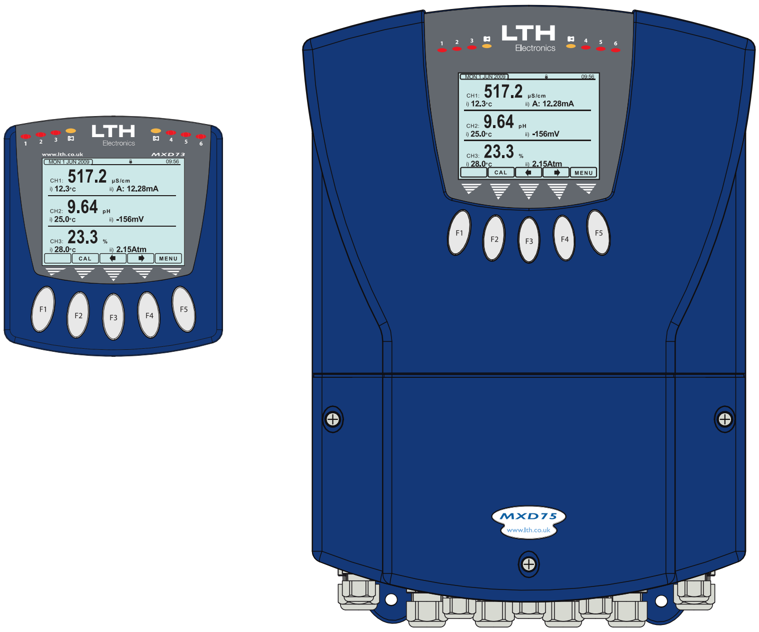
MXD70 SERIES MANUALS



JUNE 2022

KLAY-INSTRUMENTS

MXD73 Quick Start Guide

LTH Electronics

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LU4 8EZ
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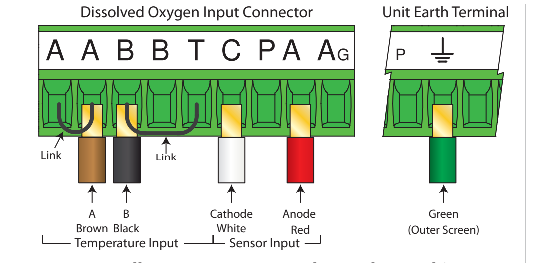
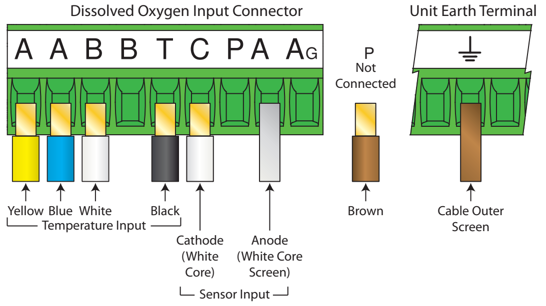
Fax +44 (0)1582 598036
email: sales@lth.co.uk
Web: www.lth.co.uk

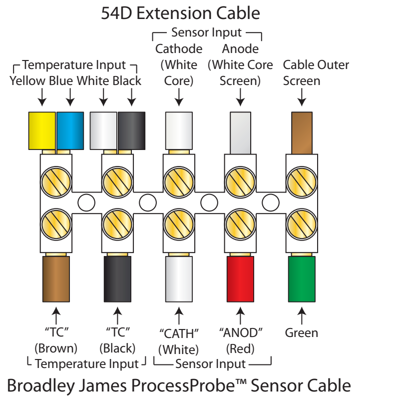
Standard Dissolved Oxygen Input Card Connection Details



Broadley James ProcessProbe™ Polargraphic Dissolved Oxygen Sensor Cable Connection Details

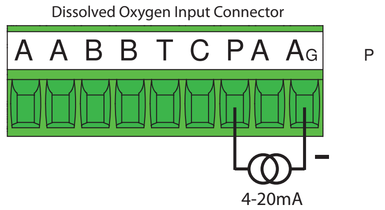


54D Extension Cable Connection Details



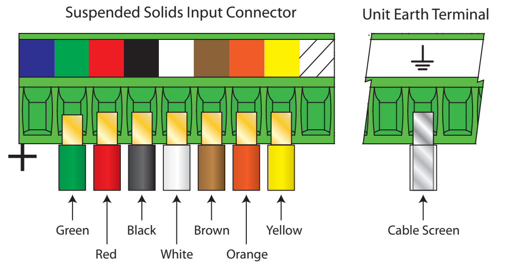
Broadley James ProcessProbe™ Sensor Cable

Broadley James ProcessProbe™ Cable To 54D Extension CableConnection Details

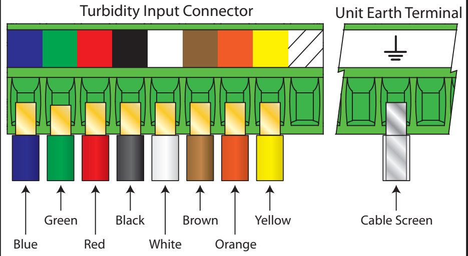


Pressure Transmitter Connection Details

Suspended Solids Input Card Connection Details



Turbidity Input Card Connection Details



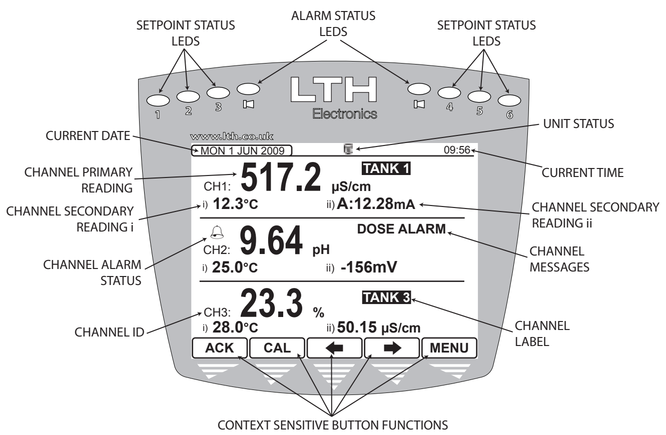
T30 Turbidity Sensor Cable Connection Details

User Interface Overview

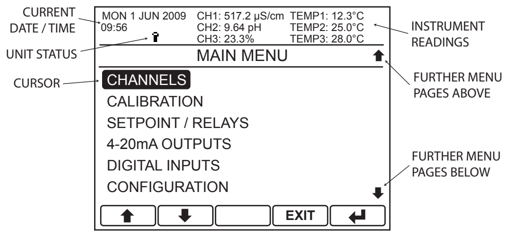
4-20mA Outputs Setup ↔ Digital Inputs Setup ↔ Error Messages ↔ Front Screen ↔ Current Output Bargraphs ↔ Live Trends 1, 2 & 3* ↔ Channels Setup ↔ Setpoint / Relays Setup

