*	*None*	*Done*	*0*	*None*
				Reset	*1*	*None*

Temperature Calibration

Reset the temperature user calibration to its default state.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2231	*Int*	*Read / Write*	*Temperature Input (2107) not set to Disabled (0)*	*Done*	*0*	*None*
				Reset	*1*	*None*

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 probe. 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 probe by leaving it in the process solution for up to 10 minutes. This will allow the temperature compensator networks to reach equilibrium.
- Lift the probe so that it is just above the process solution, and therefore as close to the temperature of that solution as possible.
- Select Span Calibrate item in the calibration menu, observe the instrument readings and wait until the output stabilises.
- Once stable press the start button and the unit will correct the span calibration to the user selected span calibration point.

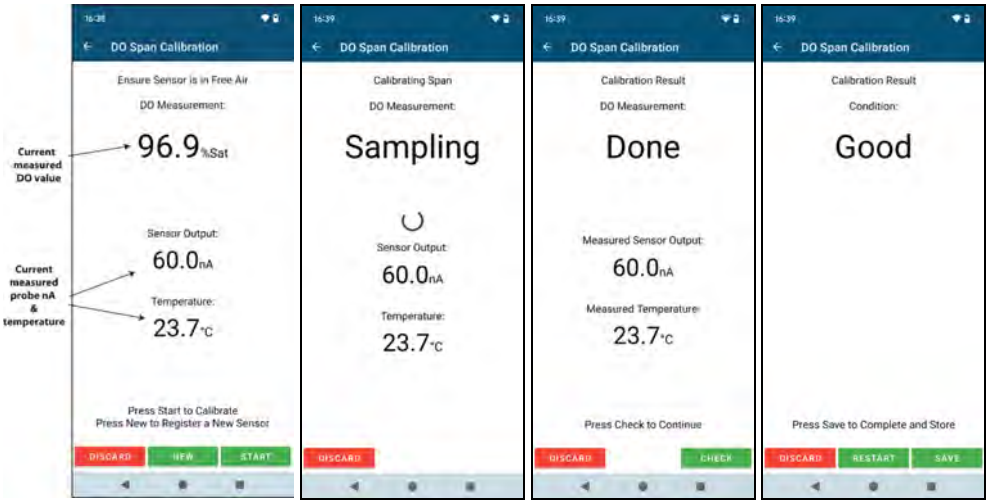
Calibration method using App

From the calibration menu if need be set the Calibration Manual Temperature Input and Calibration Manual Pressure Input. Then set the Span Calibration Point, usually 100 %Sat when calibrating in air.

To enter the span calibration menu, click on Span Calibrate, then as described above lift the probe so that it is sitting just above the process solution and using the displayed measurements wait for the readings to stabilise. Once stable press the start button and the module will begin to sample the probe.

Once complete the app will display done along with the measured probe and temperature readings at the time of calibration. Press check to continue, the app will then display calculated condition of the probe, see page 40 for further information. If the user is happy with the result press save, else press restart to return to the initial screen, or press discard to exit.

Note, if calibrating an optical probe, the app will show the result of the probes internal calibration check at the complete screen stage at which point the calibration will already be saved internally to the probe, so the user can either exit the calibration or restart if they are not happy with the displayed measure values.



Initial Screen | Sampling Screen | Complete Screen | Condition Screen

Amperometric Probe Span Calibration method using Modbus

First if need be set the *Calibration Manual Temperature Input (2202)* and *Calibration Manual Pressure Input (2204)*. Then set the *Span Calibration Point (2206)*, usually 100 %Sat when calibrating in air.

To begin the calibration process set the *Amperometric Span Calibration Status (2240)* to *Calibration Mode (1),* then as described above lift the probe so that it is sitting just above the process solution and wait for the readings to stabilise by observing *Calibration Reading (2242)* and *Calibration nA Reading (2245)*. Once stable set *Amperometric Span Calibration Status (2240)* to *Begin Span Calibration (2)*.

Once the sampling is complete *Amperometric Span Calibration Status (2240)* will automatically change to *Calibration Process Completed (3)*.

The newly calculated *Calibration Sensor Condition (2251)* along with the *Measured nA Reading (2247)* and *Measured Temperature Reading (2249)* can now be read. If these are acceptable set *Amperometric Span Calibration Status (2240)* to *Save Calibration (4)*, if not set *Amperometric Span Calibration Status (2240)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped (0)* to exit the calibration mode.

Amperometric Span Calibration Status

Controls the Amperometric probe span calibration process.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2240	*Int*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	*None*
				Begin Span Calibration	*2*	*None*
				Calibration Process Completed	*3*	*None*
				Save Calibration	*4*	*None*

Calibration Reading

The current probe reading scaled as per the calibration units. For use when calibrating using different measurement units compared to the main module measurement.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2242	*Float*	*Read*	*None*	*See register 2244*	*See register 2244*

Calibration Reading Units

The units of the calibration reading (2242)

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2244	*Int*	*Read*	*None*	*XXX.X %Sat*	*0*	*None*

				XX.XX ppm	*1*	*None*
				XXXX mBar	*2*	*None*
				XXX.X mmHg	*3*	*None*
				XX.XX mg/l	*4*	*None*

Calibration nA Reading

The probe's current nanoamp reading.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2245	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*XXX.X*	*nA*

Measured nA Reading

The probe's nanoamp measurement at the point of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2247	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*XXX.X*	*nA*

Measured Temperature Reading

The probe's temperature measurement at the point of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2249	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*+/- XXX.X*	*See register 2012*

Calibration Sensor Condition

The calculated probe condition after calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2251	*Int*	*Read*	*Probe (2136) set to Amperometric (0)*	*Good*	*0*	*None*
				Refill	*1*	*None*
				Span High	*2*	*None*
				Fault	*3*	*None*

Optical Probe Span Calibration method using Modbus

First if need be set the *Calibration Manual Pressure Input (2204)*. Then set the *Span Calibration Point (2206)*, usually 100 %Sat when calibrating in air.

