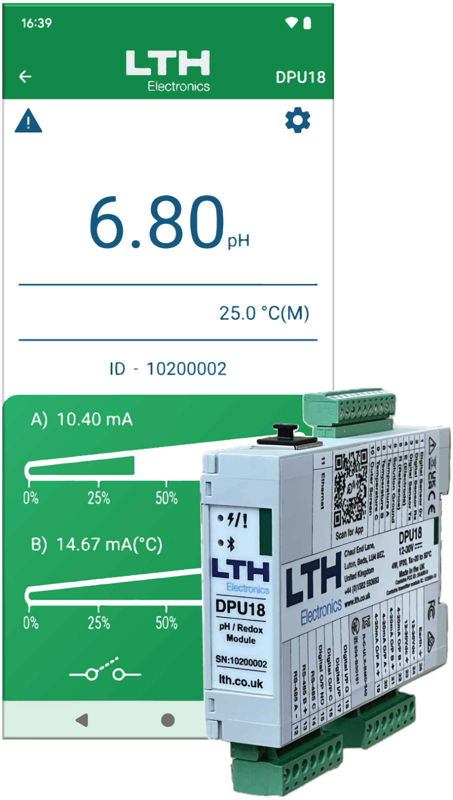
DPU18

pH / Redox
Measurement Module
& LTH Discover App


16:39
LTH Electronics
DPU18
6.80 pH
25.0 °C(M)
ID - 10200002
A) 10.40 mA
0%
25%
50%
B) 14.67 mA(°C)
0%
25%
50%
LTH Electronics
DPU18
pH / Redox Module
SN:10200002
lth.co.uk
Scan for App

Operation Guide

Preface

Product warranty

The DPU18 pH / Redox 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.

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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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Second edition: February 2026

LTH Electronics Ltd
Chaul End Lane
Luton
Bedfordshire
LU4 8EZ
England

Telephone : +44 (0)1582 593693
Email : sales@lth.co.uk
Web : www.lth.co.uk

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

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Luton
Bedfordshire
LU4 8EZ
United Kingdom

We,	**LTH Electronics Ltd** declare under our sole responsibility that the produce / products
Product identification	**DPU18**

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
Luton
Bedfordshire
LU4 8EZ
United Kingdom

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	**DPU18**

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**
Place and date of issue / Ausstellungort, -datum / Lieu et date d’émission	**Luton, 07th May 2025** **Neil Adams** Managing Director

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Introduction

The DPU18 is a microprocessor-controlled pH and Redox (ORP) measurement DIN rail mounted module that can be used with a wide range of Single ended or differential electrodes to measure and control a broad spectrum of solution pH or Redox. The module is powered from 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.

DPU18 Specification

Measurement Input	Single ended or differential with solution ground. **pH** Separate glass and reference electrode pair. Combination electrode. **Redox (ORP)** Separate glass and reference electrode pair. Combination electrode. Other manufacturer’s sensors can be accommodated.
Connection Cable	Up to 30 meters (no preamp required) LTH type 54E or LN10 cable
Ranges of Measurement	0.00 to 14.00 pH -1999mV to +1999mV.
Accuracy	± 0.05 pH. ± 3mV.
Linearity	± 0.1% of range.
Repeatability	± 0.1% of range.
Ambient Temperature Variation	±0.05% of range / °C (typical)
Operator Adjustment	Anywhere within current measurement range.
Calibration Methods	Automatic two-point 4pH, 7pH or 9pH buffer calibration with multiple industry standard buffers supported. Alternatively, 13-point custom buffers can be directly entered into module. Manual Slope and Offset Adjustment. Direct Calibration Tag Slope entry with further One-point Offset Calibration for pre-defined electrodes. All methods feature post-calibration electrode condition indication
Calibration Timer	Inbuilt calibration countdown timer which will trigger an alarm when the set calibration interval has expired.
Sensor Input Filter	Adjustable filter that averages the sensor input over a user selectable time (10sec – 5mins).
Temperature Sensor	Pt1000, Pt100 or 3K Balco 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 3 wire PT1000)
Operator Adjustment (Temperature)	Anywhere within range of temperature measurement.
Range of Temperature Compensation	-20 °C to +150 °C (-4 °F to +302 °F)

Temperature Compensation Type	Automatic or manual.
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:

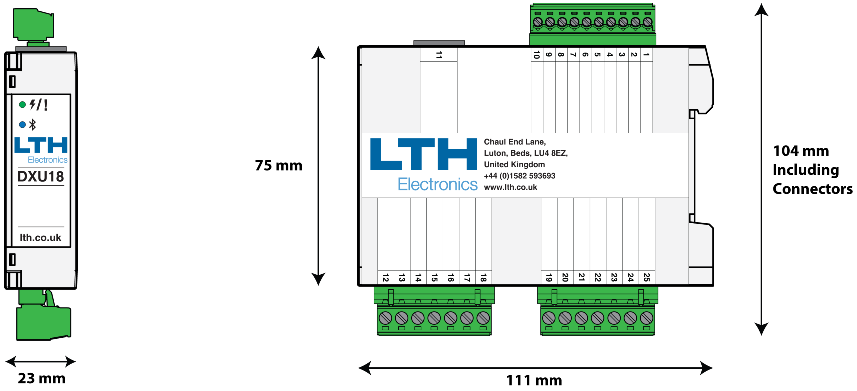
- Fit arc suppressors across active relay or contactor contacts in the vicinity.

- 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.

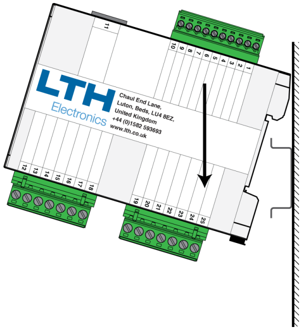
Enclosure


DXU18
lth.co.uk
23 mm
75 mm
111 mm
104 mm
Including
Connectors
Chaul End Lane,
Luton, Beds, LU4 8EZ,
United Kingdom
+44 (0)1582 593693
www.lth.co.uk

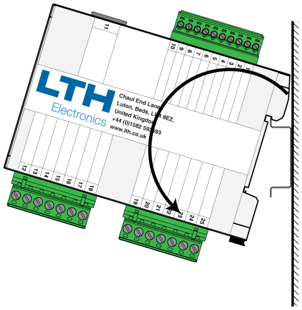
DPU18 Overall Dimensions

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

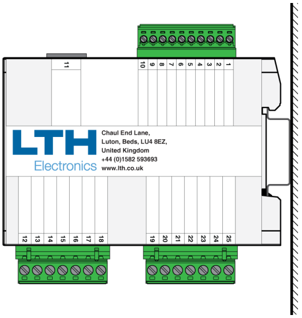
It should be attached to the rail by following the below guide.



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



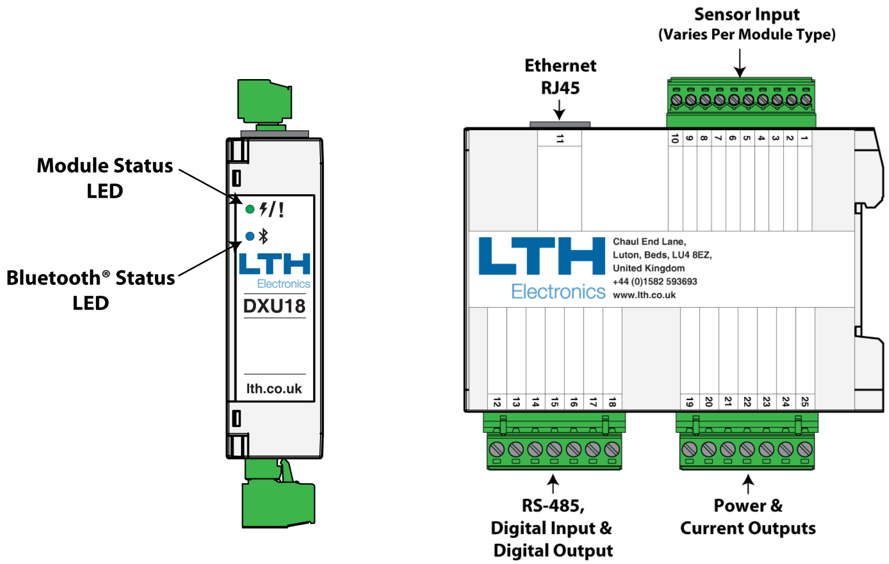
Rotate the module downwards



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


Module Status LED
Bluetooth® Status LED
ϟ/!
LTH
Electronics
DXU18
lth.co.uk
Ethernet RJ45
Sensor Input
(Varies Per Module Type)
11
10
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8
7
6
5
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2
1
LTH
Electronics
Chaul End Lane,
Luton, Beds, LU4 8EZ,
United Kingdom
+44 (0)1582 593693
www.lth.co.uk
12
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25
RS-485,
Digital Input &
Digital Output
Power &
Current Outputs

DPU18 Overview

Status LEDs

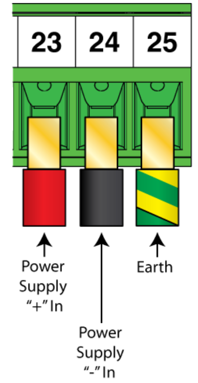
ϟ/!	Module Status LED	
○	Off	Module Unpowered
🔴	Constant Red	Module Initialising
🟢	Flashing Green	Module Running
🔴	Flashing Red	Module Error

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

DPU18 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.

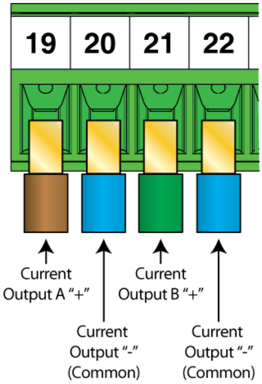

23
24
25
Power Supply "+" In
Earth
Power Supply "-" In

**12-30V DC
Power Connections**

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

Current Output Connections

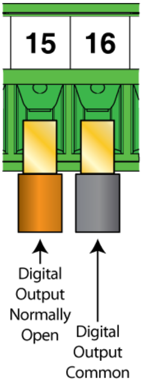
The DPU18 is supplied as standard with two current outputs, either of which can terminate into a load resistance not exceeding 750Ω and are both galvanically isolated from the rest of the module. For best noise immunity use a screened twisted pair cable, with the screen connected to Earth at one end. Use a sufficiently large cable to avoid a high resistance in the overall current loop.


19
20
21
22
Current Output A "+"
Current Output B "+"
Current Output "-" (Common)
Current Output "-" (Common)

**Current Outputs
Connection Detail**

Digital Output Connections

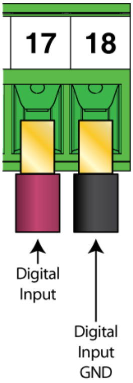
The DPU18 is supplied with a single volt free, single pole, single throw, normally open relay. Maximum switching voltage of **24v AC/DC**, maximum load **750mA**. To switch a higher voltage or load will require a slave relay.


15
16
Digital Output Normally Open
Digital Output Common

Digital Output Connection Details

Digital Input Connections

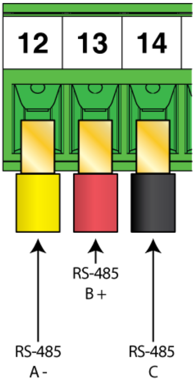
The DPU18 features a single dry contact digital input, which can be used to initiate a user configurable module operation by use of a volt free link, switch or relay. The module can be configured to initiate the appropriate action when the contact either closes or opens.


17
18
Digital Input
Digital Input GND

Digital Input Connection Details

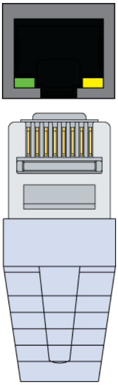
Modbus Connections

The DPU18 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 pH / Redox Electrodes

The choice of the correct type of pH / Redox electrode, 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 pH / Redox system.

The following criteria are of great importance during selection:

- The chemical makeup, temperature and the viscosity of the sample.
- The use of the correct materials for corrosion resistance.
- Position of electrode for robustness and service access.
- Ensuring a representative, uncontaminated solution sample.

The following tips might be useful. High temperature samples will restrict your choice to electrodes with high temperature references, note that low temperatures will also affect the response time of the electrode. When measuring high viscosity samples, it is important that the junction is easy to clean. Samples with high pH or salt concentrations require electrodes with alkali-resistant membranes.