*Optional Extra

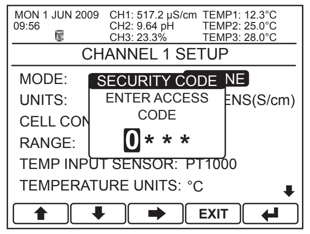
Scrolling Menu Layout



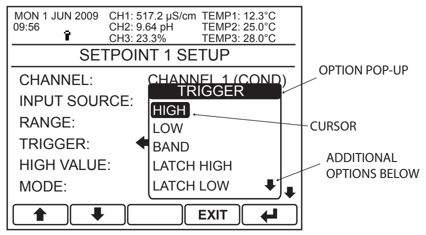
Front Layout



Main Menu Layout



Security Access Pop-Up



Pop-Up Option Layout

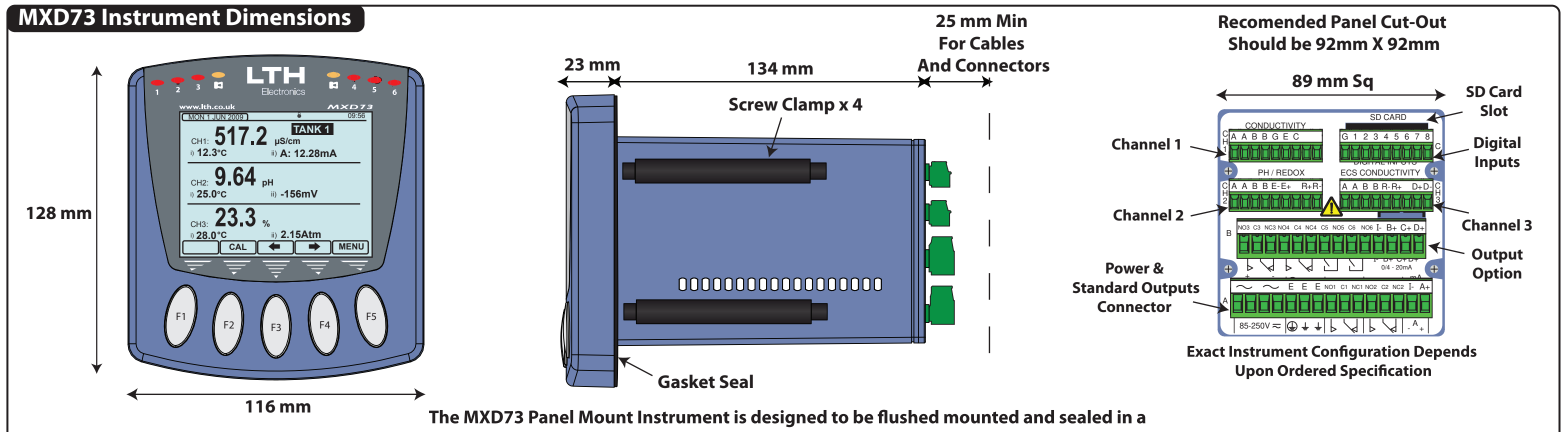
To protect the instrument setup from unauthorised or accidental tampering, a security access code system is present. This is implemented via the instrument's menu system which operates in two modes, "locked" as indicated by a padlock symbol and "unlocked" as indicated by a key symbol.

The default Access Code is: 1000

For configuration and calibration information please consult the operational manuals available online at - https://www.lth.co.uk/downloads/ or via the adjacent QR code.

Part No. 6128
Ninth Issue December 2020

MXD73 Instrument Dimensions



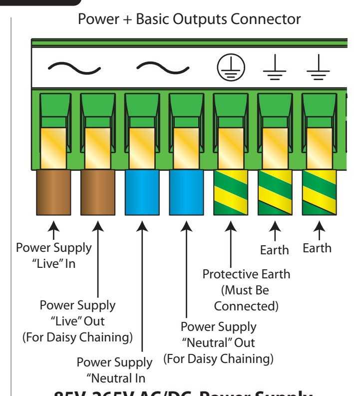
The MXD73 Panel Mount Instrument is designed to be flushed mounted and sealed in a square cut-out in a panel, and is held in place with the four screw clamps provided

Power & Standard Outputs Connection Details

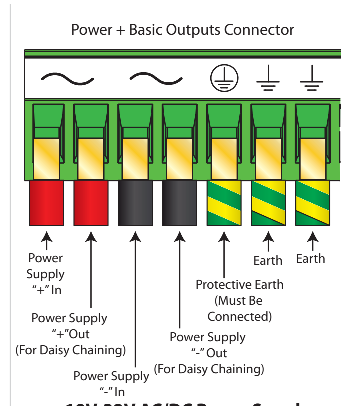
CAUTION!
Always remove the main power from the system before any alterations to the wiring. Ensure that both power lines are isolated. Make sure that the power cannot be switched on by accident whilst the instrument is being connected. For safety reasons an earth connection must be made to the earth terminal of this instrument.

Local wiring and safety regulations should be strictly adhered to when installing this instrument. If the installation methods and cable types recommended in this guide are followed, then the instrument will achieve the levels of EMC protection as specified in the appropriate manual.

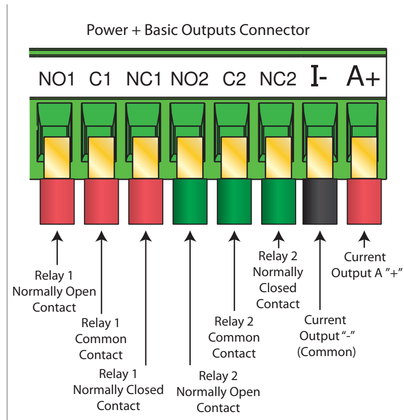
Consult the serial label on the side of the instrument for supply voltage requirements.



85V-265V AC/DC Power Supply Connection Details

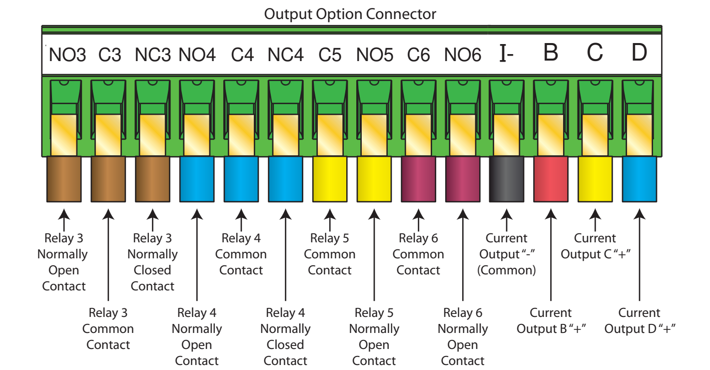


18V-32V AC/DC Power Supply Connection Details

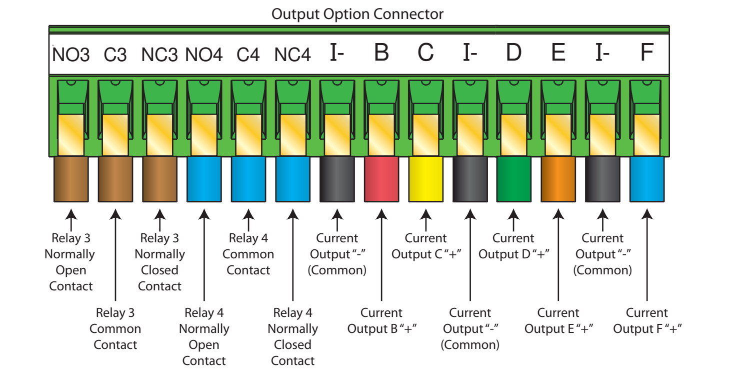


Standard Outputs Connection Details

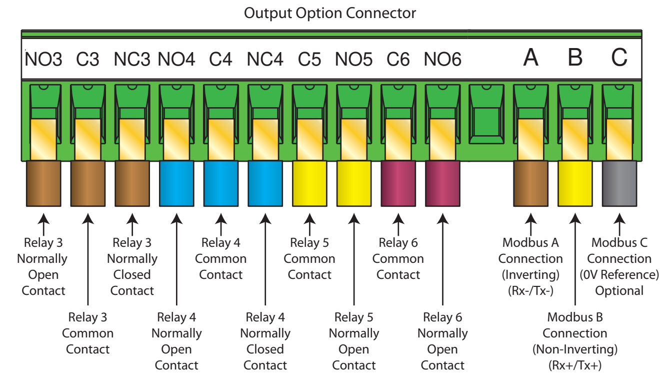
Output Option Card Connection Details



Output Option Card Connection Details.
Available Relays and Current Outputs Vary Depending On Card Type