To begin the calibration process set the *Optical Probe Span Calibration Status (2290)* to *Calibration Mode (1),* then as described above lift the probe so that it is sitting just above the process solution and wait for the readings to stabilise by observing *Calibration Reading (2242)* and *Calibration Phase Angle Reading (2291)*. Once stable set *Optical Probe Span Calibration Status (2290)* to *Begin Span Calibration (2).*

Once the sampling is complete *Optical Probe Span Calibration Status (2290)* will automatically change to *Saving Calibration (3),* once the saving to the probe is complete it will again automatically move on to *Calibration Result (4).*

The newly calculated *Calibration Result (2319)* along with the *Measured Phase Angle Reading (2294)* and *Measured Temperature Reading (2296)* can now be read. If these are acceptable set *Optical Probe Span Calibration Status (2290)* to *Calibration Stopped (0) to exit the calibration mode*, to restart the process set *Optical Probe Span Calibration Status (2290)* to *Calibration Mode (1).*

Optical Probe Span Calibration Status

Controls the Optical probe span calibration process.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2290	*Int*	*Read / Write*	*Probe (2136) set to Optical (2)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	
				Begin Span Calibration	*2*	
				Saving Calibration	*3*	
				Calibration Result	*4*	

Calibration Reading

The current probe reading scaled as per the calibration units. For use when calibrating using different measurement units compared to the main module measurement.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2242	*Float*	*Read*	*None*	*See register 2244*	*See register 2244*

Calibration Reading Units

The units of the calibration reading (2242)

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2244	*Int*	*Read*	*None*	*XXX.X %Sat*	*0*	*None*

				XX.XX ppm	*1*	
				XXXX mBar	*2*	
				XXX.X mmHg	*3*	
				XX.XX mg/l	*4*	

Calibration Phase Angle Reading

The probe's current phase angle reading.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2291	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*XX.XX*	°

Measured Phase Angle Reading

The probe's phase angle measurement at the point of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2294	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*XX.XX*	°

Measured Temperature Reading

The probe's temperature measurement at the point of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2296	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*+/- XXX.X*	*See register 2012*

Calibration Result

The result of the calibration, calculated by the probe.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2319	*Int*	*Read*	*Probe (2136) set to Optical (2)*	*Passed*	*0*	*None*
				Failed	*1*	

Full Probe Calibration

Zero Calibration Step in a De-Oxygenated Environment step

- 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 probe, 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 Sensor Full Calibrate menu item in the calibration menu and place the probe in the sodium sulphite solution or vessel and observe the nanoamp / phase angle reading. The reading should drop below 10% of the air saturated reading within 35 seconds for Amperometric probe.
- For Amperometric probes, if this time is exceeded, cycle the probe 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 probe 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 probe responds quickly enough, check that within another 3 minutes the current reading has fallen to virtually zero. Then press the Start button at the zero calibration screen to calibrate the new zero point.
- Once the Zero point has been calibrated, the module will automatically progress on to the Span Calibration menu and the user should follow the above Span Calibration steps.

Calibration method using App

From the calibration menu if need be set the Calibration Manual Temperature Input and Calibration Manual Pressure Input. Then set the Span Calibration Point, usually 100 %Sat when calibrating in air.

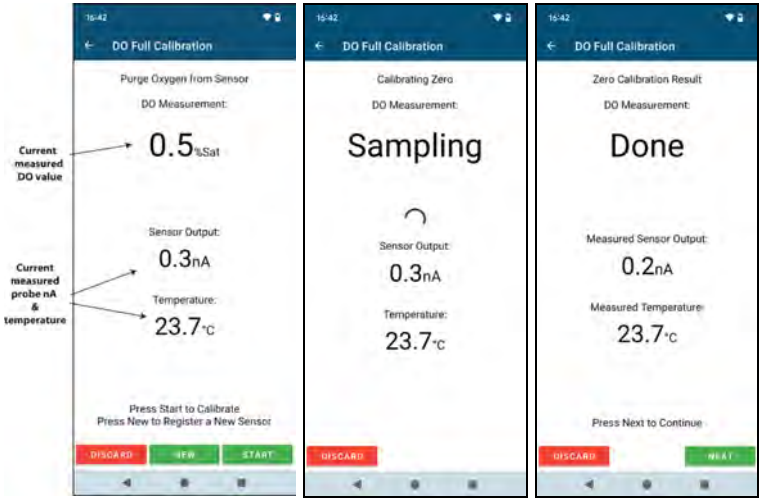
To enter the full calibration menu, click on Full Calibrate, then as described above place the probe in the oxygen purged environment and check the response time. If good enough wait 3 minutes for it to fully reach zero and proceed with the calibration by pressing the start button, then module will the begin to sample the probe.

Once complete the module will display done along with the measured probe and temperature readings at the time of the zero calibration. Press next to proceed to the span calibration point.

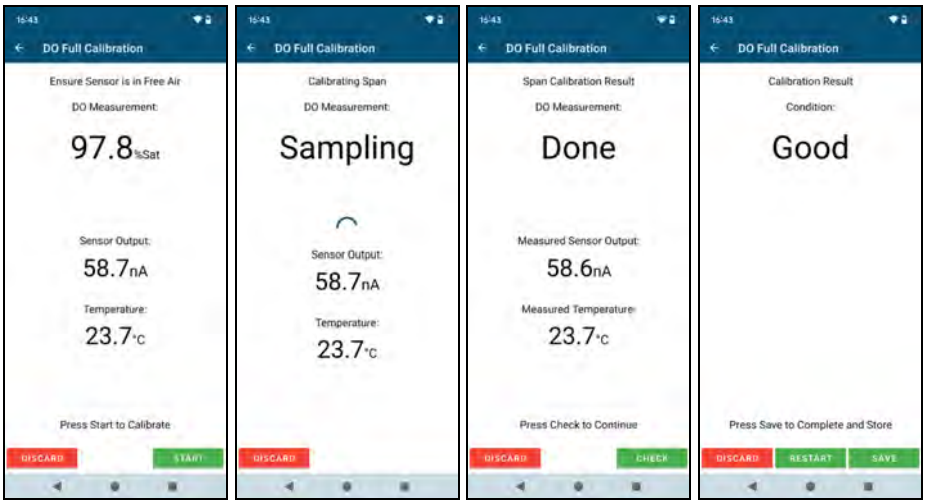
Follow the probe setup steps as described in the span calibration section, using the displayed readings check that the reading is stable and proceed with the span calibration by pressing start.

Again, once completed the app will display done along with the measured probe and temperature readings at the time of span calibration. Press check to continue, the app will then display calculated condition of the probe, see page 40 for further information. If the user is happy with the result press save, else press restart to return to the initial screen, or press discard to exit.

Note, if calibrating an optical probe, the app will show the result of the probes internal calibration check at the span complete screen stage at which point the calibration will already be saved internally to the probe, so the user can either exit the calibration or restart if they are not happy with the displayed measure values.



Zero Initial Screen | Zero Sampling Screen | Zero Complete Screen



Span Screen | Span Sampling Screen | Span Complete Screen | Condition Screen

Amperometric Probe Full Calibration method using Modbus

First if need be set the *Calibration Manual Temperature Input (2202)* and *Calibration Manual Pressure Input (2204)*. Then set the *Span Calibration Point (2206)*, usually 100 %Sat when calibrating in air.