To ensure correct electrode mounting the following conditions should be observed:

- The electrode system can only measure what is in the immediate vicinity of the sensor area of the probe.
- A moderate flow is maintained to provide an “up to date” sample. Excessive flow rates, however, can cause certain electrodes to rapidly deplete, which will result in inaccurate readings. In this case a sealed reference is recommended.
- Ensure that both the glass electrode and reference are in contact with the sample.
- 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 use a guard or filter to protect the glass electrode. Alternatively use a flat pH bulb.
- The glass electrode contains a liquid, ensure that the probe is mounted so that the internal filling solution is in contact with the glass bulb.

When a new pH electrode is first fitted or changed it must be calibrated (see page 32). Depending on the application it may also need periodic re-calibration, the DPU18 provides an inbuilt count down timer which will trigger an alarm when calibration interval has expired (see page 38).

Care and Maintenance of pH / Redox Electrodes

All pH and Redox electrodes contain an electrolyte solution, gel or polymer that has a limited life in both operation and on the shelf. The electrode shelf life depends on its storage conditions, it is recommended that the electrode should be used within six to twelve months after purchase.

For gel filled, non-flow electrodes the storage boot may become dried out during storage. This can result in evaporation of the water inside the electrode causing high impedance in the reference cell. If allowed to fully dry out the operation of the electrode will be irreversibly damaged. For electrodes in storage it is recommended that every three to four months the following procedure is carried out:

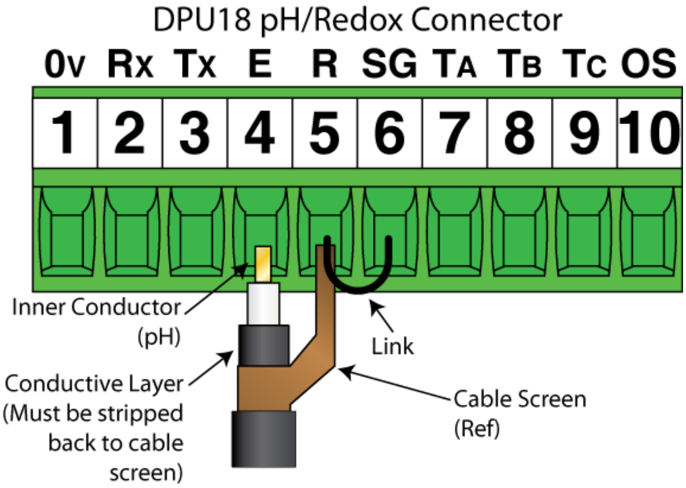
- Remove the black storage boot or transit cover at the end of the electrode
- Re-wet the fibre pack inside the storage boot with 3.8 Molar Potassium Chloride (KCl) saturated solution or if this is not available use a quantity of 4pH buffer solution. Note do not use deionised water.
- Re-seal the storage boot or transit cover.

For electrodes with soaker bottles ensure that the electrode is stored upright in the soaker bottle, and replace the bottle solution with 3.8 Molar Potassium Chloride (KCl) saturated solution approximately every 6 months.

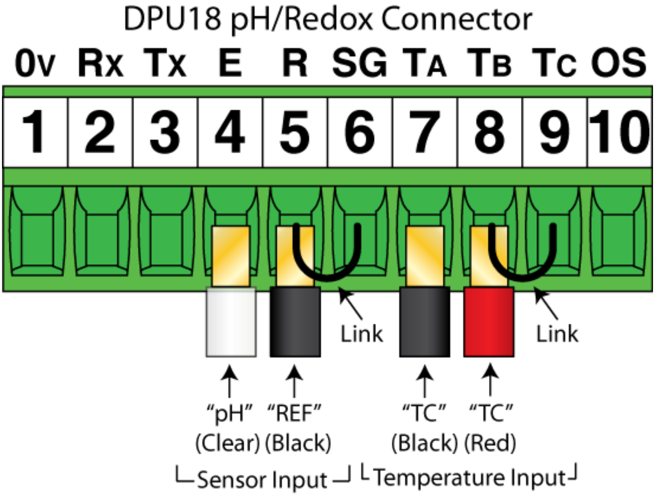
Depending on the issue the following glass body pH electrode maintenance procedures can be carried out:

- Initial Cleaning – Wash the electrode with a solution of liquid detergent and warm water by gently scrubbing with a soft tooth brush or wet tissue. Follow this by thoroughly rinsing the electrode in deionised water or clean tap water.
- Inorganic Scale Deposits – Dissolve the deposit by immersing the electrode bulb only in a solution of dilute (10%) Hydrochloric Acid for a few minutes. **Follow the supplier's data sheet when handling acids and dispose of as instructed by your local authority regulations.**
- Organic Oil or Grease Films – Wash the electrode with a solution of liquid detergent and warm water by gently scrubbing with a soft toothbrush or wet tissue. Follow this by soaking the pH electrode for between 10 and 30 minutes in a 3.8 Molar KCl solution.
- Plugged or Dry Wick – Remove contaminate with one of the above cleaning procedures. Then soak the electrode in an 80°C, 3.8 Molar KCl solution for 30 minutes. Before allowing the electrode to cool in the same solution to promote flow of internal electrolyte through the liquid junction

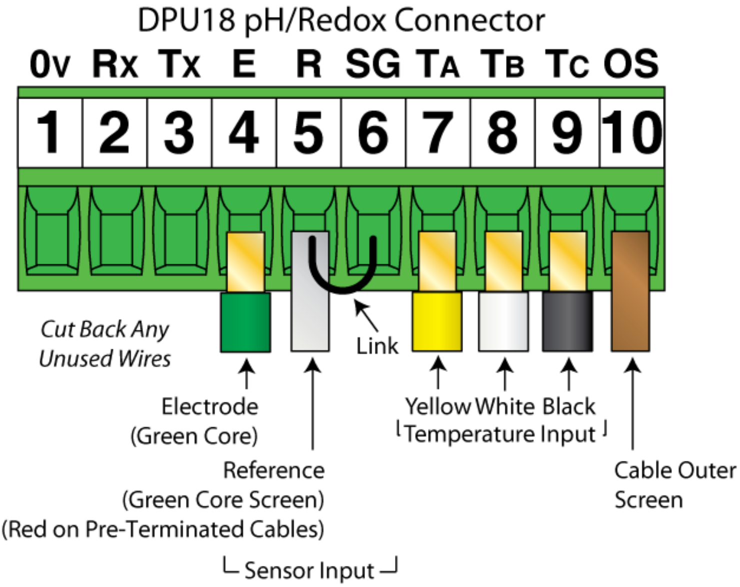
DPU18 pH / Redox Input Connection Details



pH / Redox LN10 Coax Cable Connection Details

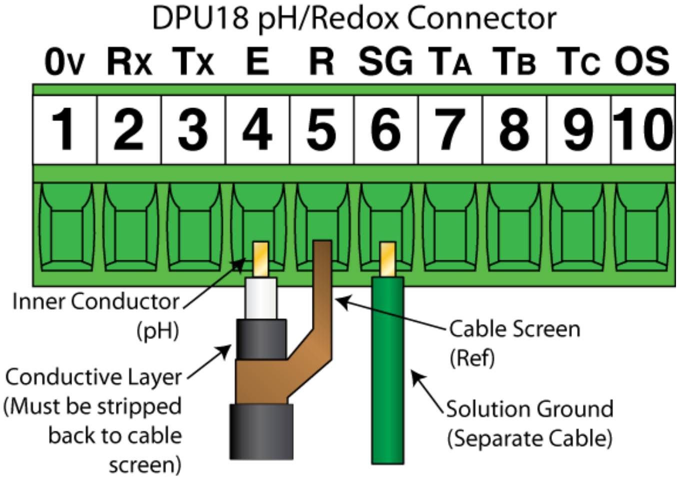

DPU18 pH/Redox Connector
0v Rx Tx E R SG TA TB TC OS
1 2 3 4 5 6 7 8 9 10
Link
Link
"pH" (Clear)
"REF" (Black)
Sensor Input
"TC" (Black)
"TC" (Red)
Temperature Input

S400 Process Probe Cable Connection Details

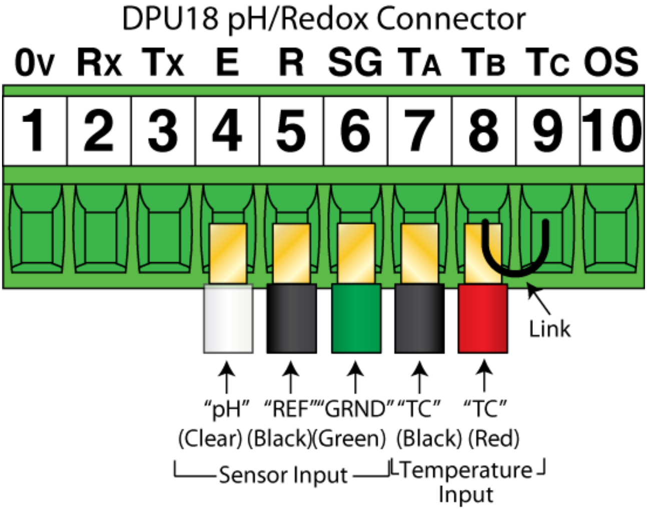

DPU18 pH/Redox Connector
0v Rx Tx E R SG TA TB TC OS
1 2 3 4 5 6 7 8 9 10
Cut Back Any Unused Wires
Link
Electrode (Green Core)
Reference (Green Core Screen) (Red on Pre-Terminated Cables)
Yellow White Black
Temperature Input
Cable Outer Screen
Sensor Input

pH / Redox 54E Extension Cable Connection Details

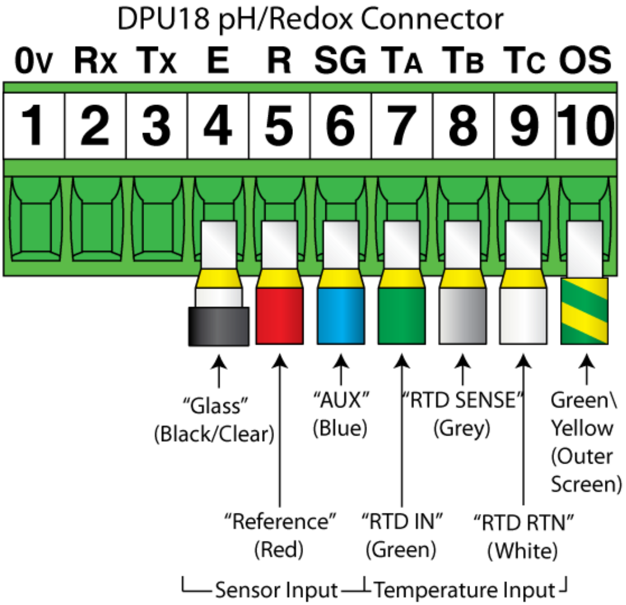
The pH / Redox input of the DPU18 also provides a differential input method of wiring the pH electrode. This provides better electrical noise immunity and allows the sensor to operate in solutions where flowing electrical currents may cause measurement problems.