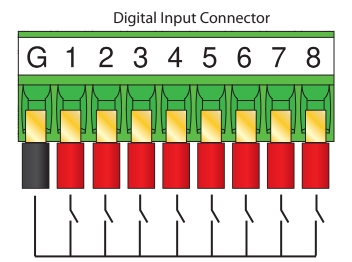


5 Current Outputs 2 Relays Output Option Card Connection Details



Modbus and 4 Relays Output Option Card Connection Details

Digital Input Connection Details



Digital Input Connection Details

Fitted Options- **Power Supply:** ☐ 24V ☐ Mains

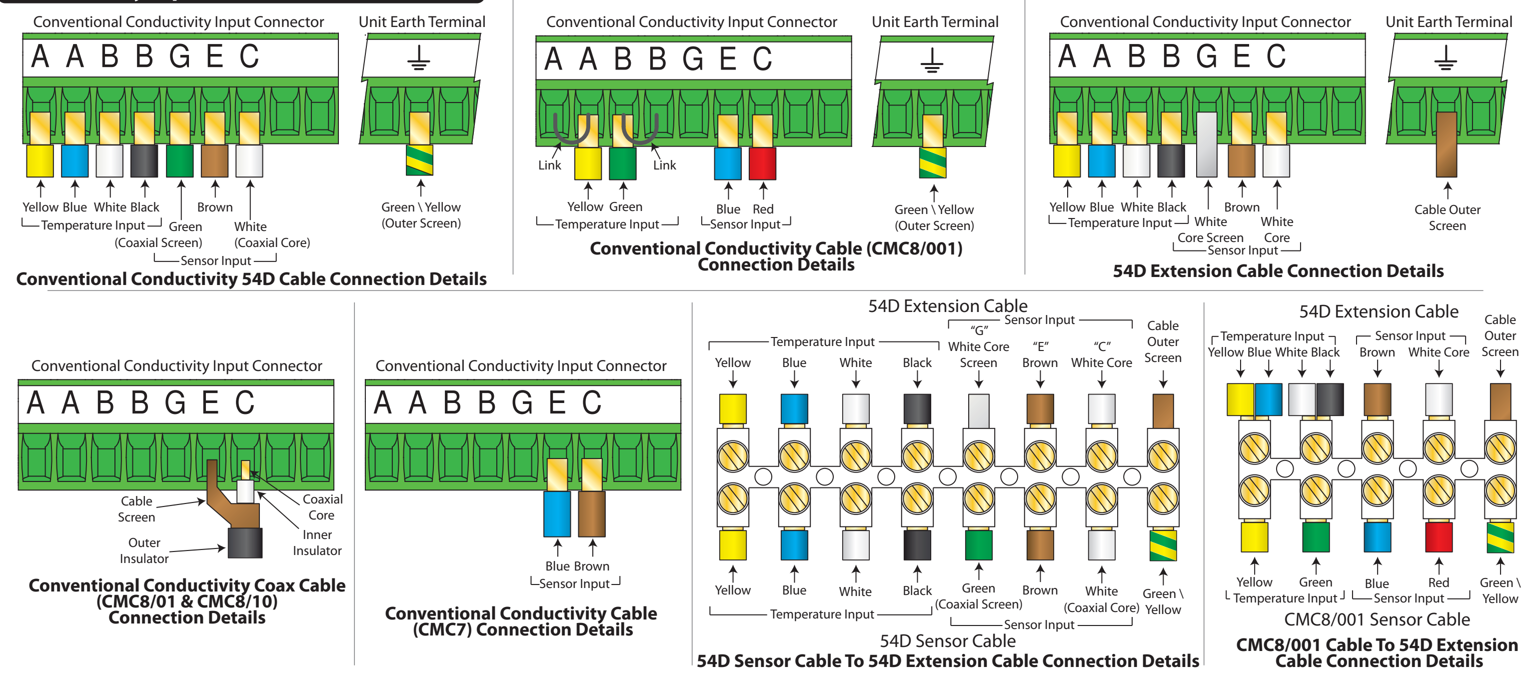
Output Option Card: ☐ 1-Current 2-Relays ☐ 3-Current 0-Relays ☐ 3-Current 4-Relays ☐ 5-Current 2-Relays ☐ Modbus 4-Relays

Channel1: ☐ Cond ☐ pH/Redox ☐ ECS ☐ DO ☐ Aux mA IP ☐ SS

Channel2: ☐ Cond ☐ pH/Redox ☐ ECS ☐ DO ☐ Aux mA IP ☐ SS

Channel3: ☐ Cond ☐ pH/Redox ☐ ECS ☐ DO ☐ Aux mA IP ☐ SS

Conductivity Input Card Connection Details



Conventional Conductivity 54D Cable Connection Details

Conventional Conductivity Cable (CMC8/001) Connection Details

54D Extension Cable Connection Details

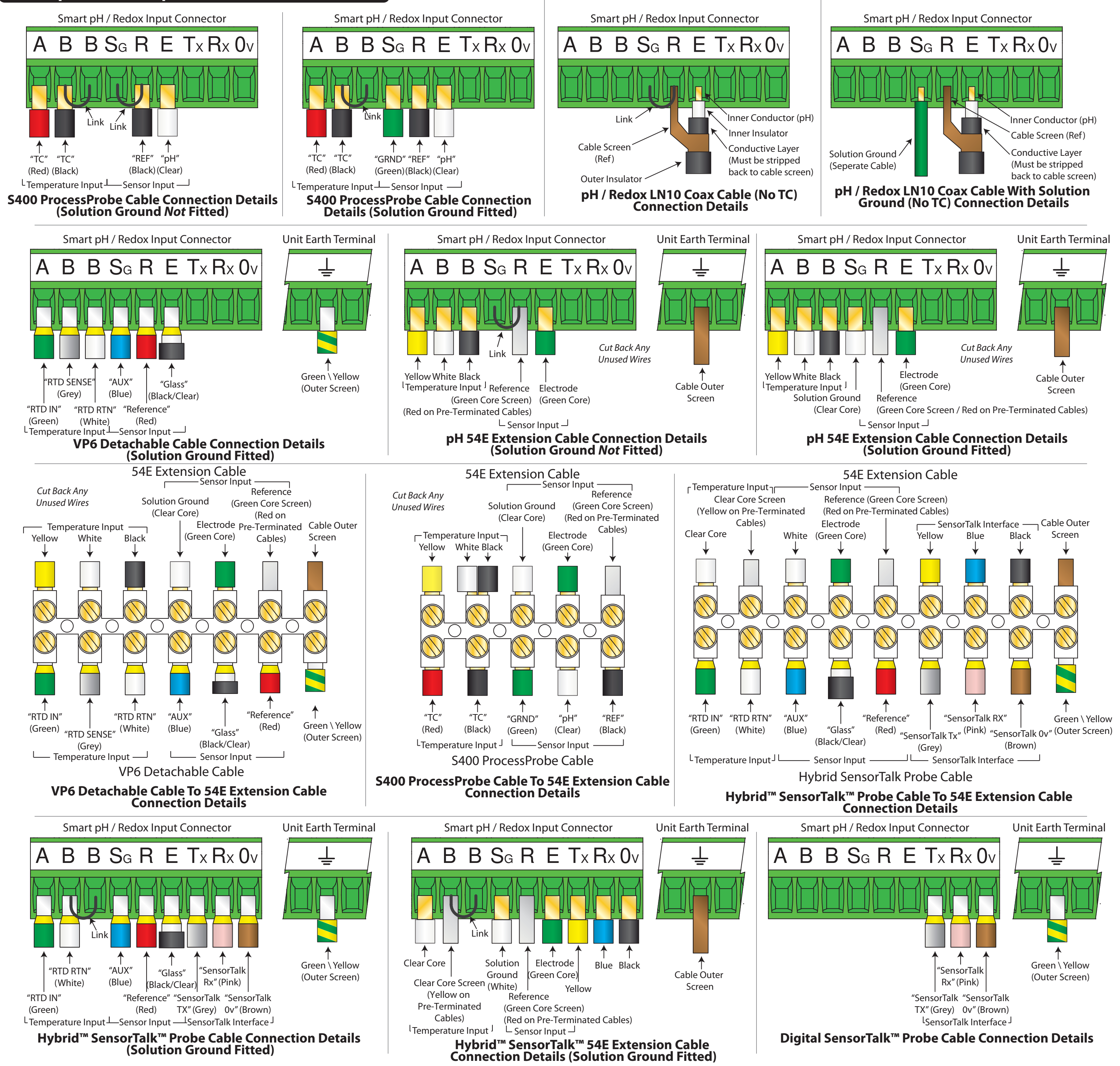
Conventional Conductivity Coax Cable (CMC8/01 & CMC8/10) Connection Details