To begin the calibration process set the *Amperometric Full Calibration Status (2260)* to *Calibration Mode (1)*, then as described above place the probe in the oxygen purged environment and check the response time. If good enough wait 3 minutes for it to fully reach zero by observing *Calibration Reading (2242)* and *Calibration nA Reading (2245)* and then proceed with the calibration by setting *Amperometric Full Calibration Status (2260)* to *Begin Zero Calibration (2)*.

Once the zero sampling is complete *Amperometric Full Calibration Status (2260)* will automatically change to *Zero Calibration Process Completed (3)*. The *Measured nA Zero Reading (2261)* and *Measured Temperature Zero Reading (2263)* have now been updated with the latest calibration values.

Next to proceed with span calibration by lifting the probe as described previously so that it is sitting just above the process solution and wait for the readings to stabilise by again observing *Calibration Reading (2242)* and *Calibration nA Reading (2245)*. Once stable set *Amperometric Full Calibration Status (2260)* to *Begin Span Calibration (4)*.

As before once the span sampling is complete *Amperometric Full Calibration Status (2260)* will automatically change to *Span Calibration Process Completed (5)*.

The newly calculated *Calibration Sensor Condition (2269)* along with the *Measured nA Span Reading (2265)* and *Measured Temperature Span Reading (2267)* can now be read. If these are acceptable set *Amperometric Full Calibration Status (2260)* to *Save Calibration (6)*, if not set *Amperometric Full Calibration Status (2260) (2240)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped (0)* to exit the calibration mode.

Amperometric Full Calibration Status

Controls the Amperometric probe full calibration process.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2260	*Int*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	
				Begin Zero Calibration	*2*	
				Zero Calibration Process Completed	*3*	
				Begin Span Calibration	*4*	
				Span Calibration Process Completed	*5*	
				Save Calibration	*6*	

Calibration Reading

The current probe reading scaled as per the calibration units. For use when calibrating using different measurement units compared to the main module measurement.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2242	*Float*	*Read*	*None*	*See register 2244*	*See register 2244*

Calibration Reading Units

The units of the calibration reading (2242)

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2244	*Int*	*Read*	*None*	*XXX.X %Sat*	*0*	*None*
				XX.XX ppm	*1*	
				XXXX mBar	*2*	
				XXX.X mmHg	*3*	
				XX.XX mg/l	*4*	

Calibration nA Reading

The probe's current nanoamp reading.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2245	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*XXX.X*	*nA*

Measured nA Zero Reading

The probe's nanoamp measurement at the point of zero calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2261	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*XXX.X*	*nA*

Measured Temperature Zero Reading

The probe's temperature measurement at the point of zero calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2263	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

Measured nA Span Reading

The probe's nanoamp measurement at the point of span calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2265	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*XXX.X*	*nA*

Measured Temperature Span Reading

The probe's temperature measurement at the point of span calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2267	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

Calibration Sensor Condition

The calculated probe condition after calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2269	*Int*	*Read*	*Probe (2136) set to Amperometric (0)*	*Good*	*0*	*None*
				Refill	*1*	
				Span High	*2*	
				Fault	*3*	

Optical Probe Full Calibration method using Modbus

First if need be set the *Calibration Manual Temperature Input (2202)* and *Calibration Manual Pressure Input (2204)*. Then set the *Span Calibration Point (2206)*, usually 100 %Sat when calibrating in air.

To begin the calibration process set the *Optical Full Calibration Status (2310)* to *Calibration Mode (1),* then as described above place the probe in the oxygen purged environment and check the response time. If good enough wait 3 minutes for it to fully reach zero by observing *Calibration Reading (2242)* and *Calibration Phase Angle Reading (2291)* and then proceed with the calibration by setting *Optical Full Calibration Status (2310)* to *Begin Zero Calibration (2).*

Once the zero sampling is complete *Optical Full Calibration Status (2310)* will automatically change to *Zero Calibration Process Completed (3).* The *Measured Phase Angle Zero Reading (2311)* and *Measured Temperature Zero Reading (2313)* have now been updated with the latest calibration values.

Next to proceed with span calibration by lifting the probe as described previously so that it is sitting just above the process solution and wait for the readings to stabilise by again observing *Calibration Reading (2242)* and *Calibration Phase Angle Reading (2291).* Once stable *Optical Full Calibration Status (2310)* to *Begin Span Calibration (4).*

Once the sampling is complete *Optical Full Calibration Status (2310)* will automatically change to *Saving Calibration (5),* once the saving to the probe is complete it will again automatically move on to *Calibration Result (6).*

The newly calculated *Calibration Result (2319)* along with the *Measured Phase Angle Span Reading (2315)* and *Measured Temperature Span Reading (2317)* can now be read. If these are acceptable set *Optical Full Calibration Status (2310)* to *Calibration Stopped (0) to exit the calibration mode*, to restart the process set *Measured Phase Angle Span Reading (2315)* to *Calibration Mode (1).*

Optical Full Calibration Status

Controls the Optical probe full calibration process.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2310	*Int*	*Read / Write*	*Probe (2136) set to Optical (2)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	
				Begin Zero Calibration	*2*	
				Zero Calibration Process Completed	*3*	
				Begin Span Calibration	*4*	
				Saving Calibration	*5*	
				Calibration Result	*6*	

Calibration Reading

The current probe reading scaled as per the calibration units. For use when calibrating using different measurement units compared to the main module measurement.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2242	*Float*	*Read*	*None*	*See register 2244*	*See register 2244*

Calibration Reading Units

The units of the calibration reading (2242)

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2244	*Int*	*Read*	*None*	*XXX.X %Sat*	*0*	*None*
				XX.XX ppm	*1*	
				XXXX mBar	*2*	
				XXX.X mmHg	*3*	
				XX.XX mg/l	*4*	

Calibration Phase Angle Reading

The probes current phase angle reading.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2291	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*XX.XX*	°

Measured Phase Angle Zero Reading

The probe's phase angle measurement at the point of zero calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2311	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*XX.XX*	°

Measured Temperature Zero Reading

The probe's temperature measurement at the point of zero calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2313	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*+/- XXX.X*	*See register 2012*

Measured Phase Angle Span Reading

The probe's phase angle measurement at the point of span calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2315	*Float*	*Read*	*Probe (2136) set to Optical (2)*	*XX.XX*	°

Measured Temperature Span Reading

The probes temperature measurement at the point of span calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2317	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