DPU18 pH/Redox Connector
0v
Rx
Tx
E
R
SG
TA
TB
TC
OS
1
2
3
4
5
6
7
8
9
10
Inner Conductor (pH)
Conductive Layer (Must be stripped back to cable screen)
Cable Screen (Ref)
Solution Ground (Separate Cable)

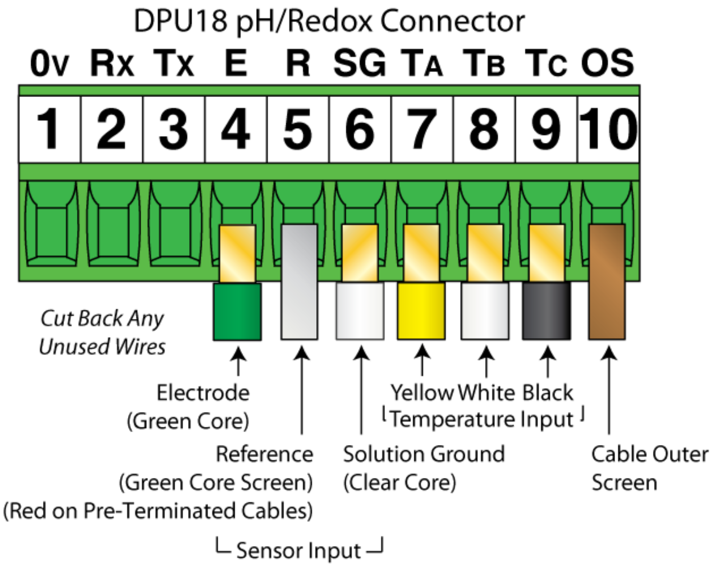
pH / Redox LN10 Coax Cable Connection Details with Separate "Solution Ground" Connection


DPU18 pH/Redox Connector
0v
Rx
Tx
E
R
SG
TA
TB
TC
OS
1
2
3
4
5
6
7
8
9
10
Link
"pH" (Clear)
"REF" (Black)
"GRND" (Green)
"TC" (Black)
"TC" (Red)
Sensor Input
Temperature Input

S400 ProcessProbe Cable Connection Details with "Solution Ground"

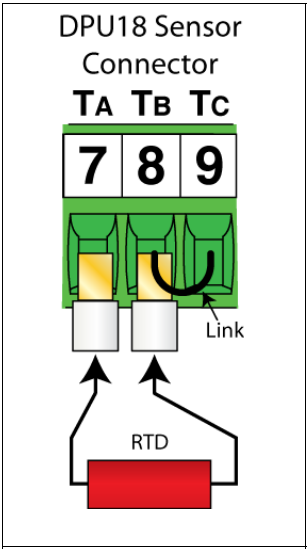

DPU18 pH/Redox Connector
0v Rx Tx E R SG TA TB TC OS
1 2 3 4 5 6 7 8 9 10
"Glass" (Black/Clear)
"AUX" (Blue)
"RTD SENSE" (Grey)
Green\ Yellow (Outer Screen)
"Reference" (Red)
"RTD IN" (Green)
"RTD RTN" (White)
Sensor Input
Temperature Input

VP6 Detachable Cable Connection Details with "Solution Ground"

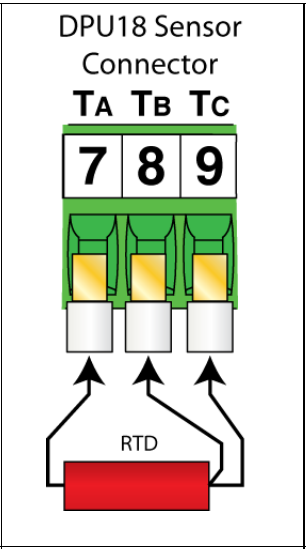

DPU18 pH/Redox Connector
0v Rx Tx E R SG TA TB TC OS
1 2 3 4 5 6 7 8 9 10
Cut Back Any Unused Wires
Electrode (Green Core)
Reference (Green Core Screen) (Red on Pre-Terminated Cables)
Solution Ground (Clear Core)
Yellow White Black
Temperature Input
Cable Outer Screen
Sensor Input

pH / Redox 54E Extension Cable Connection Details with "Solution Ground"

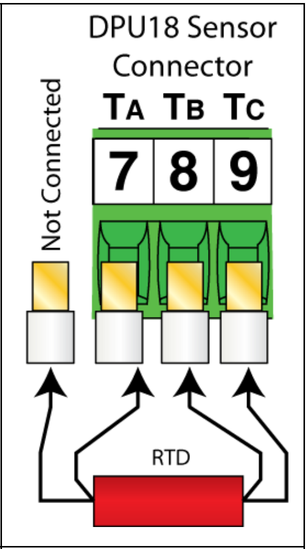
Temperature Sensor Connections


DPU18 Sensor Connector
TA TB TC
7 8 9
Link
RTD

2 Wire RTD Temperature Connection

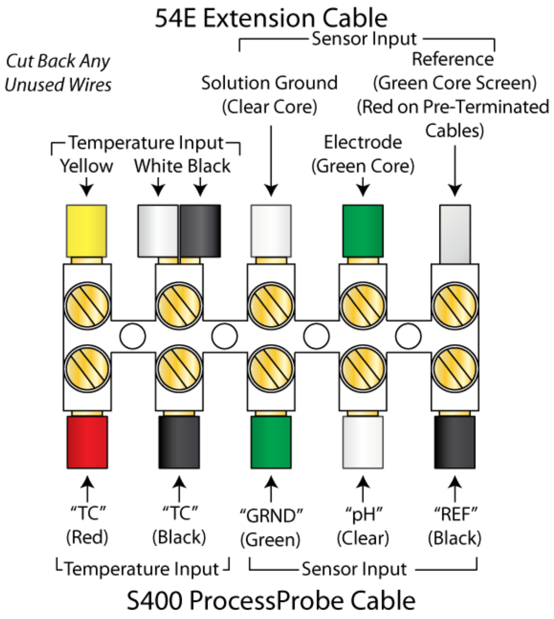

DPU18 Sensor Connector
TA TB TC
7 8 9
RTD

3 Wire RTD Temperature Connection

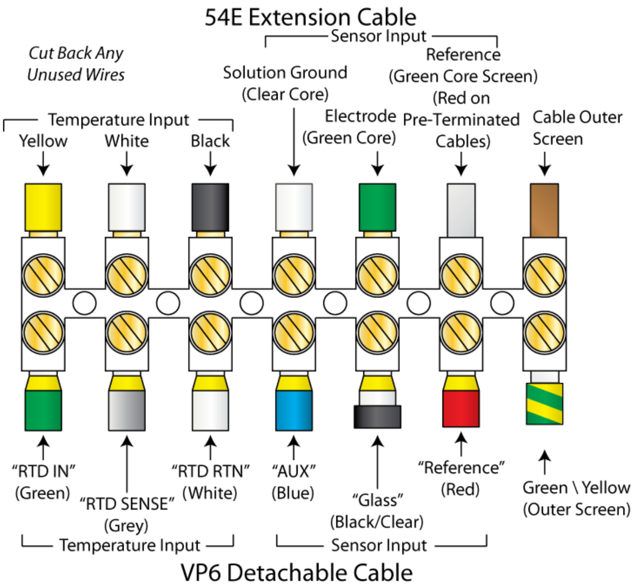

DPU18 Sensor Connector
TA TB TC
7 8 9
Not Connected
RTD

4 Wire RTD Temperature Connection

Extension Cable Connections


54E Extension Cable
Sensor Input
Reference
Cut Back Any Unused Wires
Solution Ground (Clear Core)
(Green Core Screen) (Red on Pre-Terminated Cables)
Temperature Input
Yellow
White Black
Electrode (Green Core)
"TC" (Red)
"TC" (Black)
"GRND" (Green)
"pH" (Clear)
"REF" (Black)
Temperature Input
Sensor Input
S400 ProcessProbe Cable

S400 ProcessProbe to 54E Extension Cable Connection Details


54E Extension Cable
Sensor Input
Cut Back Any Unused Wires
Solution Ground (Clear Core)
Reference (Green Core Screen) (Red on Pre-Terminated Cables)
Temperature Input
Yellow
White
Black
Electrode (Green Core)
Cable Outer Screen
"RTD IN" (Green)
"RTD SENSE" (Grey)
"RTD RTN" (White)
"AUX" (Blue)
"Glass" (Black/Clear)
"Reference" (Red)
Green \ Yellow (Outer Screen)
Temperature Input
Sensor Input
VP6 Detachable Cable

VP6 Detachable Cable to 54E 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

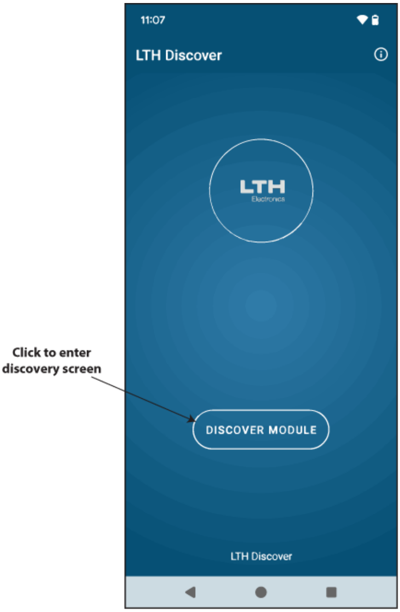
Complementing the DOU18 module is a separate mobile app, ***LTH Discover*** which can be downloaded from all major app stores.

Download on the App Store

GET IT ON Google Play

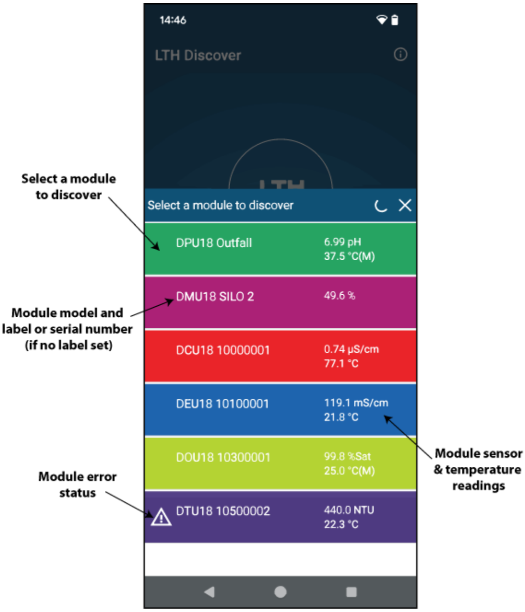
LTH Discover App

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.



Click to enter discovery screen

Opening Screen



DPU18 Outfall 6.99 pH 37.5 °C(M)
DMU18 SILO 2 49.6 %
DCU18 10000001 0.74 µS/cm 77.1 °C
DEU18 10100001 119.1 mS/cm 21.8 °C
DOU18 10300001 99.8 %Sat 25.0 °C(M)
⚠ DTU18 10500002 440.0 NTU 22.3 °C

Select a module to discover

Module model and label or serial number (if no label set)

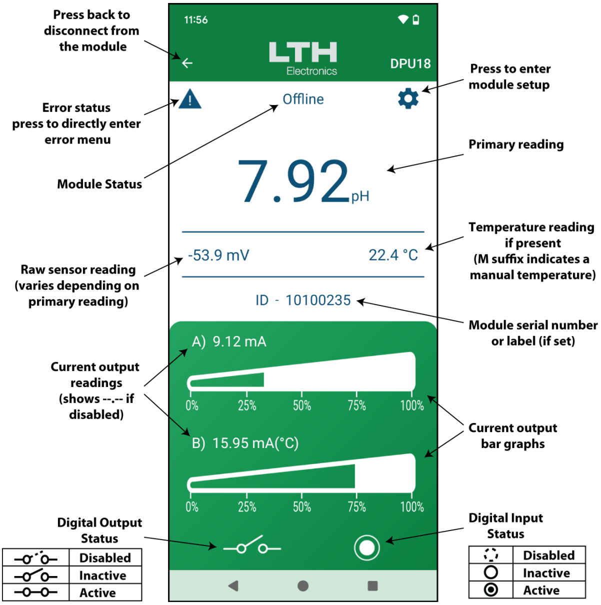
Module error status

Module sensor & temperature readings

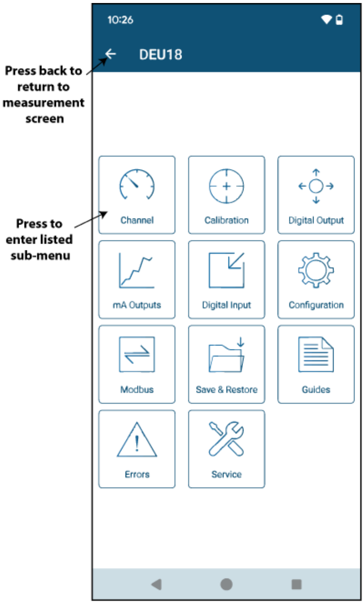
Discovery Screen

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.


Press back to disconnect from the module
Error status press to directly enter error menu
Module Status
Raw sensor reading (varies depending on primary reading)
Current output readings (shows --.-- if disabled)
Digital Output Status
Disabled
Inactive
Active
11:56
LTH Electronics
DPU18
Offline
7.92pH
-53.9 mV
22.4 °C
ID - 10100235
A) 9.12 mA
B) 15.95 mA(°C)
0% 25% 50% 75% 100%
Press to enter module setup
Primary reading
Temperature reading if present (M suffix indicates a manual temperature)
Module serial number or label (if set)
Current output bar graphs
Digital Input Status
Disabled
Inactive
Active

Measurement Screen


Press back to return to measurement screen
Press to enter listed sub-menu
10:26
DEU18
Channel
Calibration
Digital Output
mA Outputs
Digital Input
Configuration
Modbus
Save & Restore
Guides
Errors
Service

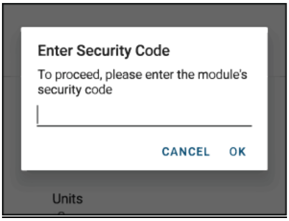
Module Setup Screen

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.