Conventional Conductivity Cable (CMC7) Connection Details

54D Sensor Cable To 54D Extension Cable Connection Details

CMC8/001 Cable To 54D Extension Cable Connection Details

Smart pH / Redox Input Card Connection Details



S400 ProcessProbe Cable Connection Details (Solution Ground *Not* Fitted)

S400 ProcessProbe Cable Connection Details (Solution Ground Fitted)

pH / Redox LN10 Coax Cable (No TC) Connection Details

pH / Redox LN10 Coax Cable With Solution Ground (No TC) Connection Details

VP6 Detachable Cable Connection Details (Solution Ground Fitted)

pH 54E Extension Cable Connection Details (Solution Ground *Not* Fitted)

pH 54E Extension Cable Connection Details (Solution Ground Fitted)

VP6 Detachable Cable To 54E Extension Cable Connection Details

S400 ProcessProbe Cable To 54E Extension Cable Connection Details

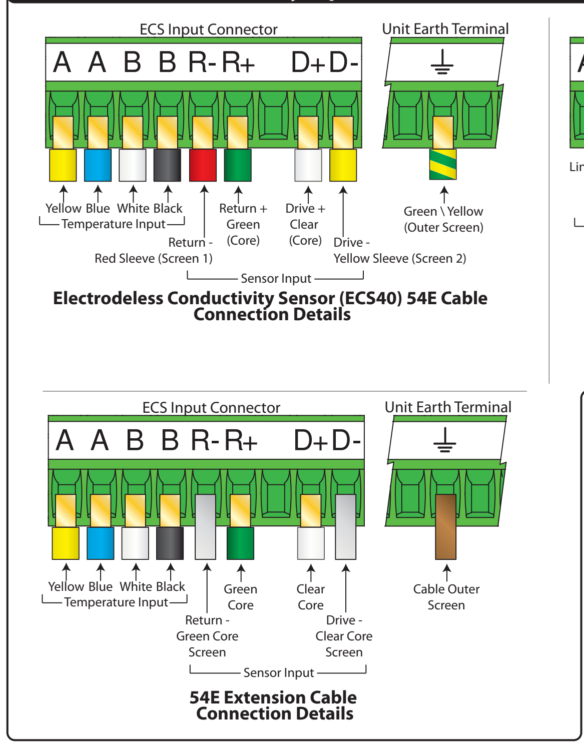
Hybrid™ SensorTalk™ Probe Cable To 54E Extension Cable Connection Details

Hybrid™ SensorTalk™ Probe Cable Connection Details (Solution Ground Fitted)

Hybrid™ SensorTalk™ 54E Extension Cable Connection Details (Solution Ground Fitted)

Digital SensorTalk™ Probe Cable Connection Details

Electrodeless Conductivity Input Card Connection Details



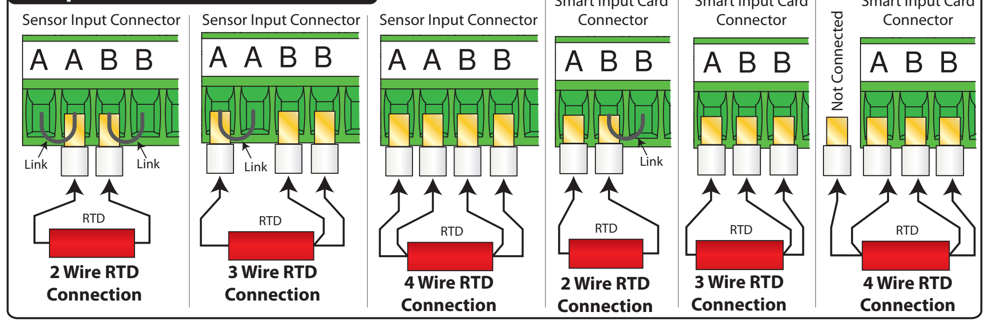
Electrodeless Conductivity Sensor (ECS40) 54E Cable Connection Details

Electrodeless Conductivity Sensor (ECS20) 54H Cable Connection Details

ECS20 54H Cable To 54E Extension Cable Connection Details

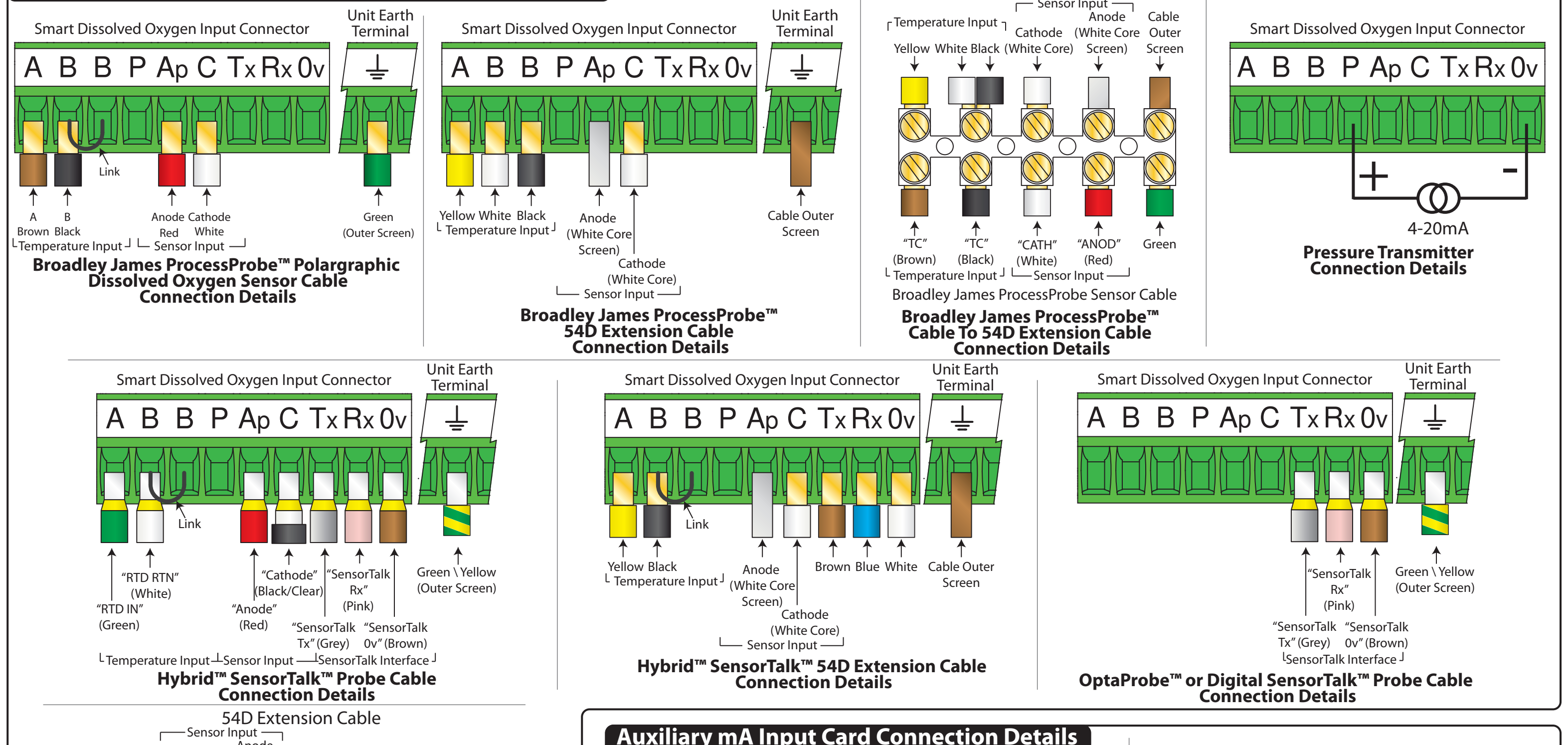
54E Extension Cable Connection Details

Temperature Connection Details



2 Wire RTD Connection | **3 Wire RTD Connection** | **4 Wire RTD Connection** | **2 Wire RTD Connection** | **3 Wire RTD Connection** | **4 Wire RTD Connection**