Calibration Result

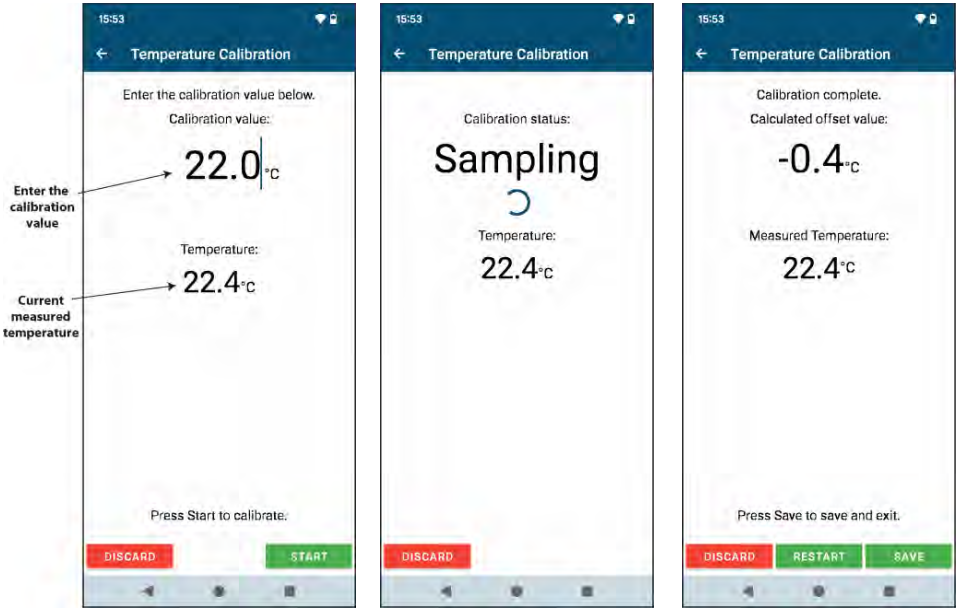
The result of the calibration, calculated by the probe.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2319	*Int*	*Read*	*Probe (2136) set to Optical (2)*	*Passed*	*0*	*None*
				Failed	*1*	

Temperature Calibration

Calibration method using App

Click on temperature offset – calibrate. Once in the initial screen enter the temperature calibration value the user is simulating, and press start to begin calibration. The module will then begin sampling the temperature sensor, if the user wishes to abandon the calibration press the discard button. Once completed it will automatically move on the result screen to show the newly calculated temperature offset value, and the measured temperature value at the time of calibration. If the user is happy with the result press save, else press restart to return to the initial screen, or press discard to exit.



Initial Screen | Sampling Screen | Result Screen

Calibration method using Modbus

First set the *Temperature Calibration Status (2277)* to *Calibration Mode (1)* and write the temperature calibration value the user is simulating to *Temperature Calibration Value (2275)*.

Now to begin sampling the temperature reading set *Temperature Calibration Status (2277)* to *Begin Calibration (2)*. Once the sampling is complete *Temperature Calibration Status (2277)* will automatically change to *Calibration Process Completed (3)*.

The newly calculated temperature offset can be read from *Calculated Temperature Offset Value (2278)* along with the *Measured Temperature Value (2280)*. If these are acceptable set *Temperature Calibration Status (2277)* to *Save Calibration (4)* if not set *Temperature Calibration Status (2277)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped* (*0)* to exit the calibration mode.

Note, to stop calibration at any point set *Temperature Calibration Status (2277)* to *Calibration Stopped* (*0)*.

Temperature Calibration Status

Controls the temperature calibration process.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2277	*Int*	*Read / Write*	*Probe (2136) set to Amperometric (0)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	*None*
				Begin Calibration	*2*	*None*
				Calibration Process Completed	*3*	*None*
				Save Calibration	*4*	*None*

Temperature Calibration Value

The temperature calibration value the user is simulating.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2275	*Float*	*Write*	*Probe (2136) set to Amperometric (0)*	*-20.0 to 150.0 Units (2108) set to °C (0)*	*°C*
				-4.0 to 302.0 Units (2108) set to °F (1)	*°F*

Calculated Temperature Offset Value

The result of the temperature offset calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2278	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*+/- XXX.X*	*See reg. 2012*

Measured Temperature Value

The temperature reading at the time of calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2280	*Float*	*Read*	*Probe (2136) set to Amperometric (0)*	*-20.0 to 150.0 Units (2108) set to °C (0)*	*°C*
				-4.0 to 302.0 Units (2108) set to °F (1)	*°F*

Digital Output

The DOU18 is equipped with a single volt free, single pole, single throw, normally open relay, which can be used to activate external sensor cleaning equipment or to indicate the module alarm status.

Operation

Mode

Select the operation mode of the Digital Output.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2401	*Int*	*Read / Write*	*None*	*Disabled*	*0*	*None*
				Alarm	*1*	*None*
				Cleaning	*2*	*None*

Polarity

Configure whether the digital output opens or closes when active.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2402	*Int*	*Read / Write*	*Mode (2401) not set to Disabled (0)*	*Normally Open*	*0*	*None*
				Normally Closed	*1*	*None*

Alarm

Source

The digital output will energise when one of the following sources are active.

- Sensor Error– When a sensor related error is detected.
- Calibration – When a calibration is in progress.
- Offline – When the module is taken offline.
- Any Error – When any error is detected.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2403	*Int*	*Read / Write*	*Mode (2401) set to Alarm (1)*	*Sensor Error*	*0*	*None*
				Calibration Mode	*1*	*None*
				Offline Mode	*2*	*None*
				Any Error	*3*	*None*

Clean

The digital output 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 probe. 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 probe.

Duration

Enter the duration of the cleaning operation. 00:01 to 60:00 (mm:ss)

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2404	*Int*	*Read / Write*	*Mode (2401) set to Cleaning (2)*	*0 to 60*	*Minutes*
2405				*0 to 60*	*Seconds*

Recovery

The user can introduce an additional post cleaning delay before coming back "On-line", this provides the probe a period to stabilise after the cleaning has finished. 00:00 to 60:00 (mm:ss)

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2406	*Int*	*Read / Write*	*Mode (2401) set to Cleaning (2)*	*0 to 60*	*Minutes*
2407				*0 to 60*	*Seconds*

Interval

Enter the time between cleaning operations. 00:01 to 96:00 (hh:mm)

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2408	*Int*	*Read / Write*	*Mode (2401) set to Cleaning (2)*	*0 to 96*	*Hours*
2409				*0 to 60*	*Minutes*

Manual Clean

Manually start the clean cycle.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2410	*Int*	*Read / Write*	*Mode (2401) set to Cleaning (2)*	*Done*	*0*	*None*
				Begin	*1*	*None*

mA Outputs

The DOU18 is fitted with two current outputs, either which can be used for the transmission of the primary variable or temperature. The current output menu contains all the necessary setup functions to configure the current output sources. The app will display the status of the current output on the measurement screen, where --.--mA indicates that the output is disabled.