Enter Security Code

To proceed, please enter the module's security code

CANCEL
OK
Units

The default security code is 1000

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*	*pH / Redox*	*1*

Description	***Register/s***	***Type***	***Access***	***Option***	***Value***
Main Reading Status	*2001*	*Int*	*Read*	*Normal*	*0*

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*	*-1999 mV to 1999 mV*	*0*
				00.00 to 14.00 pH	*1*

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*	*-999.9 to 999.9 mV*	*0*

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*

pH / Redox (ORP) 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 as a pH or Redox input.

When "pH" is selected the module will automatically apply the correct temperature compensation to the electrodes raw mV input to provide a display of pH. Note, the module can also calculate the raw mV as a secondary value.

When "Redox (mV)" is selected the module measures the unprocessed input voltage to the electrode terminals.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2101	*Int*	*Read / Write*	*None*	*pH*	*0*	*None*
				Redox/ORP(mV)	*1*	*None*

Probe

Select the probe type.

For traditional electrodes select analog.

Hybrid pH for future use.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2136	*Int*	*Read / Write*	*None*	*Analog*	*0*	*None*
				Hybrid pH	*1*	*None*

Display mV Value

Allows the for calculation of the electrode's raw mV value in addition to the calculated pH reading when pH is set as the primary units.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2102	*Int*	*Read / Write*	*Sensor Units (2101) set to pH (0)*	*No*	*0*	*None*
				Yes	*1*	*None*

Temperature

Input

Select the module’s temperature measurement sensor type for use with the primary measurement’s automatic temperature compensation system.

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 disabled is set a manual temperature compensation value must be set.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2103	*Int*	*Read / Write*	*None*	*Disabled*	*0*	*None*
				PT100	*1*	*None*
				PT1000	*2*	*None*
				3K Balco	*3*	*None*

Units

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

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2104	*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 units set to pH.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2105	*Int*	*Read / Write*	*Sensor Units (2101) set to pH (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***
2106	*Float*	*Read / Write*	*Compensation Mode (2105) set to Manual (0)*	*-20.0 to 150.0* *Units (2104) set to °C (0)*	*°C*
				-4.0 to 302.0 *Units (2104) set to °F (1)*	*°F*

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.

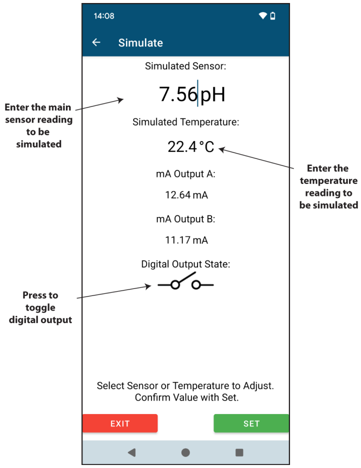
Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2119	*Int*	*Read / Write*	*None*	*Out*	*0*	*None*
				10 Seconds	*1*	*None*
				20 Seconds	*2*	*None*
				40 Seconds	*3*	*None*
				1 Minute	*4*	*None*
				3 Minute	*5*	*None*
				5 Minute	*6*	*None*

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.



14:08

Simulate

Simulated Sensor:

7.56 pH

Simulated Temperature:

22.4 °C

mA Output A:

12.64 mA

mA Output B:

11.17 mA

Digital Output State:

Select Sensor or Temperature to Adjust. Confirm Value with Set.

Enter the main sensor reading to be simulated

Enter the temperature reading to be simulated

Press to toggle digital output

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

Calibration

Calibration Procedures

Normal good practices should be observed when calibrating electrode systems against standard solutions.

- Always clean the electrode system before inserting in the standard solution to avoid contamination and to obtain the best response from the electrode system.
- Rinse the electrode system in clean (preferably demineralised) water between standard solutions.
- Allow time for the electrode system temperature to stabilise in each standard solution.
- Use standard solutions of known quality. If in doubt make up fresh solutions.
- Use clean beakers and bottles for standard solutions.
- The module can be taken offline, which de-energises the digital output and holds the current outputs at their pre-set values. This facility is useful when calibrating the system, however the operator must ensure the digital output is in a safe state when using this feature.

pH Buffers

LTH supplies buffer powders which are prepared from pure dry chemicals, sealed in a sachet or capsule which prevents the absorption of moisture and subsequent deterioration. Buffer solutions should be prepared in accordance with the instructions supplied with them.

The DPU18 offers two different but simple methods of calibration for pH electrode systems.

Auto

With the auto method, the module requests the user places the electrode in two different buffers. Then using either a selectable fixed buffer set or a user entered buffer value vs temperature lookup table, the module calculates the Offset and Slope for the electrode.

In order for the auto calibration to work correctly, the buffer temperature must either be measured by the module during calibration, or if manual temperature compensation is being used the buffer temperature must be entered in the Calibration Manual Temperature Input in the calibration menu.

Manual

In Manual calibration mode it is possible to do single or two-point calibration, using the *Buffer* and *Slope* menu items. It is important to do the calibration in the correct order.

1. Adjustment of the Buffer (Offset) value at 7.00pH
2. Adjustment of the Slope (Gain) value at any other pH (usually 4 or 9 pH).

The output from an ideal glass/reference electrode pair will normally be 0mV at 7pH, therefore the slope will have little or no effect at 7pH but increasing influence the further from 7pH the calibration point is.

If a single point calibration is required the buffer should be adjusted and no adjustment made to the slope that will remain at the previously entered value. As actual pH buffer values are used no compensation is made for the buffer solution with temperature in the module. It is important therefore to note the actual buffer value at the temperature of the solution.

Temperature has an effect on the output from the pH electrode as well, so it is important that the buffer temperature is entered into the Calibration Manual Temperature Input if manual temperature compensation is being employed. Alternatively, any automatic temperature compensation element should be placed in the buffer solution with the pH sensor if Auto TC is being used.

Redox Standards

Unlike pH electrodes, the redox electrode’s slope does not change. Nevertheless, incorrect redox potentials may be occasionally measured and the cause of these errors is usually a contaminated platinum (Pt) surface, or a contaminated or plugged reference junction. Calibration of a Redox Electrode is a single point adjustment calibration only.

For calibration and test purposes, standard solutions at various potentials can be purchased from LTH Electronics:

Part No. 138/175	124mV Redox Solution (500ml)
Part No. 138/176	358mV Redox Solution (500ml)

Calibration Menu

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

The default security access code is 1000

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*

Manual Temperature Input

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

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

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2202	*Float*	*Read / Write*	*Sensor Units (2101) set to pH (0) and Compensation Mode (2105) set to Manual (0)*	*-20.0 to 150.0* *Units (2104) set to °C (0)*	*°C*
				-4.0 to 302.0 *Units (2104) set to °F (1)*	*°F*

Sensor

Calibration Principle

This setting defines the operating mode of the pH Electrode calibration. In Manual mode the user manually adjusts the reading to match known values. In Auto Table and Auto Detection mode the module automatically adjusts the offset and slope. Whilst Cal Tag allows the user to enter the electrode's pre-defined tag span value and then perform a separate one-point buffer calibration.

Auto Detection mode requires the user to select a buffer set from a list of supported standard buffers. If the user wishes to use different buffers, select Auto Table and then enter their own buffers using the buffer table menu.

Only available when units set to pH in the channel setup menu.

See Manual pH Sensor Calibration on page 42, Auto Detection & Auto Table pH Sensor Calibration on page 47 and Cal Tag pH Sensor Calibration on page 52 for further information.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2204	*Int*	*Read / Write*	*Sensor Units (2101) set to pH (0)*	*Manual*	*0*	*None*
				Auto Table	*1*	
				Auto Detection	*2*	
				Cal Tag	*3*	

Buffer Type

Select the standard buffer set when using Auto Detection calibration principle.

The pH variance due to temperature for each of the listed buffers can be found in Appendix A – Calibration Buffer Solutions on page 86.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2205	*Int*	*Read / Write*	*Sensor Units (2101) set to pH (0) and Calibration Principle set to Auto Detection (2)*	*LTH 4.00/ 7.00/ 9.00*	*0*	*None*
				Reagecon 2.00/ 4.00/ 7.00/ 9.00/ 12.00	*1*	
				NIST Technical 1.68/ 4.00/ 7.00/ 10.01/ 12.46	*2*	
				NIST Standard 1.68/ 4.01/ 6.87/ 9.18	*3*	
				DIN 19267 1.09/ 4.65/ 6.79/ 9.23/ 12.75	*4*	

Tag Span Value

Enter the sensor span calibration value from the attached calibration tag.

Only available when calibration principle is set to Cal Tag.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2208	*Float*	*Read*	*Sensor Units (2101) set to pH (0) & Calibration Principle (2204) set to Cal Tag (3)*	*50.00 to 150.00*	*%*

pH Calibrate

Enter the pH Auto Calibration routine.

Only available when calibration principle is set to either auto table or auto detection.

See Auto Detection & Auto Table pH Sensor Calibration on page 47 for further information.

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

Buffer Offset Calibrate

Enter the pH Manual Offset Calibration Routine

Only available when calibration principle is set to manual.

See page 42 for more details.

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

One-Point Calibration

Enter the pH Cal Tag One-point calibration routine.

Only available when calibration principle is set to Cal Tag.

See Cal Tag pH Sensor Calibration on page 52 for further information.

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

Offset Value

Displays the electrode Offset currently being used by the module. Only available when units set to pH in the channel setup menu.

Cannot be edited.

Changed by either using the pH manual offset calibration, one-point calibration, or the pH auto table / auto detection calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2206	*Float*	*Read*	*Sensor Units (2101) set to pH (0)*	*-14.00 to +14.00*	*pH*

Slope Calibrate

Enter the pH Manual Slope Calibration Routine

Only available when calibration principle is set to manual.

See page 42 for more details.

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

Slope Value

Displays the electrode Slope currently being used by the module. Only available when units set to pH in the channel setup menu.

Cannot be edited.

Changed by either using the pH manual slope calibration, or by the pH auto calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2208	*Float*	*Read*	*Sensor Units (2101) set to pH (0)*	*50.00 to 150.00*	*%*

Sensor Condition

The DPU18 is capable of analysing the result of the pH electrode offset and slope calibration and indicate to the user the condition the electrode is in.

- Good – The electrode is operating within set parameters.
- Replace Soon – The electrode is getting towards the end of is operating life.
- Replace – The electrode is exhausted and should be replaced.

Cannot be edited, only available when units set to pH in the channel setup menu.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2210	*Int*	*Read*	*Sensor Units (2101) set to pH (0)*	*Good*	*0*	*None*
				Replace Soon	*1*	
				Replace	*2*	

Offset Calibrate Enter the Redox Offset Calibration Routine Only available when calibration principle is set to manual. See page 55 for more details.						
Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
App Only						

Offset Value The Redox offset value currently being applied. The value will change depending on the result of the Redox offset calibration. Cannot be edited.					
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2211	*Float*	*Read*	*Sensor Units (2101) set to Redox/ORP(mV) (1)*	*-1999 to +1999*	*mV*

Temperature

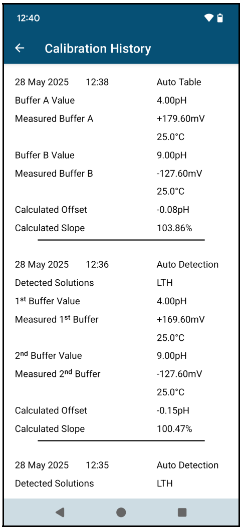
Offset - Calibrate Enter the temperature offset calibration screen. See Temperature Calibration on page 57 for further details						
Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
App Only						

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***
2213	*Float*	*Read*	*Temperature Input (2103) not set to Disabled (0)*	*-50.0 to +50.0* *Units (2104) set to °C (0)*	*°C*
				-122.0 to +122.0 *Units (2104) set to °F (1)*	*°F*

History

Records

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



28 May 2025 12:38	Auto Table
Buffer A Value	4.00pH
Measured Buffer A	+179.60mV
	25.0°C
Buffer B Value	9.00pH
Measured Buffer B	-127.60mV
	25.0°C
Calculated Offset	-0.08pH
Calculated Slope	103.86%
28 May 2025 12:36	Auto Detection
Detected Solutions	LTH
1st Buffer Value	4.00pH
Measured 1st Buffer	+169.60mV
	25.0°C
2nd Buffer Value	9.00pH
Measured 2nd Buffer	-127.60mV
	25.0°C
Calculated Offset	-0.15pH
Calculated Slope	100.47%
28 May 2025 12:35	Auto Detection
Detected Solutions	LTH

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***
2217	*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*
2218	*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*
2219	*Int*	*Read / Write*	*Reminder Set (22120 set to Yes (1)*	*1 to 31*	*Day*
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2220	*Int*	*Read / Write*	*Reminder Set (22120 set to Yes (1)*	*1 to 12*	*Month*
Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2221	*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*
2222	*Int*	*Read / Write*	*Calibration Due Set (3208 Bit 2 = 1)*	*Done*	*0*	*None*
				Defer	*1*	*None*

Buffer

If the user wishes to use buffers not listed in the buffer type menu, the buffer table menu allows them to enter the table of pH variation due to temperature for two buffers.