Smart Dissolved Oxygen Input Card Connection Details



Broadley James ProcessProbe™ Polargraphic Dissolved Oxygen Sensor Cable Connection Details

Broadley James ProcessProbe™ 54D Extension Cable Connection Details

Broadley James ProcessProbe™ Cable To 54D Extension Cable Connection Details

Pressure Transmitter Connection Details

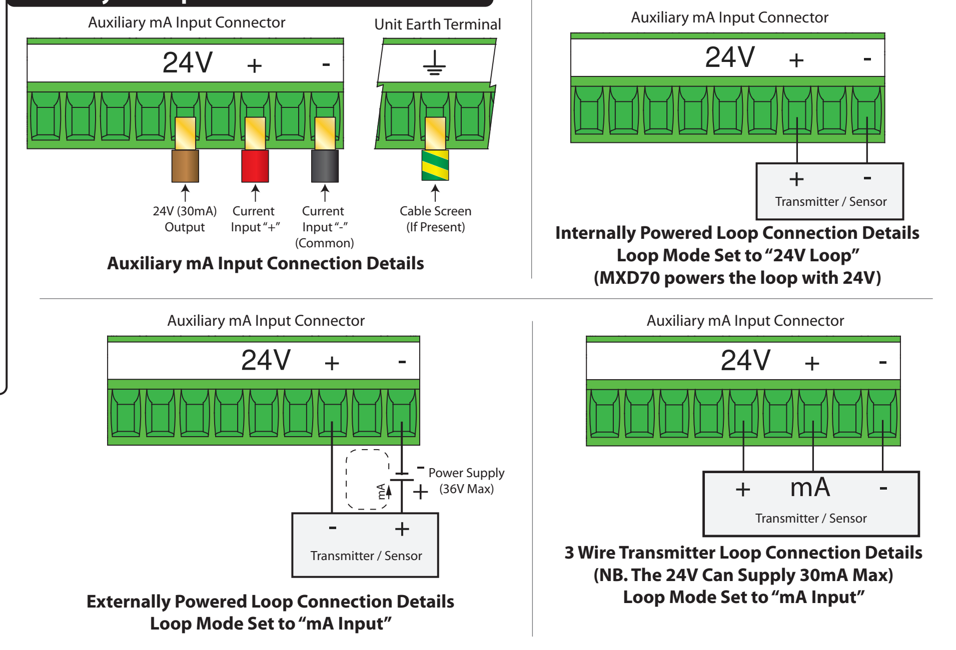
Hybrid™ SensorTalk™ Probe Cable Connection Details

Hybrid™ SensorTalk™ 54D Extension Cable Connection Details

OptaProbe™ or Digital SensorTalk™ Probe Cable Connection Details

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

Auxiliary mA Input Card Connection Details

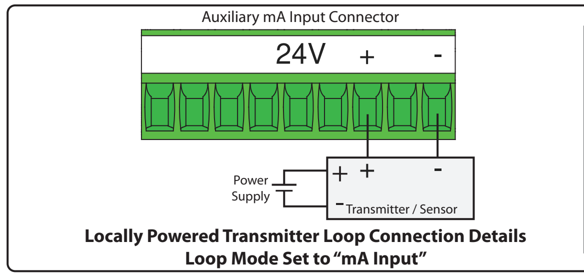


Auxiliary mA Input Connection Details

Internally Powered Loop Connection Details Loop Mode Set to "24V Loop" (MXD70 powers the loop with 24V)

Externally Powered Loop Connection Details Loop Mode Set to "mA Input"

3 Wire Transmitter Loop Connection Details (NB. The 24V Can Supply 30mA Max) Loop Mode Set to "mA Input"



Locally Powered Transmitter Loop Connection Details Loop Mode Set to "mA Input"

MXD75
Quick Start Guide

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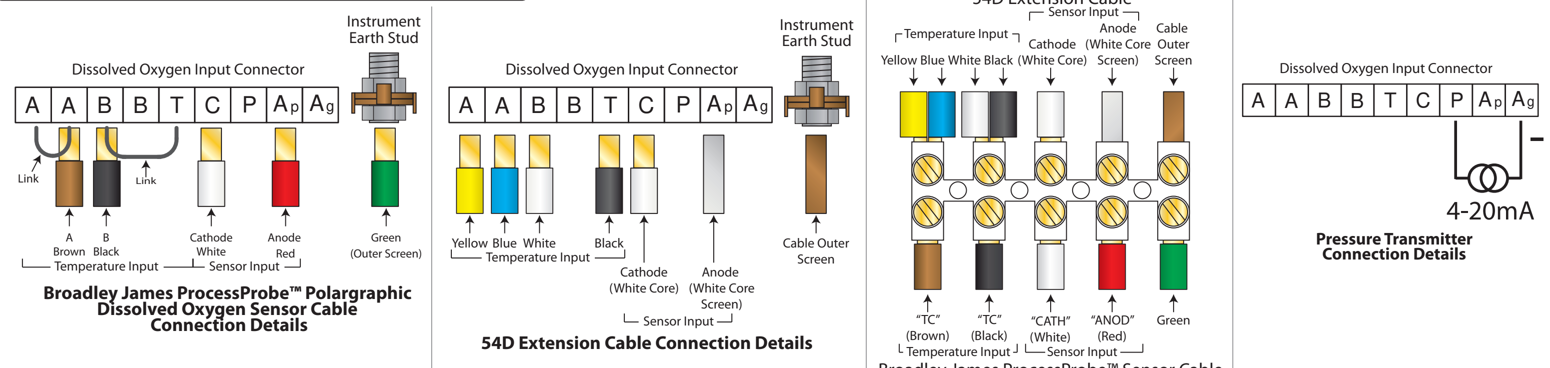
Web: lth.co.uk

Standard Dissolved Oxygen Input Card Connection Details



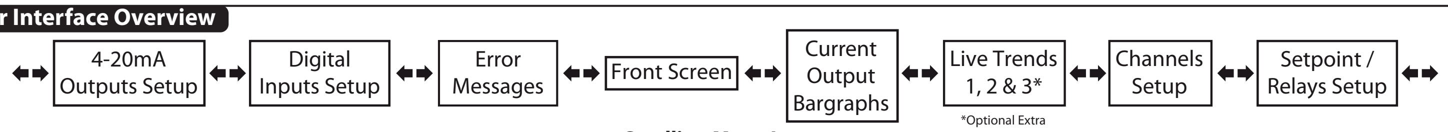
Broadley James ProcessProbe™ Polargraphic Dissolved Oxygen Sensor Cable Connection Details

54D Extension Cable Connection Details

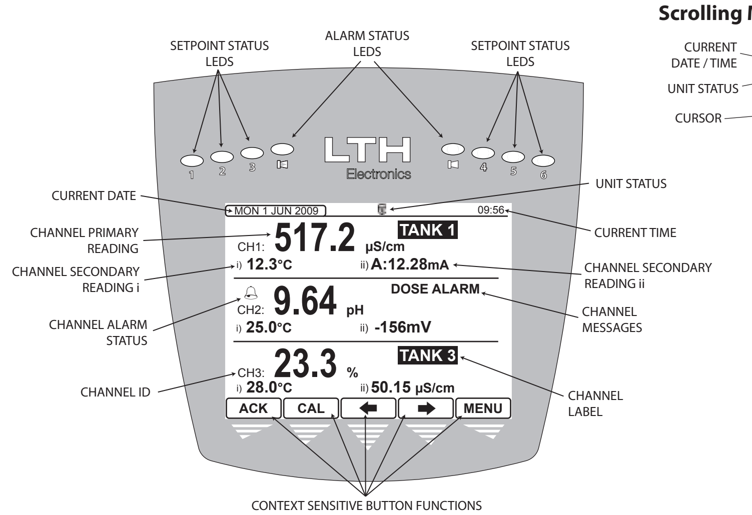
Broadley James ProcessProbe™ Cable To 54D Extension Cable Connection Details