Output

Mode

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A:2501 B:2601	*Int*	*Read / Write*	*None*	*Disabled*	*0*	*None*
				0 – 20mA	*1*	*None*
				4 – 20mA	*2*	*None*

Source

Select the source for the current output. Note, the temperature option is only available if the Temperature Input option in the Channel Menu is set to either PT1000 or PT100.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A:2502 B:2602	*Int*	*Read / Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*Sensor*	*0*	*None*
				Temperature	*1*	*Temperature Input (2103) not set to Disabled (0)*

Scaling

Zero (0mA)

Enter the desired sensor value to be represented by 0mA (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.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits & Units*	
A:2503 B:2603	*Float*	*Read / Write*	*Output Mode (A:2501, B:2601) set to 0 – 20mA (1)*	*If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to %Sat (0)*	*0.0 to 300.0%Sat*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to ppm (1)	*0.00 to 20.00ppm*

				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mBar (2)	*0.0 to 999.9mBar*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mmHg (3)	*0.0 to 999.9mmHg*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mg/l (4)	*0.00 to 20.00mg/l*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to nA (5)	*0.0 to 500.0nA*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2108) set to °C (0)	*-20.0 to 150.0°C*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2108) set to °F (1)	*-4.0 to 302.0°F*

Zero (4mA)

Enter the desired sensor value to be represented by 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.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits & Units***	
A:2505 B:2605	*Float*	*Read / Write*	*Output Mode (A:2501, B:2601) set to 4 – 20mA (2)*	*If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to %Sat (0)*	*0.0 to 300.0%Sat*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to ppm (1)	*0.00 to 20.00ppm*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mBar (2)	*0.0 to 999.9mBar*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mmHg (3)	*0.0 to 999.9mmHg*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mg/l (4)	*0.00 to 20.00mg/l*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to nA (5)	*0.0 to 500.0nA*

				If Source (A:2502, B:2602) set to Temperature (1) And Units (2108) set to °C (0)	*-20.0 to 150.0°C*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2108) set to °F (1)	*-4.0 to 302.0°F*

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.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits & Units***	
A:2507 B:2607	*Float*	*Read / Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to %Sat (0)*	*0.0 to 300.0%Sat*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to ppm (1)	*0.00 to 20.00ppm*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mBar (2)	*0.0 to 999.9mBar*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mmHg (3)	*0.0 to 999.9mmHg*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to mg/l (4)	*0.00 to 20.00mg/l*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to nA (5)	*0.0 to 500.0nA*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2108) set to °C (0)	*-20.0 to 150.0°C*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2108) set to °F (1)	*-4.0 to 302.0°F*

Action

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.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A:2509 *B:2609*	*Int*	*Read / Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*No Action*	*0*	*None*
				Drive to 0mA	*1*	*None*
				Drive to 4mA	*2*	*None*
				Drive to 22mA	*3*	*None*
				Hold Level	*4*	*None*

Offline Mode

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A:2510 *B:2610*	*Int*	*Read / Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*No Action*	*0*	*None*
				Drive to 0mA	*1*	*None*
				Drive to 4mA	*2*	*None*
				Drive to 22mA	*3*	*None*
				Hold Level	*4*	*None*

Calibrate

Output

Permits the user to adjust the current output, to calibrate any equipment that may be being used to monitor the current output signal.

App Method
On entering the calibration function module will set the current output to a fixed value as per shown in the calibration menu. Enter the value as measured by the external meter in the displayed field then press next to proceed to the next point.

Repeat as before until both points have been calibrated. Next proceed to the check section where the current output will be set to a mid-point between to allow for calibration verification.

If the calibration is successful select Save, else select Restart to repeat the calibration or Discard to exit.

Modbus Method
4-20mA Mode Example

Set Current Output Calibration Status register (A:2530, B:2630) to 2 (Start 4mA Calibration), then write the measured current output value to the Calibration 4mA Value register (A:2533, B2633).

Next set the Current Output Calibration Status register to 3 (Start 20mA Calibration), then write the measured current output value to the Calibration 20mA Value register (A:2535, B2635).

Next set the Current Output Calibration Status register to 5 (Check Calibration 12mA). If satisfied with the calibration check value set the Current Output Calibration Status register to 6, else set the register to 0.

0-20mA Mode Example

Follow the above example but use Start 0mA Calibration state (1), instead of Start 4mA Calibration state (2), Calibration 0mA Value register (A:2531, B2631) instead of Calibration 4mA Value register and Check Calibration 10mA state (4) instead of Check Calibration 12mA state (5).

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
A:2530 B:2630	*Int*	*Read / Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*Stop Calibration*	*0*	*None*
				Start 0mA Calibration	*1*	*Output Mode (A:2501, B:2601) set to 0 – 20mA (1)*
				Start 4mA Calibration	*2*	*Output Mode (A:2501, B:2601) set to 4 – 20mA (2)*
				Start 20mA Calibration	*3*	*None*
				Check Calibration 10mA	*4*	*Output Mode (A:2501, B:2601) set to 0 – 20mA (1)*
				Check Calibration 12mA	*5*	*Output Mode (A:2501, B:2601) set to 4 – 20mA (2)*
				Save Calibration	*6*	*None*

Calibration 0mA Value					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
A:2531 B:2631	*Float*	*Write*	*Output Mode (A:2501, B:2601) set to 0 – 20mA (1)*	*0.000 to 2.000*	*mA*
Calibration 4mA Value					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
A:2533 B:2633	*Float*	*Write*	*Output Mode (A:2501, B:2601) set to 4 – 20mA (2)*	*2.000 to 6.000*	*mA*
Calibration 20mA Value					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
A:2535 B:2635	*Float*	*Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*18.000 to 22.000*	*mA*

Reset

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

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
A:2511 B:2611	*Int*	*Read / Write*	*Output Mode (A:2501, B:2601) Not set to Disabled (0)*	*Done*	*0*	*None*
				Reset Calibration (Clears to 0 once complete)	*1*	*None*

Digital Input

The DOU18 is fitted with a single digital input. The digital input menu contains all the necessary setup functions to configure the digital input sources. This input is intended to be switched using a volt free link, switch or relay. The user can select whether closing or opening the contact initiates the configured action.

Operation

Function

The digital input can be configured to operate in the following ways:

- Offline
- Interlock
- Flow Switch
- Tank Level
- Switch Setup
- Cleaning

Offline, Interlock, Flow Switch and Tank Level – When active will take the module "offline". This causes any digital outputs to de-energise, the 0/4-20mA output to change to its set offline state and the selected function message to appear on the measurement screen.

Switch Setup – When active the module will load the configuration that has been stored in one of the two internal save stores. The original configuration is restored upon the digital input going inactive.