Table

Enter the buffer table configuration menu used by the Auto Table calibration principle.

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

Number of Points

Define the number of data points used to define the pH variation due to temperature for the used buffers.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2250	*Int*	*Read / Write*	*None*	*1-13*	*None*

Nominal Value

Set the nominal value of the two pH buffers.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
Buffer A: 2251 *Buffer B: 2253*	*Float*	*Read / Write*	*None*	*00.00 to 14.00*	*pH*

Table Entry

For each point, enter the temperature and then the equivalent pH value at the temperature for the two buffers.

Register/s			***Type***	***Access***	***Condition/s***	***Value Limits & Units***
@ Temperature	*Buffer A*	*Buffer B*	*Float*	*Read / Write*	*None*	*@ Temperature* *-20.0 to 150.0 °C Units (2104) set to °C (0)* *-4.0 to 302.0 °F Units (2104) set to °F (1)* *Buffer A & Buffer B* *00.00 to 14.00 pH*
Point 1: 2260	*Point 1: 2262*	*Point 1: 2264*				
Point 2: 2266	*Point 2: 2268*	*Point 2: 2270*				
Point 3: 2272	*Point 3: 2274*	*Point 3: 2276*				
Point 4: 2278	*Point 4: 2280*	*Point 4: 2282*				
Point 5: 2284	*Point 5: 2286*	*Point 5: 2288*				
Point 6: 2290	*Point 6: 2292*	*Point 6: 2294*				
Point 7: 2296	*Point 7: 2298*	*Point 7: 2300*				
Point 8: 2302	*Point 8: 2304*	*Point 8: 2306*				
Point 9: 2308	*Point 9: 2310*	*Point 9: 2312*				
Point 10: 2314	*Point 10: 2316*	*Point 10: 2318*				
Point 11: 2320	*Point 11: 2322*	*Point 11: 2324*				
Point 12: 2326	*Point 12: 2328*	*Point 12: 2330*				
Point 13: 2332	*Point 13: 2334*	*Point 13: 2336*				

Reset Buffer

Reset the table back to the default LTH 4.00 and 9.00pH buffers.

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

Reset

Sensor Calibration

Reset the sensor user calibration to its default state.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2223	*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***
2224	*Int*	*Read / Write*	*Temperature Input (2108) not set to Disabled (0)*	*Done*	*0*	*None*
				Reset	*1*	*None*

Manual pH Sensor Calibration

When using Manual calibration mode, it is possible to do either a single or two-point calibration. This is accomplished by using the Buffer and Slope menu items. However, it is important to do the calibration in the correct order:

1. Adjustment of the Buffer (Offset) value at 7.00 pH.
2. Adjustment of the Slope (Gain) value at any other pH (usually 4 or 9 pH).

If a single point calibration is required, then only the buffer should be adjusted and no adjustment made to the slope.

As actual pH buffer values are used no compensation is made for the buffer solution with temperature in the module. It is important therefore to know the actual buffer value at the temperature of the solution. The standard LTH 4, 7 and 9 pH values at temperature can be seen on page 86.

It is also important that the buffer temperature is entered into the Calibration Manual Temperature Input if manual temperature compensation is being employed. Alternatively, any automatic temperature compensation element should be placed in the buffer solution with the pH sensor if Auto temperature compensation mode is being used.

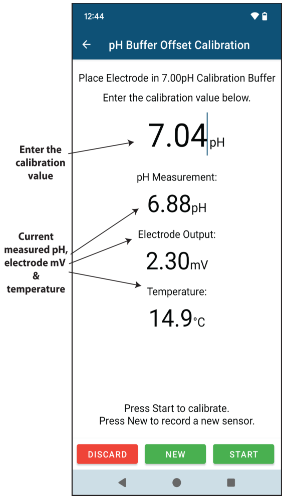
Manual Buffer Offset Calibration

Calibration method using App

With the calibration principle set to Manual, click on Buffer Offset Calibrate. Place the pH electrode in the offset buffer solution (usually 7pH) and wait for the displayed pH measurement to settle. Enter pH calibration solution value in the empty field at the top of the screen, taking into account the effect of the solution temperature on the buffer value.

Then press the Start button to begin the calibration. The module will then start sampling the electrode, if the user wishes to abandon the calibration process press the Discard button.

Once completed the module will automatically move on to the results screen to show the newly calculated offset value and resultant condition of the electrode, along with the measured electrode output and temperature at the time of calibration. If the user is happy with the result they can either press save which will save the offset value and exit back to the calibration main menu or press Slope which will the precede onto the slope calibration.



12:44

pH Buffer Offset Calibration

Place Electrode in 7.00pH Calibration Buffer

Enter the calibration value below.

7.04pH

pH Measurement:

6.88pH

Electrode Output:

2.30mV

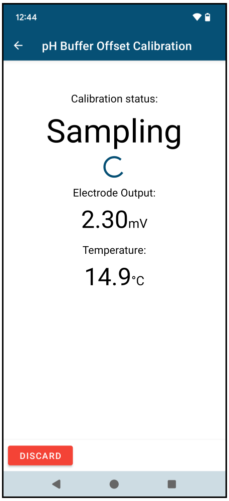
Temperature:

14.9°C

Press Start to calibrate.
Press New to record a new sensor.

Enter the calibration value
Current measured pH, electrode mV & temperature
DISCARD
NEW
START

Initial Screen



12:44

pH Buffer Offset Calibration

Calibration status:

Sampling

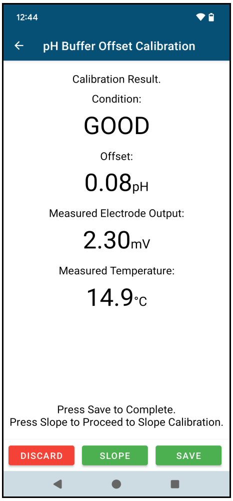
Electrode Output:

2.30mV

Temperature:

14.9°C

Sampling Screen



12:44

pH Buffer Offset Calibration

Calibration Result.

Condition:

GOOD

Offset:

0.08pH

Measured Electrode Output:

2.30mV

Measured Temperature:

14.9°C

Press Save to Complete.
Press Slope to Proceed to Slope Calibration.

Result Screen

Calibration method using Modbus

First set the *Calibration Principle (2204)* to *Manual (0)*, next set the *Buffer Offset Calibration Status (2361)* to *Calibration Mode (1)*. Place the pH electrode in the offset buffer solution (usually 7pH) and wait for the pH measurement to settle. Write the pH calibration solution value to *Buffer Offset Calibration Value (2362)*, considering the effect of the solution temperature on the buffer value, then set *Buffer Offset Calibration Status (2361)* to *Begin Calibration (2)*.

Once the sampling is complete *Buffer Offset Calibration Status (2361)* will automatically change to *Calibration Process Complete (3)*.

The newly calculated offset can be read from *Calculated Offset Value (2365)* along with the *Calibration Sensor Condition (2364), Measured Sensor Electrode Value (2367)* and *Measure Temperature Value (2239)*. If these are acceptable set *Buffer Offset Calibration Status (2361)* to *Save Calibration (4)* if not set *Buffer Offset Calibration Status (2361)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped* (*0)* to exit the calibration mode.

Buffer Offset Calibration Status

Controls the buffer offset calibration process.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2361	*Int*	*Read / Write*	*Calibration Principle (2204) set to Manual (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*

Buffer Offset Calibration Value

The buffer offset calibration value the user is simulating.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2362	*Float*	*Write*	*Sensor Units (2101) set to pH (0)*	*00.00 to 14.00*	*pH*

Calibration Sensor Condition

The calculated sensor condition after calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2364	*Int*	*Read*	*None*	*Good*	*0*	*None*
				Replace Soon	*1*	*None*
				Replace	*2*	*None*

Calculated Offset Value

The result of the calibration, note this is not applied to the module until the calibration state is set to save.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2365	*Float*	*Read*	*None*	*+/- XX.XX*	*pH*

Measured Sensor Electrode Value

The electrode output at the time of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2367	*Float*	*Read*	*None*	*+/- XXXX.X*	*mV*

Measured Temperature Value

The temperature reading at the time of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2369	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

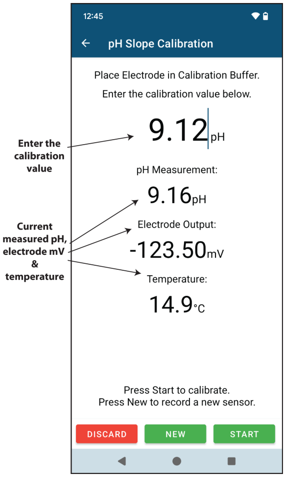
Manual Slope Calibration

Calibration method using App

With the calibration principle set to Manual, click on slope Calibrate. Place the pH electrode in the calibration buffer solution (usually 4 or 9 pH) and wait for the displayed pH measurement to settle. Enter pH calibration solution value in the empty field at the top of the screen, taking into account the effect of the solution temperature on the buffer value.

Then press the Start button to begin the calibration. The module will then start sampling the electrode, if the user wishes to abandon the calibration process press the Discard button.

Once completed the module will automatically move on to the results screen to show the newly calculated offset value and resultant condition of the electrode, along with the measured electrode output and temperature at the time of calibration. If the user is happy with the result they can either press save which will save the offset value and exit back to the calibration main menu or press Slope which will the precede onto the slope calibration.



Enter the calibration value

Current measured pH, electrode mV & temperature

pH Slope Calibration

Place Electrode in Calibration Buffer.
Enter the calibration value below.

9.12pH

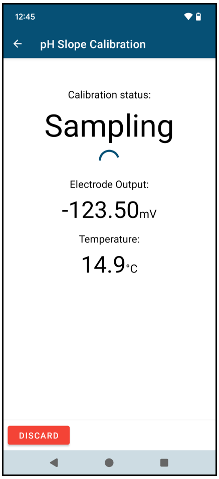
pH Measurement:
9.16pH

Electrode Output:
-123.50mV

Temperature:
14.9°C

Press Start to calibrate.
Press New to record a new sensor.

Initial Screen



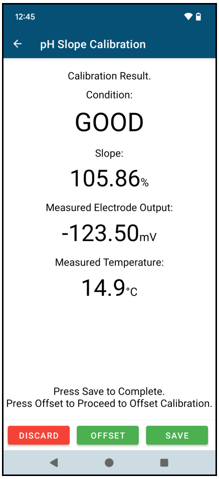
pH Slope Calibration

Calibration status:
Sampling

Electrode Output:
-123.50mV

Temperature:
14.9°C

Sampling Screen



pH Slope Calibration

Calibration Result.
Condition:
GOOD

Slope:
105.86%

Measured Electrode Output:
-123.50mV

Measured Temperature:
14.9°C

Press Save to Complete.
Press Offset to Proceed to Offset Calibration.

Result Screen

Calibration method using Modbus

First set the *Calibration Principle (2204)* to *Manual (0)*, next set the *Slope Calibration Status (2371)* to *Calibration Mode (1)*. Place the pH electrode in the calibration buffer solution (usually 4 or 9 pH) and wait for the displayed pH measurement to settle. Write the pH calibration solution value to the *Slope Calibration Value (2375)*, considering the effect of the solution temperature on the buffer value, then set *Slope Calibration Status (2371)* to *Begin Calibration (2)*.

Once the sampling is complete *Slope Calibration Status (2371)* will automatically change to *Calibration Process Complete (3)*.