Pressure Transmitter Connection Details

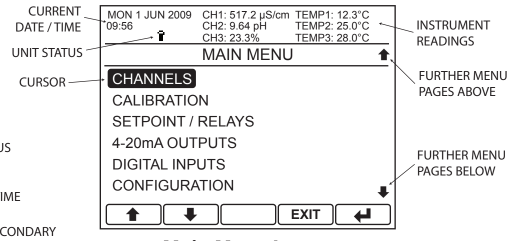
User Interface Overview



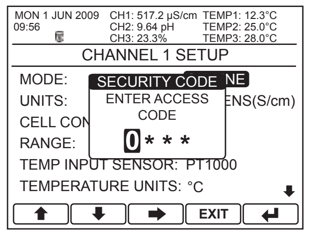
Scrolling Menu Layout



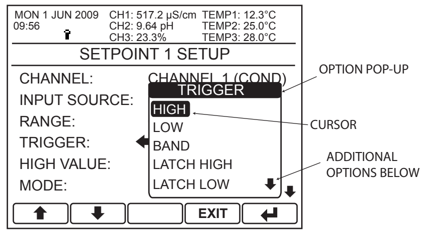
Front Layout



Main Menu Layout



Security Access Pop-Up



Pop-Up Option Layout

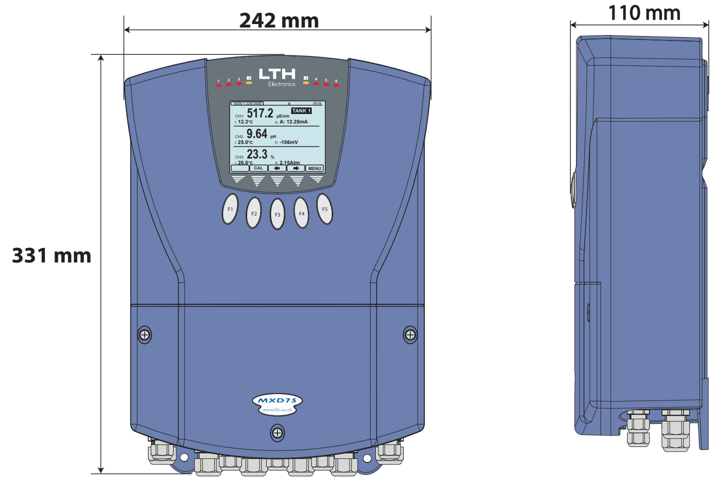
To protect the instrument setup from unauthorised or accidental tampering, a security access code system is present. This is implemented via the instrument's menu system which operates in two modes, "locked" as indicated by a padlock symbol and "unlocked" as indicated by a key symbol.

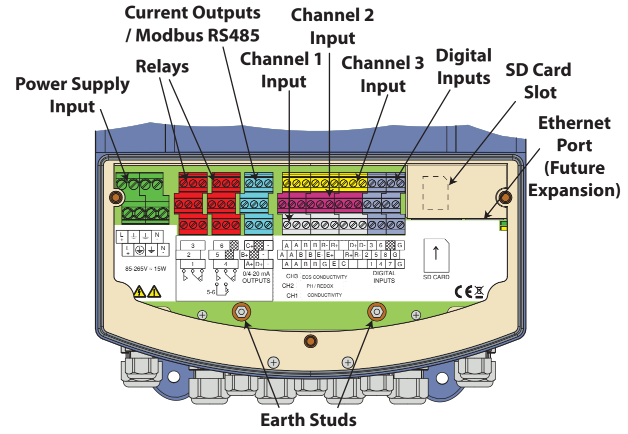
The default Access Code is: 1000

For configuration and calibration information please consult the operational manuals available online at - https://www.lth.co.uk/downloads/ or via the adjacent QR code.

Part No. 6127
Tenth Issue December 2020

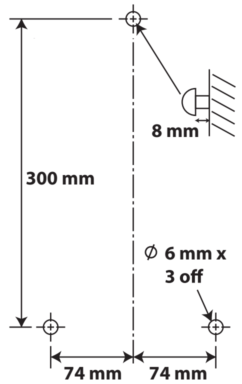
MXD75 Instrument Dimensions





Exact Instrument Configuration Depends Upon Ordered Specification

- LTH recommends using No. 10 x 1¼ inch round head screws or similar for mounting.
- Ensure top screw head is 8 mm proud.
- Care must be taken when fitting the unit on uneven walls or surfaces. Do not over stress the mounting lugs.
- Over tightening the mounting screws could also break the lugs.



Drill Hole Dimensions

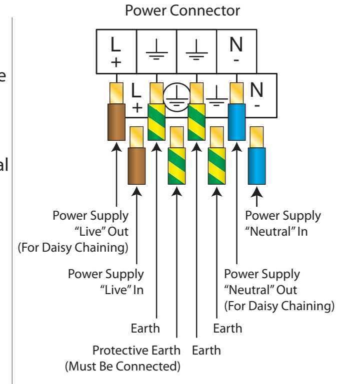
Power Connection Details

CAUTION!

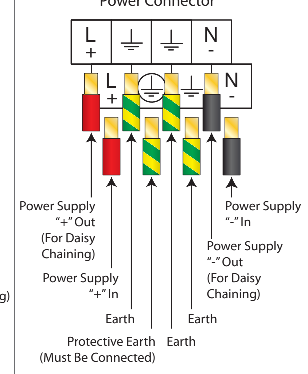
Always remove the main power from the system before any alterations to the wiring. Ensure that both power lines are isolated. Make sure that the power cannot be switched on by accident whilst the instrument is being connected. For safety reasons an earth connection must be made to the earth terminal of this instrument.

Local wiring and safety regulations should be strictly adhered to when installing this instrument. If the installation methods and cable types recommended in this guide are followed, then the instrument will achieve the levels of EMC protection as specified in the appropriate manual.

Consult the serial label on the side of the instrument for supply voltage requirements.