Cleaning – Manually move the digital output cleaning cycle to the clean phase of the cycle.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2701	*Int*	*Read / Write*	*None*	*Disabled*	*0*	*None*
				Offline	*1*	*None*
				Interlock	*2*	*None*
				Flow Switch	*3*	*None*
				Tank Level	*4*	*None*
				Switch Setup	*5*	*Save Store A Present (3102 = 1) or Save Store B Present (3111 = 1)*
				Cleaning	*6*	*Digital Output Mode (2401) set to cleaning (2)*

Store

Select which store to load when using Switch Setup.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2702	*Int*	*Read / Write*	*Function (2701) set to Switch Setup (5)*	*Store A*	*0*	*Save Store A Present (3102 = 1)*
				Store B	*1*	*Save Store B Present (3111 = 1)*

Polarity

Configure whether the digital input activates on the closing of circuit (normal) or the opening of the circuit (reverse).

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2703	*Int*	*Read / Write*	*Function (2701) not set to Disabled (0)*	*Normally Open*	*0*	*None*
				Normally Closed	*1*	*None*

Configuration

The configuration menu enables the user to configure the basic operating parameters of the module.

Time & Date

Current

The module's current internal Time and Date.

Hour

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2801	*Int*	*Read / Write*	*None*	*0-23*	*Hour*

Minute

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2802	*Int*	*Read / Write*	*None*	*0-59*	*Minute*

Day

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2803	*Int*	*Read / Write*	*None*	*1-31*	*Day*

Month

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2804	*Int*	*Read / Write*	*None*	*1-12*	*Month*

Year

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2805	*Int*	*Read / Write*	*None*	*2000-3000*	*Year*

Update

Set the module's time as to the time on the device running the app.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Security Code

Change Code

Sets the security access code used by the LTH Discover app to prohibit changes to the module's configuration by unauthorised personnel.

Note, if set to 0000 the security code is permanently disabled unless changed back to another number.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	
App Only					

Hardware

User Label

Set's the module's user label as displayed instead of the serial number in the Bluetooth discovery screen and measurement screen.

Note, leave blank to revert back to using the module's serial number.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2807	*ASCII 4 Bytes*	*Read / Write*	*None*	*8 Characters - ASCII Codes 0x20 to 0x7E* *(2 Characters per Register)* *Each Register Read as (Upper Byte << 8 | Lower Byte << 0)* *Unused characters set to 0*	*None*

Model

The module's model Type

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2812	*Int*	*Read*	*None*	*DOU18*	*3*	*None*

Serial Number

The module's Serial Number

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2813	*Long*	*Read*	*None*	*8 Digits*	*None*

MAC Address

The module's Ethernet port MAC Address

Hexadecimal format with each register holding 4 digits,
Register read as (Upper Byte << 8 | Lower Byte << 0)

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2815	*3 Byte Hex*	*Read*	*None*	*XX-XX-XX-XX-XX-XX*	*None*

Unlock

Modbus

The DXU18 series features optional functions which when purchased will expand the module's capabilities. By default, the Modbus function of the DXU18 is locked. it can be unlocked by LTH or your local distributor at the time of order.

Alternatively, the Modbus function may be ordered after purchase by supplying LTH or your local distributor the serial number of your module along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the module and the required function to be unlocked.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
App Only					

Firmware

Module Firmware Version

The module's main firmware version number.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2821	*Long*	*Read*	*None*	*Format: AA.BB.CC* *Read as: AA << 16 | BB <<8 | CC << 0*	*None*

Measurement Firmware Version

The module's measurement section firmware version number.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2823	*Long*	*Read*	*None*	*Format: AA.BB.CC* *Read as: AA << 16 | BB <<8 | CC << 0*	*None*

Bluetooth Firmware Version

The module's Bluetooth section firmware version number.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2825	*Long*	*Read*	*None*	*Format: AA.BB.CC* *Read as: AA << 16 | BB <<8 | CC << 0*	*None*

Update Module Firmware

Update the Module's main firmware.

When selected the app gives the user the option of using either the firmware bundled with the LTH Discover app or alternatively using a different version of firmware that LTH may have provided separately by browsing to the firmware "*.bin" file location on the phone. Note, when using iOS, the file must be located in the LTH Discover folder as found in the On My iPhone folder.

Note, Updating the firmware may take up to 5 minutes to complete, during which the device uploading the firmware must remain connected to the module via Bluetooth by staying within range of the module and with the LTH Discover app open.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Modbus

The DOU18 features an optional Modbus interface via either RTU or ASCII over RS-485 or RCP/IP over Ethernet. Using the interface the module's measurements can be read, status checked, configurations changed, and calibrations performed.

Note, by default the Modbus functionality is locked, and requires an additional purchase to unlock. This can be done at the time of ordering the module or alternatively may be ordered after purchase by supplying LTH or your local distributor the serial number of your module along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the module.

Supported Modbus Function Codes

Function Code	Type	Function
3	Read Holding Register	Reads one or more registers. 1 to a maximum of 125 consecutive registers (1 register = 2 bytes) can be read with a telegram.
6	Write Single Register	Write a single register with a new value. ! Note. Registers whose address space consume more than one register i.e. Floats, cannot be set using this function code.
16	Write Multiple Registers	Writes several registers with a new value. A maximum of 120 consecutive registers can be written with a single telegram.

! Maximum number of writes - If a non-volatile parameter is modified via the Modbus this change is saved in the internal module storage. The number of writes to the storage is technically restricted to a maximum of 1 million. Attention must be paid to this limit since, if exceeded, it results in data loss and module failure. For this reason, avoid constantly writing module parameters via the Modbus.

Response Times - The time it takes the module to respond to a request telegram from the Modbus master is typically 25 to 50 milliseconds. It may take longer for a command to be executed in the module. Thus, the data is not updated until the command has been executed. Write commands especially are affected by this.

Data types - the following data types are supported by the module:

• **FLOAT** – Floating point numbers IEE 754, Data length 4 bytes (2 registers)

Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM

S = Sign, E = Exponent, M = Mantissa

• **INT** – Integer (16 bits), Data length 2 bytes (1 register)

Byte 1	Byte 0
Most Significant Bit (MSB)	Least Significant Bit (LSB)

• **LONG** – Long Integer (32 bits), Data length 4 bytes (2 registers)

Byte 3	Byte 2	Byte 1	Byte 0
Most Significant Bit (MSB)	…	…	Least Significant Bit (LSB)

Byte Transmission Sequence – The bytes are transmitted in the following data order:

Type	Sequence			
	1st	2nd	3rd	4th
FLOAT (Big Endian)	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)
INT	Byte 1 (MSB)	Byte 0 (LSB)		
LONG (Big Endian)	Byte 3 (MSB)	Byte 2	Byte 1	Byte 0 (LSB)

Operation

Mode

Set the operation mode of the Modbus interface, note the RS485 and Ethernet interfaces cannot both be used at the same time.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2901	*Int*	*Read / Write*	*None*	*Disabled*	*0*	*None*
				RS485 RTU	*1*	*None*
				RS485 ASCII	*2*	*None*
				Ethernet TCP/IP	*3*	*None*