The newly calculated slope can be read from *Calculated Slope Value (2375)* along with the *Calibration Sensor Condition (2374), Measured Sensor Electrode Value (2377)* and *Measure Temperature Value (2279)*. If these are acceptable set *Slope Calibration Status (2371)* to *Save Calibration (4)* if not set *Slope Calibration Status (2371)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped (0)* to exit the calibration mode.

Slope Calibration Status

Controls the slope calibration process.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2371	*Int*	*Read / Write*	*Calibration Principle (2204) set to Manual (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*

Slope Calibration Value

The slope calibration value the user is simulating.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2372	*Float*	*Write*	*Sensor Units (2101) set to pH (0)*	*00.00 to 14.00*	*pH*

Calibration Sensor Condition

The calculated sensor condition after calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2374	*Int*	*Read*	*None*	*Good*	*0*	*None*
				Replace Soon	*1*	*None*
				Replace	*2*	*None*

Calculated Slope Value

The result of the calibration, note this is not applied to the module until the calibration state is set to save.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2375	*Float*	*Read*	*None*	*XXX.XX*	*%*

Measured Sensor Electrode Value

The electrode output at the time of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2377	*Float*	*Read*	*None*	*+/- XXXX.X*	*mV*

Measured Temperature Value

The temperature reading at the time of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2379	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

Auto Detection & Auto Table pH Sensor Calibration

The Auto pH sensor calibration is a two-point offset and slope calibration, which requires the use of two pH buffer solutions.

If using Auto Detection, the module detects the buffer being used from the list of buffers set by the buffer type menu. It then uses an inbuilt table to calculate the actual buffer value due to the effect of temperature on the solution and then calculates the buffer offset and slope. A table of supported buffers and their variation due to temperature can be found in Appendix A – Calibration Buffer Solutions on page 86.

Alternatively, if the user wishes to use a buffer not listed in the buffer type menu the Auto Table method allows the user to enter the table of pH at temperature for their solutions using the buffer table menu. The guide to using buffer table can be found on page 39.

By default, the buffer table used by the auto table method comes pre-configured with the following two LTH buffers:

4pH – LTH Order Number 138/199
9pH – LTH Order Number 138/201

For the auto calibration to work correctly, the buffer temperature must either be measured by the module during calibration, or if manual temperature compensation is being used the buffer temperature must be entered in the “Manual Temperature Input” in the calibration menu.

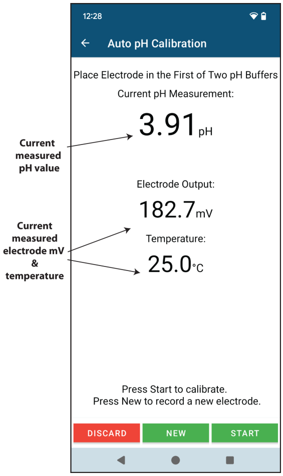
Calibration method using App

First set the calibration principle to either Auto Detection or Auto Table. If using Auto Detection and if not already done so set the buffers being used in the buffer type menu. If using Auto Table and if not already entered, enter the two buffers being used into the buffer table menu. The select pH Calibrate to enter the auto calibration menu.

If using Auto Table place the electrode in the buffer listed in the top of the screen, else if using Auto Detection, the electrode can be placed in either one of the buffers being used. Wait for the displayed pH measurement to settle and press start to begin calibration. The module will then begin sampling the senor, if the user wishes to abandon the calibration at any point press the discard button.

Once the sampling is done the app will display the measured electrode output and temperature and if using auto detection, the detected solution, for the first buffer. Press next to continue. The app will then request for the electrode to be placed in the second pH buffer. Take the electrode out of the first buffer, rinse and then place the electrode in the second buffer. Wait for the displayed pH measurement to settle and press start to begin the sampling of the second buffer.

As with the first buffer the app will display the measured electrode output and temperature and if using auto detection, the detected solution, for the second buffer. Again, press next to continue. Finally, the app will display the calculated offset and slope along with the sensor condition. If the user is happy with the result press save, else press restart to return to the initial screen, or press discard to exit.



Auto pH Calibration

Place Electrode in the First of Two pH Buffers

Current pH Measurement:

3.91 pH

Electrode Output:

182.7 mV

Temperature:

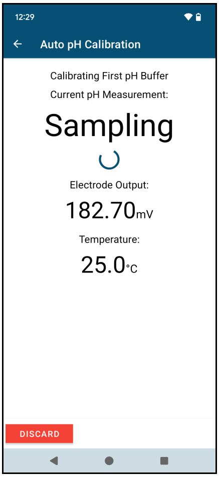
25.0 °C

Press Start to calibrate.
Press New to record a new electrode.

Current measured pH value

Current measured electrode mV & temperature

Initial Screen



Auto pH Calibration

Calibrating First pH Buffer

Current pH Measurement:

Sampling

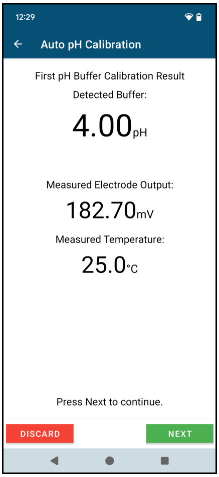
Electrode Output:

182.70 mV

Temperature:

25.0 °C

Sampling First Buffer



Auto pH Calibration

First pH Buffer Calibration Result

Detected Buffer:

4.00 pH

Measured Electrode Output:

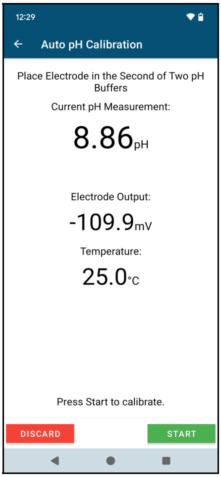
182.70 mV

Measured Temperature:

25.0 °C

Press Next to continue.

First Buffer Result



Auto pH Calibration

Place Electrode in the Second of Two pH Buffers

Current pH Measurement:

8.86 pH

Electrode Output:

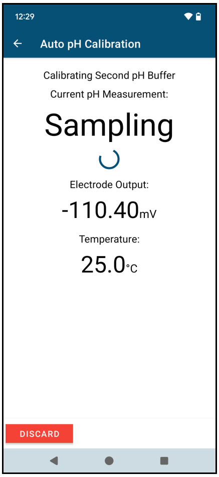
-109.9 mV

Temperature:

25.0 °C

Press Start to calibrate.

Second Buffer Screen



Auto pH Calibration

Calibrating Second pH Buffer

Current pH Measurement:

Sampling

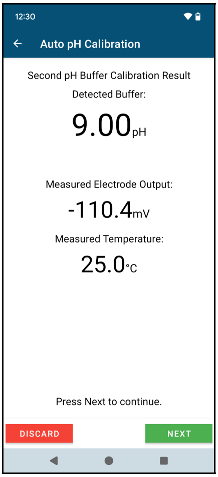
Electrode Output:

-110.40 mV

Temperature:

25.0 °C

Sampling Second Buffer



Auto pH Calibration

Second pH Buffer Calibration Result

Detected Buffer:

9.00 pH

Measured Electrode Output:

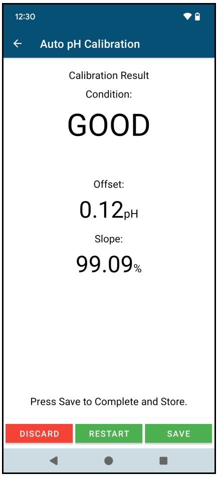
-110.4 mV

Measured Temperature:

25.0 °C

Press Next to continue.

Second Buffer Result



Auto pH Calibration

Calibration Result

Condition:

GOOD

Offset:

0.12 pH

Slope:

99.09 %

Press Save to Complete and Store.

Overall Result

Calibration method using Modbus

First set the *Calibration Principle (2204)* to either *Auto Table (1) or Auto Detection (2)*, next set the *Auto pH Calibration Status (2340)* to *Calibration Mode (1)*. If using auto table method place the pH electrode in buffer A as defined in the buffer table, else if using auto detection place the pH electrode in either of the buffers from the set as defined in the *Buffer Type (2205)* menu.

Wait for the pH measurement to settle and then set *Auto pH Calibration Status (2340)* to *Begin First Buffer Sampling (2)*. Once the first buffer sampling is complete *Auto pH Calibration Status (2340)* will automatically change to *First Buffer Sampling Complete (3)*. The *First Buffer Measured Sensor Electrode Value (2344)*, and *First Buffer Measure Temperature Value (2346)* will be updated with the sampled values along with the *Detected First Buffer Value (2357)* if using auto detection.

Now rinse the electrode and place it in the second, or b if using auto table, buffer. Again, wait for the pH measurement to settle and set *Auto pH Calibration Status (2340)* to *Begin Second Buffer Sampling (4)*.

Once the second buffer sampling is complete *Auto pH Calibration Status (2340)* will automatically change to *Second Buffer Sampling Complete (5)*. The *Second Buffer Measured Sensor Electrode Value (2348),* and *Second Buffer Measure Temperature Value (2350)* will be updated with the sampled values along with the *Detected Second Buffer Value (2359)* if using auto detection.

Also available will be the newly calculated offset and slope which can be read from *Calculated Offset Value (2353)* and *Calculated Slope Value (2355)* along with the new *Calibration Sensor Condition (2352)*. If these are acceptable set *Auto pH Calibration Status (2340)* to *Save Calibration (6)* if not set *Auto pH Calibration Status (2340)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped* (*0)* to exit the calibration mode.

Auto pH Calibration Status

Controls the slope calibration process.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2340	*Int*	*Read / Write*	*Calibration Principle (2204) set to either Auto Table (1) or Auto Detection (2)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	*None*
				Begin First Buffer Sampling	*2*	*None*
				First Buffer Sampling Complete	*3*	*None*
				Begin Second Buffer Sampling	*4*	*None*
				Second Buffer Sampling Complete	*5*	*None*
				Save Calibration	*6*	*None*

Electrode mV Output

The current electrode mV output.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2342	*Float*	*Read*	*None*	*+/- XXXX.X*	*mV*

First Buffer Measured Sensor Electrode Value

The electrode output at the time of calibrating the first buffer.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2344	*Float*	*Read*	*None*	*+/- XXXX.X*	*mV*

First Buffer Measured Temperature Value

The temperature reading at the time of calibrating the first buffer.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2346	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

Second Buffer Measured Sensor Electrode Value

The electrode output at the time of calibrating the second buffer.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2348	*Float*	*Read*	*None*	*+/- XXXX.X*	*mV*

Second Buffer Measured Temperature Value

The temperature reading at the time of calibrating the second buffer.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2350	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

Calibration Sensor Condition

The calculated sensor condition after calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2352	*Int*	*Read*	*None*	*Good*	*0*	*None*
				Replace Soon	*1*	*None*
				Replace	*2*	*None*

Calculated Offset Value

The result of the calibration, note this is not applied to the module until the calibration state is set to save.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2353	*Float*	*Read*	*None*	*+/- XX.XX*	*pH*

Calculated Slope Value

The result of the calibration, note this is not applied to the module until the calibration state is set to save.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2355	*Float*	*Read*	*None*	*XXX.XX*	*%*

Frist Buffer Detected Value

The detected value of the first buffer.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2357	*Float*	*Read*	*None*	*00.00 to 14.00*	*pH*

Second Buffer Detected Value

The detected value of the second buffer.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2359	*Float*	*Read*	*None*	*00.00 to 14.00*	*pH*

Cal Tag pH Sensor Calibration

Calibration method to support the use of pH electrodes with a pre-defined calibration span value, achieved by allowing the user to directly enter the span value thus only requiring a one-point offset calibration to be conducted before the sensor can be used.

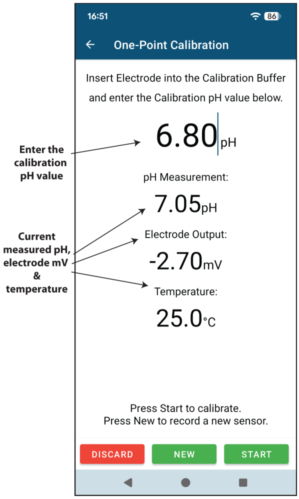
Calibration method using App

With the calibration principle set to Cal Tag, first enter the Tag Span value from the Calibration Data tag attached to the electrode, note the entered span value must be as a percentage not mV/pH.

To calibrate the electrode's offset, click on One-point calibration Calibrate. Insert the electrode into the calibration buffer and wait for the displayed pH measurement to settle. Enter the Calibration pH value from the tag into the empty filed at the top of the screen.