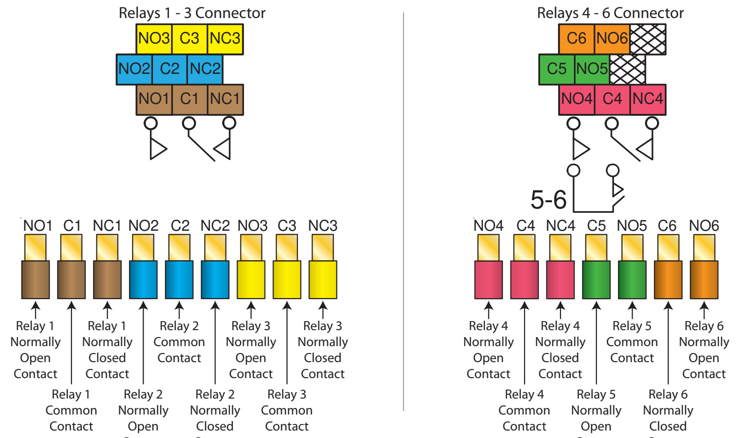


85V-265V AC/DC Power Supply Connection Details



18V-32V AC/DC Power Supply Connection Details

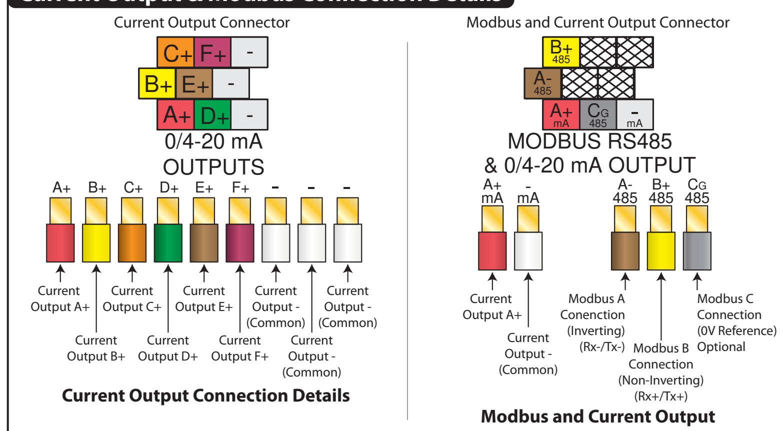
Relay Connection Details



Relay Connection Details

Available Relays Vary Depending On Instrument Configuration

Current Output & Modbus Connection Details

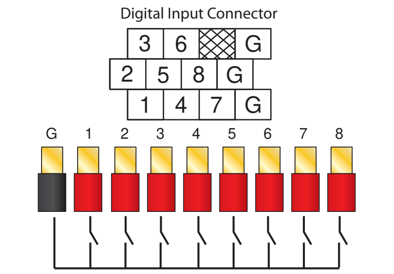


Current Output Connection Details

Modbus and Current Output Connection Details

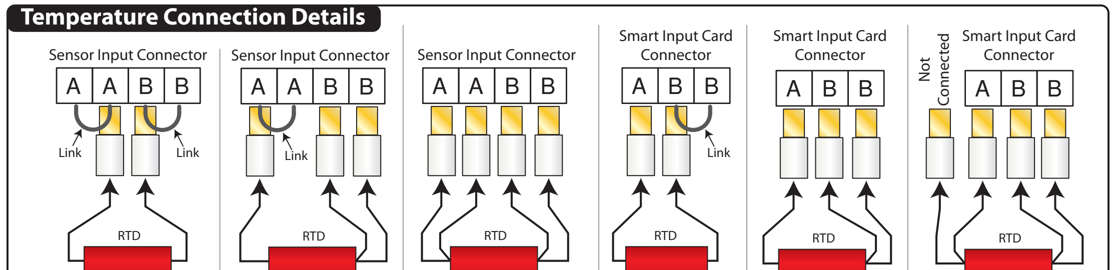
Available Current Output and Modbus Connections Vary Depending Upon Instrument Configuration

Digital Input Connection Details



Digital Input Connection Details

Temperature Connection Details



2 Wire RTD Connection | **3 Wire RTD Connection** | **4 Wire RTD Connection** | **2 Wire RTD Connection** | **3 Wire RTD Connection** | **4 Wire RTD Connection**

Fitted Options- **Power Supply:** ☐ 24V ☐ Mains

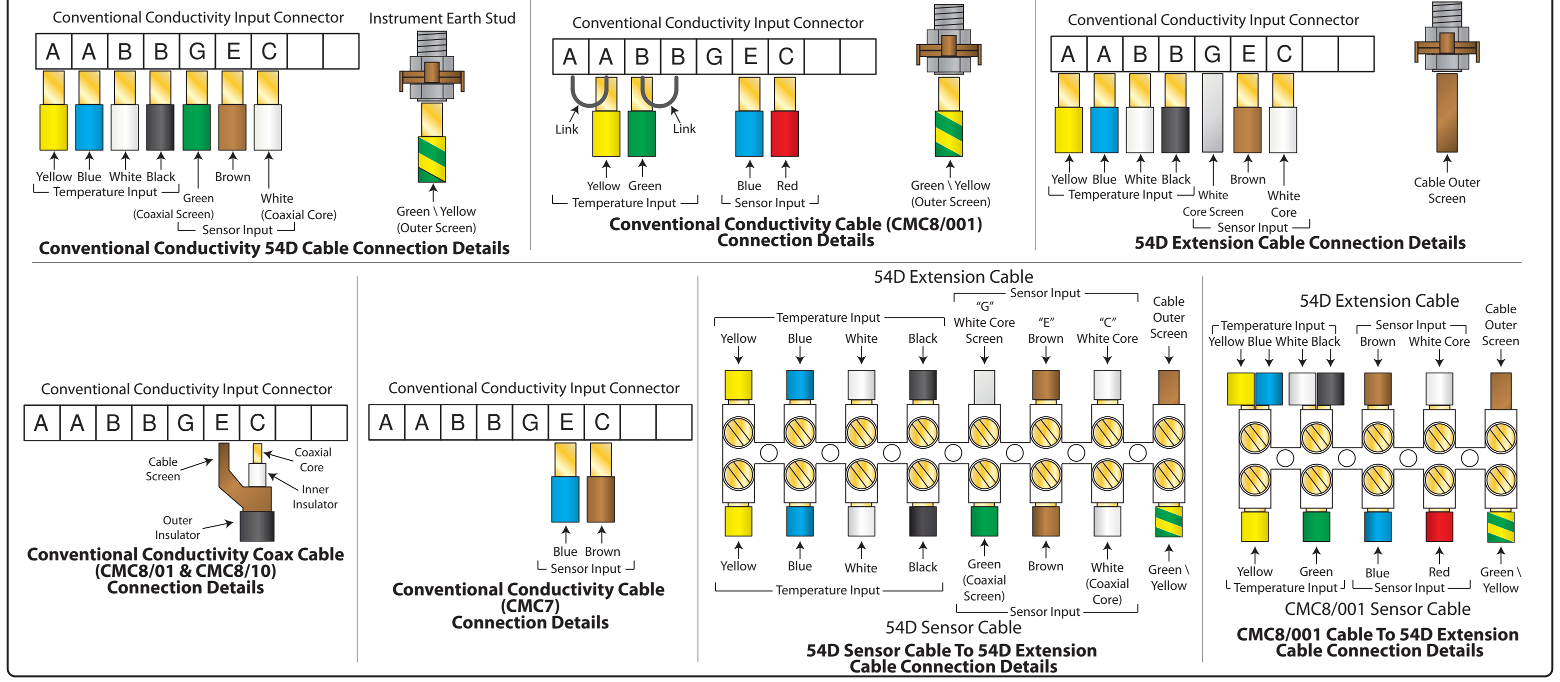
Output Option Card: ☐ 1-Current 2-Relays ☐ 3-Current 0-Relays ☐ 3-Current 4-Relays ☐ 5-Current 2-Relays ☐ Modbus 4-Relays

Channel1: ☐ Cond ☐ pH/Redox ☐ ECS ☐ DO ☐ Aux mA IP ☐ SS

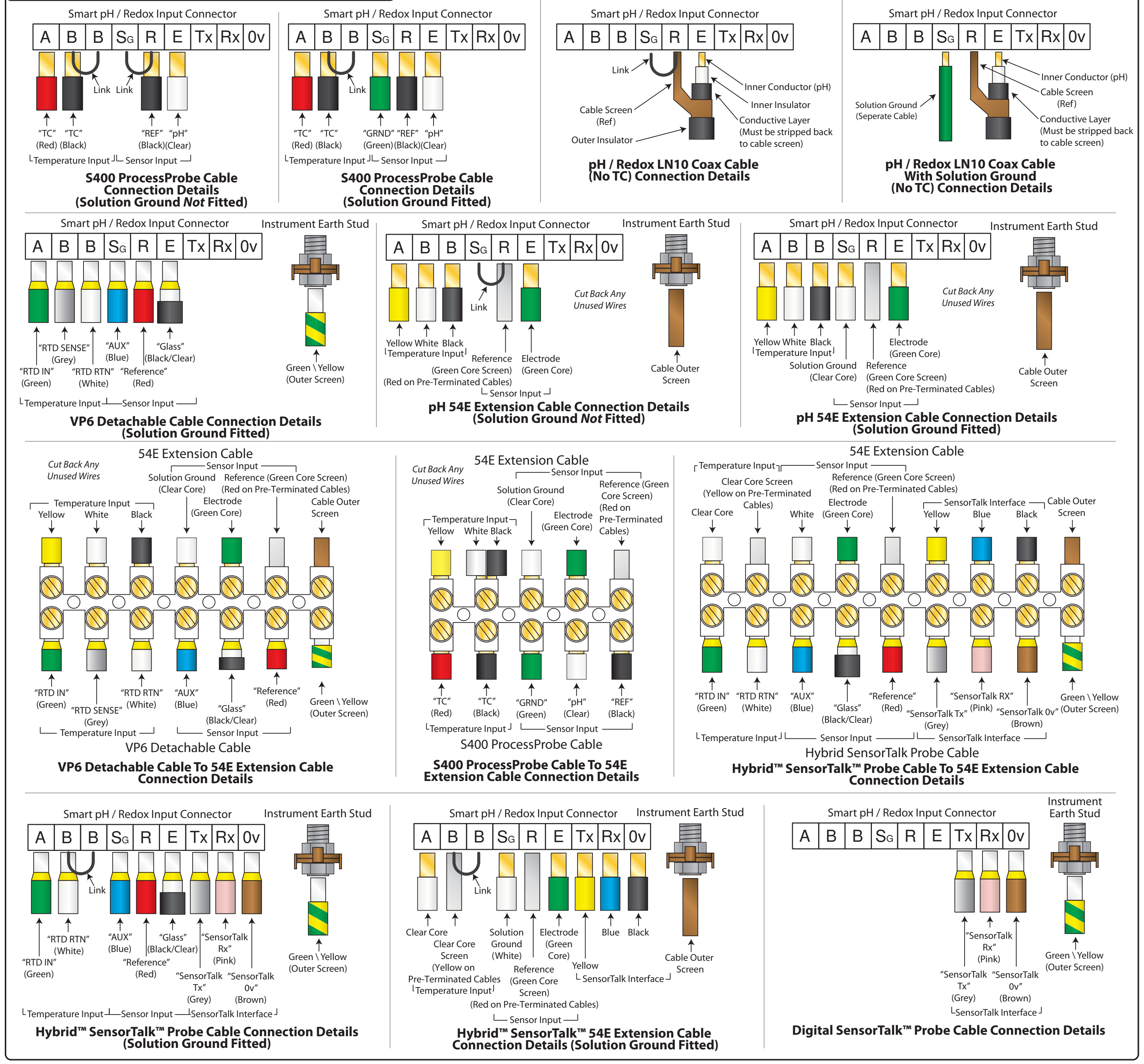
Channel2: ☐ Cond ☐ pH/Redox ☐ ECS ☐ DO ☐ Aux mA IP ☐ SS