Slave Address

Set the slave address of the Module when using the RS485 interface.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2902	*Int*	*Read / Write*	*Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)*	*1-255*	*None*

Interface

Baud Rate

Set the RS485 interface baud rate.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2903	*Int*	*Read / Write*	*Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)*	*300*	*0*	*None*
				600	*1*	*None*
				1200	*2*	*None*
				2400	*3*	*None*
				4800	*4*	*None*
				9600	*5*	*None*

				19200	6	None
				31250	7	None
				38400	8	None

Parity

Set the parity format of the RS485 interface.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2904	Int	Read / Write	Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)	None	0	None
				Odd	1	None
				Even	2	None

Stop Bits

Set the number of stop bits used by the RS485 interface.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2905	Int	Read / Write	Mode (2901) set to either RS485 RTU (1) or RS485 ASCII (2)	1	0	None
				2	1	None

Use DHCP

If available on the connected network use the DHCP server to automatically configure the TCP/IP interface. Note, if required the module's MAC address can be found in the configuration menu.

Register/s	Type	Access	Condition/s	Option	Value	Condition/s
2906	Int	Read / Write	Mode (2901) set to Ethernet TCP/IP (3)	No	0	None
				Yes	1	None

TCP/IP Address

If not using DHCP, specify the Module's own TCP/IP address.

If using DHCP this menu will display the DHCP assigned Gateway Address.

Register/s	Type	Access	Condition/s	Value Limits	Units
2907 (DHCP Disabled)	Long	Read / Write	Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)	Format: AAA.BBB.CCC.DDD Equal to:	None

2909 (DHCP Enabled)		*Read*	*Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)*	*AAA << 0 | BBB <<8 | CCC <<16 | DDD<<24 Each element 0-255*	

Gateway Address

If not using DHCP, specify the Gateway Address on the IP network the module is connected to. Note, if no Gateway is present the Address can be set to 0.0.0.0.

If using DHCP this menu will display the DHCP assigned Gateway Address.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2911 (DHCP Disabled)	*Long*	*Read / Write*	*Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)*	*Format: AAA.BBB.CCC.DDD Equal to: AAA << 0 | BBB <<8 | CCC <<16 | DDD<<24 Each element 0-255*	*None*
2913 (DHCP Enabled)		*Read*	*Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)*		

Subnet Mask

If not using DHCP, specify the Subnet Mask of the IP network the module is connected to.

If using DHCP this menu will display the DHCP assigned Subnet Mask.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2915 (DHCP Disabled)	*Long*	*Read / Write*	*Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)*	*Format: AAA.BBB.CCC.DDD Equal to: AAA << 0 | BBB <<8 | CCC <<16 | DDD<<24 Each element 0-255*	*None*
2917 (DHCP Enabled)		*Read*	*Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)*		

Port Number

Specify the TCP port the Modbus communication utilises.

Unless already in use by a different process, recommend leaving as the Modbus standard port of 502.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2919	*Int*	*Read / Write*	*Mode (2901) set to Ethernet TCP/IP (3)*	*1-65535*	*None*

Save, Restore & Reset

The DOU18 features the ability to save and restore the current configuration of the module to one of two stores "A and B". In addition, using the LTH Discover app the user can save the configuration of the module to the phone which can then be used to setup additional modules or emailed to LTH or your local distributer to help with support issues.

The save and restore menu also features the ability to reset the whole module back to its factory settings.

Stores

Save

Save the configuration of the module to one of the internal module stores A or B.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A:3101 *B:3110*	*Int*	*Read / Write*	*None*	*Done*	*0*	*None*
				Perform Save *Note, returns to 0 once complete*	*1*	*None*

Save Present

Indicates if either of the internal module stores A or B has an existing save stored in them.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A:3102 *B:3111*	*Int*	*Read*	*None*	*No save present*	*0*	*None*
				Save Present	*1*	*None*

Store Time and Date

The time and date of the internal module store. Returns 0 if no store present.

Hour

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
A:3103 *B:3112*	*Int*	*Read*	*None*	*0-23*	*Hour*

Minute

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
A:3104 *B:3113*	*Int*	*Read*	*None*	*0-59*	*Minute*

Day					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
A:3105 *B:3114*	*Int*	*Read*	*None*	*1-31*	*Day*
Month					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
A:3106 *B:3115*	*Int*	*Read*	*None*	*1-12*	*Month*
Year					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
A:3107 *B:3116*	*Int*	*Read*	*None*	*2000-3000*	*Year*

Restore

Restore the module configuration from one of the internal module stores.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
A:3108 *B:3117*	*Int*	*Read*	*None*	*Done*	*0*	*None*
				Perform Restore *Note, returns to 0 once complete*	*1*	*None*

Delete

Delete the module configuration from one of the internal module stores.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
A:3109 *B:3118*	*Int*	*Read*	*None*	*Done*	*0*	*None*
				Perform Delete *Note, returns to 0 once complete*	*1*	*None*

Phone – Upload to Module

Upload a module configuration saved as a .json file from the phone to the module.

Note, when using iOS, the file must be located in the *LTH Discover* folder as found in the *On My iPhone* folder.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
App Only						

Phone – Download from Module

Download the module configuration as a .json file from the module to the phone.

Note, when using iOS, the downloaded file will be located in the *LTH Discover* folder as found in the *On My iPhone* folder.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Default

Module

Reset the module to back to its factory settings.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3100	*Int*	*Read / Write*	*None*	*Done*	*0*	*None*
				Perform Reset *Note, returns to 0 once complete*	*1*	*None*

Errors

The DOU18 features an extensive error system that constantly monitors the condition of the base module, the sensor inputs, and the current outputs. When an error occurs, the module will indicate via the status LED on the enclosure front. Additionally, if configured the current outputs will change to their error state, and the digital output will energise.

When using the *LTH Discover* app, a full break down of currently active errors can be seen in the Error menu which is accessible via the main menu or by clicking on the error icon, if present, in the top left of the measurement screen. Whilst in the error menu, clicking on any of the active errors brings up a detailed description of the error and suggested remedies for the issue.

Additional guidance to fixing faults can be found in the Fault Finding section from page 92.