Then press the Start button to begin the calibration. The module will then start sampling the electrode, if the user wishes to abandon the calibration process press the Discard button.

Once completed the module will automatically move on to the results screen to show the newly calculated offset value and resultant condition of the electrode, along with the measured electrode output and temperature at the time of calibration. If the user is happy with the result, press save which will save the offset value and exit back to the calibration main menu.


16:51
86
One-Point Calibration
Enter the calibration pH value
Current measured pH, electrode mV & temperature
DISCARD
NEW
START

Insert Electrode into the Calibration Buffer and enter the Calibration pH value below.

6.80pH

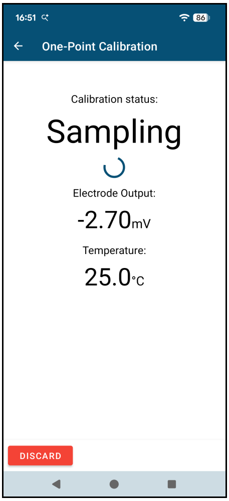
pH Measurement:
7.05pH

Electrode Output:
-2.70mV

Temperature:
25.0°C

Press Start to calibrate.
Press New to record a new sensor.

Initial Screen

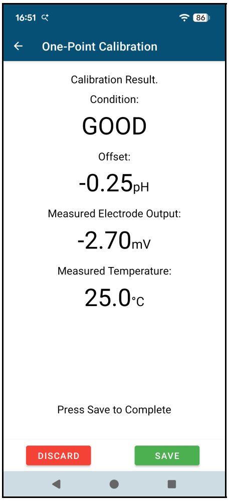


Calibration status:
Sampling

Electrode Output:
-2.70mV

Temperature:
25.0°C

Sampling Screen



Calibration Result.
Condition:
GOOD

Offset:
-0.25pH

Measured Electrode Output:
-2.70mV

Measured Temperature:
25.0°C

Press Save to Complete

Result Screen

Calibration method using Modbus

First set the *Calibration Principle (2204)* to *Cal Tag (3)* and write the sensor's span calibration value from the attached tag to *Tag Span Value (2208).*

Next set the *One-Point Calibration Status (2361)* to *Calibration Mode (1)*. Insert the electrode into the calibration buffer solution and wait for the pH measurement to settle. Write the Calibration pH as found on the sensor's calibration tag to *Calibration pH Value (2362)*, then set *One-Point Calibration Status (2361)* to *Begin Calibration (2).*

Once the sampling is complete *One-Point Calibration Status (2361)* will automatically change to *Calibration Process Complete (3).*

The newly calculated offset can be read from *Calculated Offset Value (2365)* along with the *Calibration Sensor Condition (2364)*, *Measured Sensor Electrode Value (2367)* and *Measure Temperature Value (2239)*. If these are acceptable set *One-Point Calibration Status (2361)* to *Save Calibration (4)* if not set *One-Point Calibration Status (2361)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped (0)* to exit the calibration mode.

One-Point Calibration Status

Controls the one-point calibration process.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2361	*Int*	*Read / Write*	*Calibration Principle (2204) set to Cal Tag (3)*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	*None*
				Begin Calibration	*2*	*None*
				Calibration Process Completed	*3*	*None*
				Save Calibration	*4*	*None*

Calibration pH Value

The Calibration pH value of the senor's included calibration solution, as found on the calibration tag.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2362	*Float*	*Write*	*Sensor Units (2101) set to pH (0)*	*00.00 to 14.00*	*pH*

Calibration Sensor Condition

The calculated sensor condition after calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2364	*Int*	*Read*	*None*	*Good*	*0*	*None*
				Replace Soon	*1*	*None*
				Replace	*2*	*None*

Calculated Offset Value

The result of the calibration, note this is not applied to the module until the calibration state is set to save.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2365	*Float*	*Read*	*None*	*+/- XX.XX*	*pH*

Measured Sensor Electrode Value

The electrode output at the time of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2367	*Float*	*Read*	*None*	*+/- XXXX.X*	*mV*

Measured Temperature Value

The temperature reading at the time of calibration.

Register/s	***Type***	***Access***	***Condition/s***	***Value Limits***	***Units***
2369	*Float*	*Read*	*None*	*+/- XXX.X*	*See register 2012*

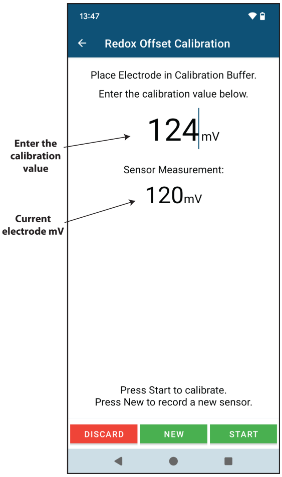
Redox Offset Calibration

The Redox Offset calibration enables the user to adjust the sensor reading to match a known input. Only available when channel units are set to Redox/ORP(mV).

Calibration method using App

Click on sensor offset – calibrate. Once in the initial screen place the sensor in the calibration buffer and wait for it to stabilise, then enter the buffer calibration value in the field at the top of the screen and press start to begin calibration.

The module will then begin sampling the 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 offset value, and the measured sensor output 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.



Place Electrode in Calibration Buffer.

Enter the calibration value below.

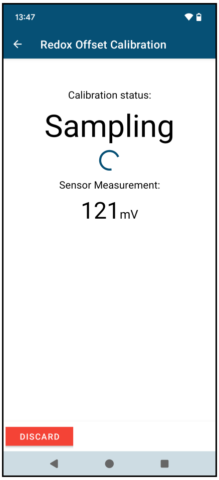
124mV

Sensor Measurement:

120mV

Press Start to calibrate.
Press New to record a new sensor.

Initial Screen



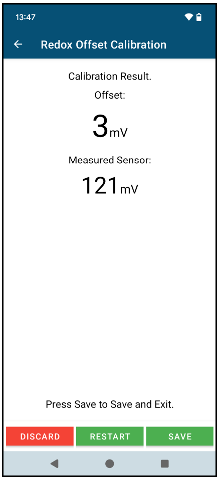
Calibration status:

Sampling

Sensor Measurement:

121mV

Sampling Screen



Calibration Result.

Offset:

3mV

Measured Sensor:

121mV

Press Save to Save and Exit.

Result Screen

Calibration method using Modbus

First set the *Redox Offset Calibration Status (2381)* to *Calibration Mode (1)*. Place the sensor in the calibration buffer and wait for it to stabilise, then write the calibration buffer value to *Redox Offset Calibration Value (2382)*.

Now to begin sampling the solution set *Redox Offset Calibration Status (2381)* to *Begin Calibration (2)*. Once the sampling is complete the *Redox Offset Calibration Status (2381)* will automatically change to *Calibration Process Completed (3)*.

The newly calculated redox offset value can be read from *Redox Offset Value (2384)* along with the *Measured Sensor Value (2386)*. If these are acceptable set *Redox Offset Calibration Status (2381)* to *Save Calibration (4)* if not set *Redox Offset Calibration Status (2381)* to either *Calibration Mode (1)* to restart the process or *Calibration Stopped (0)* to exit the calibration mode.

Redox Offset Calibration Status

Controls the calibration process.

Register/s	*Type*	*Access*	*Condition/s*	*Option*	*Value*	*Condition/s*
2381	*Int*	*Read / Write*	*None*	*Calibration Stopped*	*0*	*None*
				Set Module to Calibration Mode	*1*	
				Begin Calibration	*2*	
				Calibration Process Completed	*3*	
				Save Calibration	*4*	

Redox Offset Calibration Value

The calibration value the user is simulating.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2382	*Float*	*Write*	*None*	*+/- XXXX*	*mV*

Redox Offset Value

The result of the calibration, note this is not applied to the module until the calibration state is set to save.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2384	*Float*	*Read*	*None*	*+/- XXXX*	*mV*

Measured Sensor Value

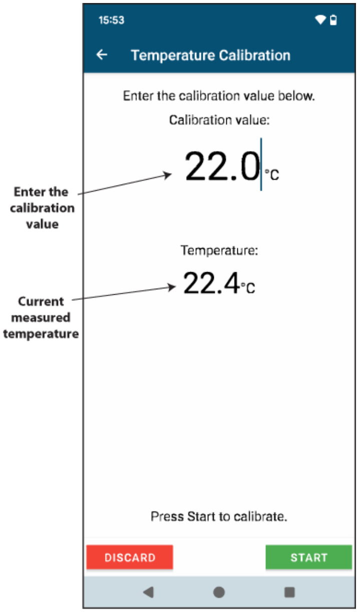
The sensor reading at the time of calibration.

Register/s	*Type*	*Access*	*Condition/s*	*Value Limits*	*Units*
2386	*Float*	*Write*	*None*	*+/- XXXX*	*mV*

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.



Enter the calibration value below.

Calibration value:

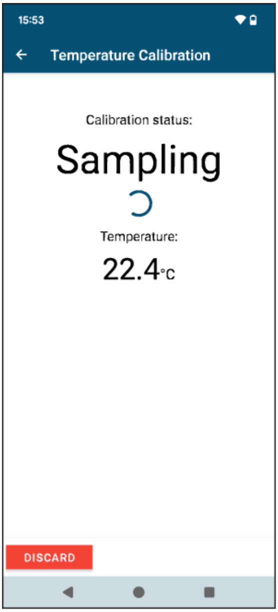
22.0°C

Temperature:

22.4°C

Press Start to calibrate.

Initial Screen



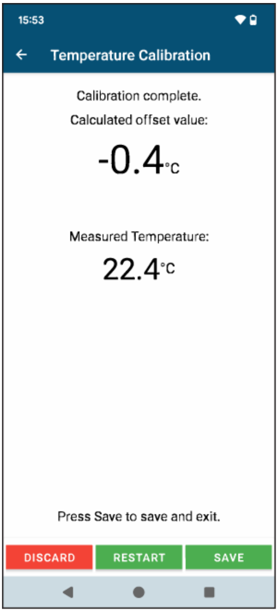
Calibration status:

Sampling

Temperature:

22.4°C

Sampling Screen



Calibration complete.

Calculated offset value:

-0.4°C

Measured Temperature:

22.4°C

Press Save to save and exit.

Result Screen

Calibration method using Modbus

First set the *Temperature Calibration Status (2388)* to *Calibration Mode (1)* and write the temperature calibration value the user is simulating to *Temperature Calibration Value (2389)*.

Now to begin sampling the temperature reading set *Temperature Calibration Status (2388)* to *Begin Calibration (2)*. Once the sampling is complete *Temperature Calibration Status (2388)* will automatically change to *Calibration Process Completed (3)*.

The newly calculated temperature offset can be read from *Calculated Temperature Offset Value (2391)* along with the *Measured Temperature Value (2393)*. If these are acceptable set *Temperature Calibration Status (2388)* to *Save Calibration (4)* if not set *Temperature Calibration Status (2388)* 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 (2388)* to *Calibration Stopped (0)*.

Temperature Calibration Status

Controls the temperature calibration process.

Register/s	***Type***	***Access***	***Condition/s***	***Option***	***Value***	***Condition/s***
2388	*Int*	*Read / Write*	*None*	*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***
2389	*Float*	*Write*	*None*	*-20.0 to 150.0* *Units (2104) set to °C (0)*	*°C*
				-4.0 to 302.0 *Units (2104) 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***
2391	*Float*	*Read*	*None*	*+/- 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***
2393	*Float*	*Read*	*None*	*-20.0 to 150.0* *Units (2104) set to °C (0)*	*°C*
				-4.0 to 302.0 *Units (2104) set to °F (1)*	*°F*

Digital Output

The DPU18 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 sensor. Note when cleaning is active the input will be taken offline, this will prevent any undesired control actions resulting from spraying cleaning solution onto the sensor.

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 sensor 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 DPU18 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 pH (0)*	*00.00 to 14.00pH*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to Redox (1)	*-1999 to +1999mV*

				If Source (A:2502, B:2602) set to Temperature (1) And Units (2104) set to °C (0)	*-20.0 to 150.0°C*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2104) 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 pH (0)*	*00.00 to 14.00pH*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to Redox (1)	*-1999 to +1999mV*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2104) set to °C (0)	*-20.0 to 150.0°C*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2104) 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 pH (0)*	*00.00 to 14.00pH*
				If Source (A:2502, B:2602) set to Sensor (0) and Units (2101) set to Redox (1)	*-1999 to +1999mV*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2104) set to °C (0)	*-20.0 to 150.0°C*
				If Source (A:2502, B:2602) set to Temperature (1) And Units (2104) 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 DPU18 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*	*DPU18*	*0*	*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 DPU18 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*

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

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.

<table>
<tr><th>Register/s</th><th>Type</th><th>Access</th><th>Condition/s</th><th>Value Limits</th><th>Units</th></tr>
<tr><td>2911
(DHCP
Disabled)</td><td rowspan="2">Long</td><td>Read / Write</td><td>Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)</td><td rowspan="2">Format:
AAA.BBB.CCC.DDD
Equal to:
AAA << 0 | BBB <<8 | CCC <<16 | DDD<<24
Each element 0-255</td><td rowspan="2">None</td></tr>
<tr><td>2913
(DHCP
Enabled)</td><td>Read</td><td>Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)</td></tr>
</table>

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.

<table>
<tr><th>Register/s</th><th>Type</th><th>Access</th><th>Condition/s</th><th>Value Limits</th><th>Units</th></tr>
<tr><td>2915
(DHCP
Disabled)</td><td rowspan="2">Long</td><td>Read / Write</td><td>Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to No (0)</td><td rowspan="2">Format:
AAA.BBB.CCC.DDD
Equal to:
AAA << 0 | BBB <<8 | CCC <<16 | DDD<<24
Each element 0-255</td><td rowspan="2">None</td></tr>
<tr><td>2917
(DHCP
Enabled)</td><td>Read</td><td>Mode (2901) set to Ethernet TCP/IP (3) and Use DHCP (2906) set to Yes (1)</td></tr>
</table>

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 DPU18 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 DPU18 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 91.

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*

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*

Service

The DPU18 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 – Calibration Buffer Solutions

The following tables list the built in pH calibration buffer solutions for use with the auto detection calibration system.

LTH 4.00pH / 7.00pH / 9.00pH Buffers

@Temperature (°C)	4.00pH Buffer (pH)	7.00pH Buffer (pH)	9.00pH Buffer (pH)
10	4.00	7.07	9.18
15	4.00	7.04	9.12
20	4.00	7.02	9.06
25	4.00	7.00	9.00
30	4.01	6.99	8.95
35	4.02	6.98	8.90
40	4.03	6.97	8.86
50	4.05	6.96	8.79
60	4.08	6.96	8.74
70	4.08	6.96	8.74
80	4.08	6.98	8.74
90	4.08	7.00	8.74

Reagecon 2.00pH / 4.00pH / 7.00pH / 9.00pH / 12.00pH

@Temperature (°C)	2.00pH Buffer (pH)	4.00pH Buffer (pH)	7.00pH Buffer (pH)	9.00pH Buffer (pH)	12.00pH Buffer (pH)
10	2.01	4.00	7.07	9.18	12.54
15	2.01	4.00	7.04	9.12	12.36
20	2.01	4.00	7.02	9.06	12.17
25	2.00	4.00	7.00	9.00	12.00
30	1.99	4.01	6.99	8.95	11.81
35	2.00	4.02	6.98	8.90	11.63
40	2.01	4.03	6.97	8.86	11.47
45	2.01	4.04	6.97	8.83	11.39
50	2.00	4.05	6.96	8.79	11.30
55	2.00	4.07	6.96	8.77	11.13
60	2.00	4.08	6.96	8.74	10.95

NIST Technical 1.68pH / 4.00pH / 7.00pH / 10.01pH / 12.46pH

@Temperature (°C)	1.68pH Buffer (pH)	4.00pH Buffer (pH)	7.00pH Buffer (pH)	10.01pH Buffer (pH)	12.46pH Buffer (pH)
0	1.67	4.00	7.12	10.32	13.42
5	1.67	4.00	7.09	10.25	13.21
10	1.67	4.00	7.06	10.18	13.01
15	1.67	4.00	7.04	10.12	12.80
20	1.68	4.00	7.02	10.06	12.64
25	1.68	4.01	7.00	10.01	12.46
30	1.68	4.02	6.99	9.97	12.30
35	1.69	4.03	6.98	9.93	12.13
40	1.69	4.03	6.98	9.89	11.99
45	1.70	4.05	6.98	9.86	11.84
50	1.71	4.06	6.97	9.83	11.71
55	1.72	4.08	6.97	9.83	11.57
60	1.72	4.09	6.97	9.83	11.45
65	1.73	4.10	6.98	9.83	11.45
70	1.74	4.13	6.99	9.83	11.45
75	1.75	4.14	7.01	9.83	11.45
80	1.77	4.16	7.03	9.83	11.45
85	1.78	4.18	7.05	9.83	11.45
90	1.79	4.21	7.08	9.83	11.45
95	1.81	4.23	7.11	9.83	11.45

NIST Standard 1.68/4.01/6.87/9.18/12.45

@Temperature (°C)	1.68pH Buffer (pH)	4.01pH Buffer (pH)	6.87pH Buffer (pH)	9.81pH Buffer (pH)	12.45pH Buffer (pH)
0	1.67	4.00	6.98	9.46	13.21
5	1.67	4.00	6.95	9.40	13.21
10	1.67	4.00	6.92	9.33	13.00
15	1.67	4.00	6.90	9.28	12.81
20	1.68	4.00	6.88	9.23	12.63
25	1.68	4.01	6.87	9.18	12.45
30	1.68	4.01	6.85	9.14	12.29
35	1.69	4.02	6.84	9.10	12.13
40	1.69	4.02	6.84	9.09	12.09
45	1.70	4.02	6.84	9.08	12.04
50	1.71	4.03	6.84	9.07	11.98

NIST Standard Cont.

@Temperature (°C)	1.68pH Buffer (pH)	4.01pH Buffer (pH)	6.87pH Buffer (pH)	9.81pH Buffer (pH)	12.45pH Buffer (pH)
55	1.72	4.04	6.84	9.04	11.84
60	1.72	4.05	6.83	9.01	11.71
65	1.73	4.08	6.83	8.99	11.57
70	1.74	4.09	6.84	8.96	11.45
75	1.75	4.13	6.85	8.92	11.45
80	1.77	4.16	6.86	8.89	11.45
85	1.78	4.21	6.88	8.85	11.45
90	1.79	4.23	6.89	8.83	11.45

DIN 19267 1.09/4.65/6.79/9.23/12.75

@Temperature (°C)	1.09pH Buffer (pH)	4.65pH Buffer (pH)	6.79pH Buffer (pH)	9.23pH Buffer (pH)	12.75pH Buffer (pH)
0	1.08	4.67	6.89	9.48	13.95
5	1.08	4.67	6.87	9.43	13.63
10	1.09	4.66	6.84	9.37	13.37
15	1.09	4.66	6.82	9.32	13.16
20	1.09	4.65	6.80	9.27	12.96
25	1.09	4.65	6.79	9.23	12.75
30	1.10	4.65	6.78	9.18	12.61
35	1.10	4.65	6.77	9.13	12.45
40	1.10	4.66	6.76	9.09	12.29
45	1.10	4.67	6.76	9.04	12.09
50	1.11	4.68	6.76	9.00	11.89
55	1.11	4.69	6.76	8.96	11.79
60	1.11	4.70	6.76	8.92	11.69
65	1.11	4.71	6.76	8.90	11.56
70	1.11	4.72	6.76	8.88	11.43
75	1.11	4.73	6.77	8.86	11.31
80	1.12	4.75	6.78	8.85	11.19
85	1.12	4.77	6.79	8.83	11.09
90	1.13	4.79	6.80	8.82	10.99
95	1.13	4.82	6.81	8.81	10.89

Appendix B – Temperature Data

The table below lists approximate resistance values of temperature sensors that may be used with the DPU18.

Temperature (°C)	**PT1000 RTD**	**PT100 RTD**	**3K Balco RTD**
0	1000.0Ω	100.00Ω	2663 Ω
10	1039.0Ω	103.90Ω	2798 Ω
20	1077.9Ω	107.79Ω	2933 Ω
25	1097.3Ω	109.73Ω	3000 Ω
30	1116.7Ω	111.67Ω	3068 Ω
40	1155.4Ω	115.54Ω	3203 Ω
50	1194.0Ω	119.40Ω	3338 Ω
60	1232.4Ω	123.24Ω	3473 Ω
70	1270.7Ω	127.07Ω	3608 Ω
80	1308.9Ω	130.89Ω	3743 Ω
90	1347.0Ω	134.70Ω	3878 Ω
100	1385.0Ω	138.50Ω	4013 Ω

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

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The DPU18 has been designed to include a wide range of self-diagnostic test, 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 DPU18 generates, along with their probable causes. If the fault has not been cleared after these checks have been made 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 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 Module 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 DPU18 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 Sensor Reading Is Constantly Over-range or Under-range

- Ensure that the sensor and temperature input is correctly connected (see Installation and Choice of pH / Redox Electrodes page 17) and that the sensor is not faulty or damaged.
- If the units are set to pH, check the temperature compensation state (see Channel Setup Section page 30). If the compensation is set to “Manual” check that the fixed temperature is at the correct level. If the compensation is “Automatic” check that the temperature reading is correct.

The Sensor Reading Is Incorrect

- If reading pH, check that the correct probe type has been selected (see pH / Redox (ORP) Input Setup, page 29).
- Check that no error messages are being set. Check that the sensor cable has been correctly connected (see Installation Section, Page 18).
- Check that the Temperature reading is correct.
- Check the module calibration using a pH simulator, Adjust the channel calibration if necessary (see Calibration Section, page 32).
- Use another instrument to check the sensor.

The Sensor Is Not Functioning Correctly

- Check that the sensor glass is not broken or cracked.
- Check the reference probe KCl (where applicable) for leakage or contamination.
- Ensure all probe protective caps have been removed.
- Check that any junction boxes used are correctly connected.
- Check that a suitable high impedance, low noise cable has been used.
- Check for damaged or broken cables.
- Check for damp, grease, or liquids near connectors, junction boxes, or terminations.
- Where extension cables have been used, try connecting the sensor directly to the module.

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached. (See Temperature Sensor Connections, page 22)
- Check that the temperature sensor type is correctly selected in the Channel Setup menu.
- Where practical check the temperature sensor resistance against the table in Temperature Data, page 89.

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.

Problems with Cables and Connectors

The cable connecting the pH probe to the module is the most common cause of problems in pH measurement systems. The importance of the following recommendations cannot be over stressed.

Input Resistance

The high input resistance, required for the optimum performance from a pH electrode system, will be seriously degraded if any grease, dirt, or dampness is allowed to collect around any of the connections between the probe and the module. This includes any connectors or junction boxes which may be used. Particular attention must be paid to the method of extending the pH electrode cable. A general rule would be the fewer connections there are, the less problems are likely to occur.

Input Cable

The choice of cable is important. Only polythene or PTFE cables are acceptable. Secondly, any vibration or cable movement on a standard co-axial cable will give rise to fluctuations in the readings. To prevent this a low noise cable must be employed. This type of cable can be identified as having a black impregnated polythene layer which is exposed when the outer braid is separated for connection. This must be completely removed at the terminations to avoid a possible short circuit between the electrode and reference pair.

In all cases the screening braid must not be separated from the core conductor by more than 5mm in order to avoid “hum” pickup.

Cables should be kept as short as possible and must be run separately (100mm separation typically) from any power carrying cable.

Cable Length

The response of the module to a sudden change in the sensor input will be determined mainly by the source resistance of the electrode and the length of the connection cable. For a typical pH electrode of

1000MΩ resistance, in combination with a typical cable, the time taken to settle to its new value is about 0.5 seconds per metre of cable (depending on the cable capacitance).

Problems with Electrodes

The combination electrodes supplied by LTH are of low resistance and will be less affected by humidity than other, high resistance systems. In any case, the connecting leads and cable connectors must be kept dry, and the cable screen must not be allowed to come into contact with any earthed metal parts. The glass bulb must be kept in a moist condition for correct operation. If the electrode is allowed to dry out, it may be recovered by immersing in a saturated KCl solution or dilute acid for at least 24 hours before use.

Electrodes can be expected to last for at least one year under normal operating conditions before replacement becomes necessary. However, operation at elevated temperatures or pressures, and the presence of sulphides or ionic metals, will shorten the electrode life. If the electrode cannot be set up against solutions or shows a sluggish response to changes in pH, it should be replaced.

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.

LTH
Electronics

Chaul End Lane
Luton
Bedfordshire
LU4 8EZ
United Kingdom

Telephone: +44 (0) 1582 593693
Email: sales@lth.co.uk
Web: www.lth.co.uk