Module Errors

E01: Read/Write Error

Try switching the module off and then on again. If the message persists, consult with your supplier, as this module may require to be returned for repair.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3200 Bit 1	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E02: Data Error

The module configuration has for some reason become corrupted. Try switching the module off and then on again. If the message persists use the Default Module function in the Save/Restore menu or consult with your supplier, as this module may require to be returned for repair.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3200 Bit 2	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E03: Storage Error

The save setup configuration has for some reason become corrupted. Try switching the module 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 module may require to be returned for repair.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3200 Bit 3	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E04: Factory Error

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3200 Bit 4	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E05: User Cal Error

The module's user calibration has for some reason become corrupted. Try switching the module off and then on again. If the message persists use the Default module function in the Save/Restore menu or consult with your supplier, as this module may require to be returned for repair.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3200 Bit 5	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

Sensor Input Errors

E23: Sensor Over Range

The sensor reading is greater than the configured operating range, check channel settings, sensor condition and connections. If the message persists, please consult with your supplier.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3202 Bit 3	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E24: Sensor Under Range

The sensor reading is less than the configured operating range, check channel settings, sensor condition and connections. If the message persists, please consult with your supplier.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3202 Bit 4	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E25: Sensor Removed

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3202 Bit 5	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E26: Sensor Communication

There is a communication error with the optical probe. Try switching the module off and then on again. If the message persists, consult with your supplier.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3202 Bit 5	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E27: Incompatible Sensor

The connected probe is incompatible with this module. Try switching the module off and then on again. If the message persists, consult with your supplier.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3202 Bit 5	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E31: Temperature Over Range

The temperature reading is greater than the configured operating range, check channel settings, sensor condition and connections. If the message persists, please consult with your supplier.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3203 Bit 1	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E32: Temperature Under Range

The temperature reading is less than the configured operating range, check channel settings, sensor condition and connections. If the message persists, please consult with your supplier.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
3203 Bit 2	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

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.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3206 Bit 1 *B: 3207 Bit 1*	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E62: Source < Output A Zero
E72: Source < Output B Zero

The source's input level is less than that set for the current output zero.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3206 Bit 2 *B: 3207 Bit 2*	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E63: Source > Output A Span
E73: Source > Output B Span

The source's input level is greater than that set for the current output span.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3206 Bit 3 *B: 3207 Bit 3*	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E64: Source > Output A Zero
E74: Source > Output B Zero

The source's input level is greater than that set for the current output zero.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3206 Bit 4 *B: 3207 Bit 4*	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

E65: Source < Output A Span
E75: Source < Output B Span

The source's input level is less than that set for the current output span.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3206 Bit 5 *B: 3207 Bit 5*	*Int*	*Read*	*None*	*Error Not Present*	*0*	*None*
				Error Present	*1*	*None*

Service Messages

M81: Service Due

The Planned Service interval for this module 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, Email: sales@lth.co.uk

NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3208 Bit 1	*Int*	*Read*	*None*	*Message Not Present*	*0*	*None*
				Message Present	*1*	*None*

M82: Calibration Due

The time since the last calibration was performed has exceeded the time set in the calibration menu.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3208 Bit 2	*Int*	*Read*	*None*	*Message Not Present*	*0*	*None*
				Message Present	*1*	*None*

Sensor Messages

M100: LED Temperature Exceeded

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3209 Bit 0	*Int*	*Read*	*None*	*Message Not Present*	*0*	*None*
				Message Present	*1*	*None*

M101: CIP Temperature Exceeded

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

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3209 Bit 1	*Int*	*Read*	*None*	*Message Not Present*	*0*	*None*
				Message Present	*1*	*None*

M102: SIP Temperature Exceeded

The optical probe's temperature has exceeded the Steam In Place operating temperature (default 100°C). The probe is now turned off. Readings will return once the probe's temperature has fallen below the LED activation temperature.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
A: 3209 Bit 2	*Int*	*Read*	*None*	*Message Not Present*	*0*	*None*
				Message Present	*1*	*None*

Service

The DOU18 features a service reminder system that will inform the user when the module is due its service.

Reminder

Enabled

Set's whether the service reminder is enabled or not.

Requires service security code prior to use.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Interval

Specify the number of days between servicing.

Requires service security code prior to use.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
App Only					

Date

The date of the next service reminder.

Requires service security code prior to use.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
App Only					

Update

Set the next service date to the current date plus the number of interval days.

Requires service security code prior to use.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Defer

Once the service alarm has occurred, allows the user to temporarily disable the alarm for 7 days whilst they arrange for a service visit.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
App Only						

Appendix A – Do Measurement

Probe Interface

The output signal from a Dissolved Oxygen probe 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 probe will be of the order of hundreds of micro-amps (10^{-6} Amps), whereas the output from a Polarographic probe will be of the order of hundreds of nano-amps (10^{-9} Amps).

In addition, Polarographic probes require a bias voltage to be applied between the cathode and anode of the dissolved oxygen 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:

$$Pc = \frac{Po - P_{vapor(To)}}{P - P_{vapor(T)}}$$

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 probe 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 measurement when an accurate reading is required. For systems where active 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 DOU18.

Temperature (°C)	PT1000 RTD	BJ22K Thermistor
0	1000.0Ω	64.88 kΩ
10	1039.0Ω	41.34 kΩ
20	1077.9Ω	26.97 kΩ
25	1097.3Ω	22.00 kΩ
30	1116.7Ω	18.03 kΩ
40	1155.4Ω	12.30 kΩ
50	1194.0Ω	8.57 kΩ
60	1232.4Ω	6.07 kΩ
70	1270.7Ω	4.38 kΩ
80	1308.9Ω	3.21 kΩ
90	1347.0Ω	2.39 kΩ
100	1385.0Ω	1.80 kΩ

Appendix C – Radio Declarations

United States (FCC)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canada (ISED)

This device complies with Industry Canada license exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Transmitter Antenna (from Section 7.1.2 RSS-Gen, Issue 3, December 2010): User manuals for transmitters shall display the following notice in a conspicuous location: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Fault Finding

The DOU18 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 in the Errors section on page 79 gives a list that the DOU18 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 module.
- 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.
- Digital Output configuration.
- Digital Input 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 DC, check the power supply voltage at the connector. The design of the DOU18 allows the unit to accept from 12 to 30V DC. 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 Probe 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 probe.
- 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 temperature compensation, ensure that the correct values have been entered.
- If using a probe with a detachable cable. Check to see if probe connector pins are covered with liquid or dirt. If the connector appears clean, try a new cable or a different probe.
- Possible faulty cable or junction boxes. Check the cable with a multimeter for any open or short circuits.

The Amperometric Probe Output Is Incorrect
- Ensure that the probe and temperature input is correctly connected (see Installation section) and that the probe is not faulty or damaged.
- Check that the probe type, bias voltage and membrane correction factor have been set correctly in the module.

- Ensure all sensor protective caps have been removed.
- If using manual temperature compensation, ensure that the correct values have been entered.
- Ensure the correct pressure and salinity compensation values has been entered.
- Possible faulty probe connector. Check to see if probe connector pins are covered with liquid or dirt. If the connector appears clean, try a new cable or a different probe.
- 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 90.

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 37).
- 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 manufactured by LTH Electronics Ltd 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 Electronics Ltd are thoroughly tested to their published specification before despatch. As LTH have 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 to the factory 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.

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