Channel3: ☐ Cond ☐ pH/Redox ☐ ECS ☐ DO ☐ Aux mA IP ☐ SS

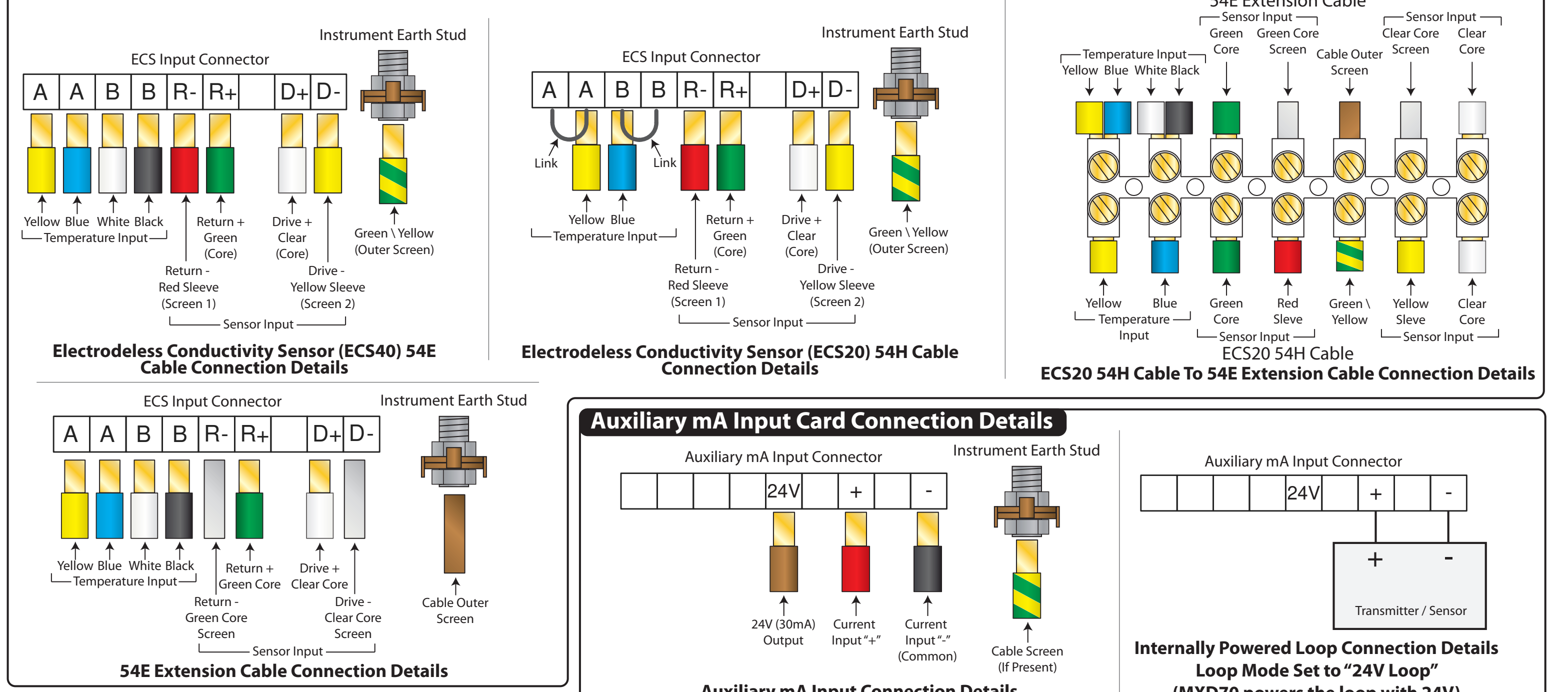
Conductivity Input Card Connection Details



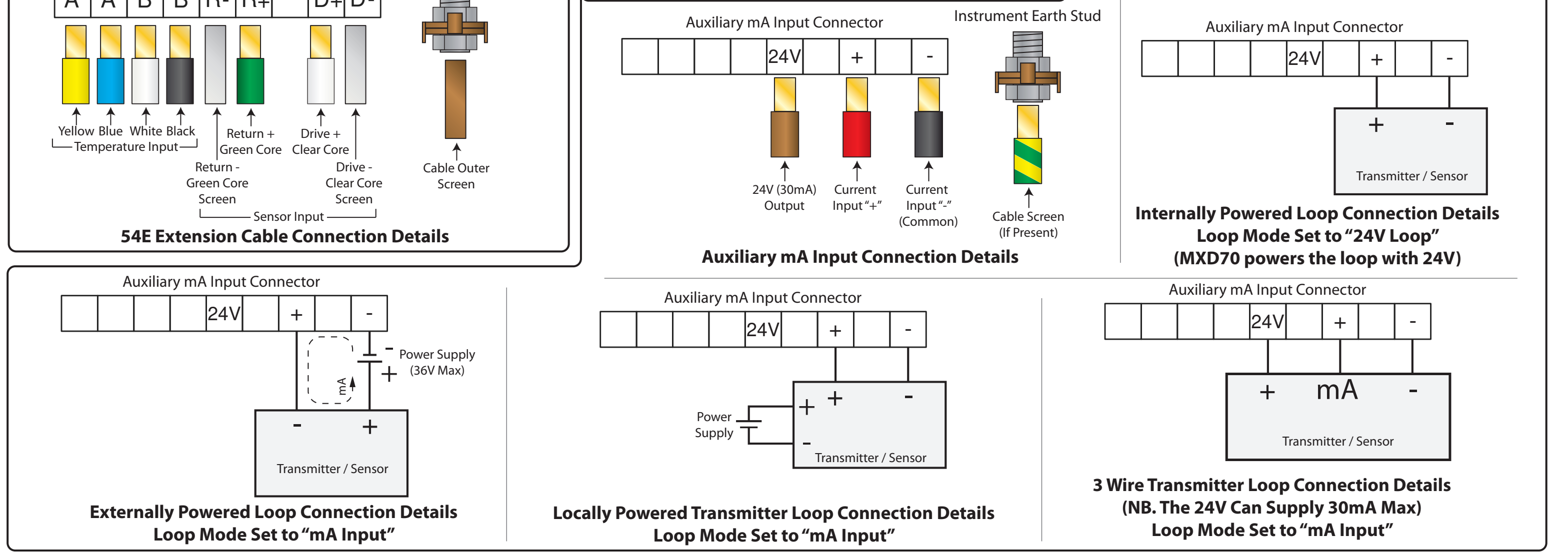
Smart pH / Redox Input Card Connection Details



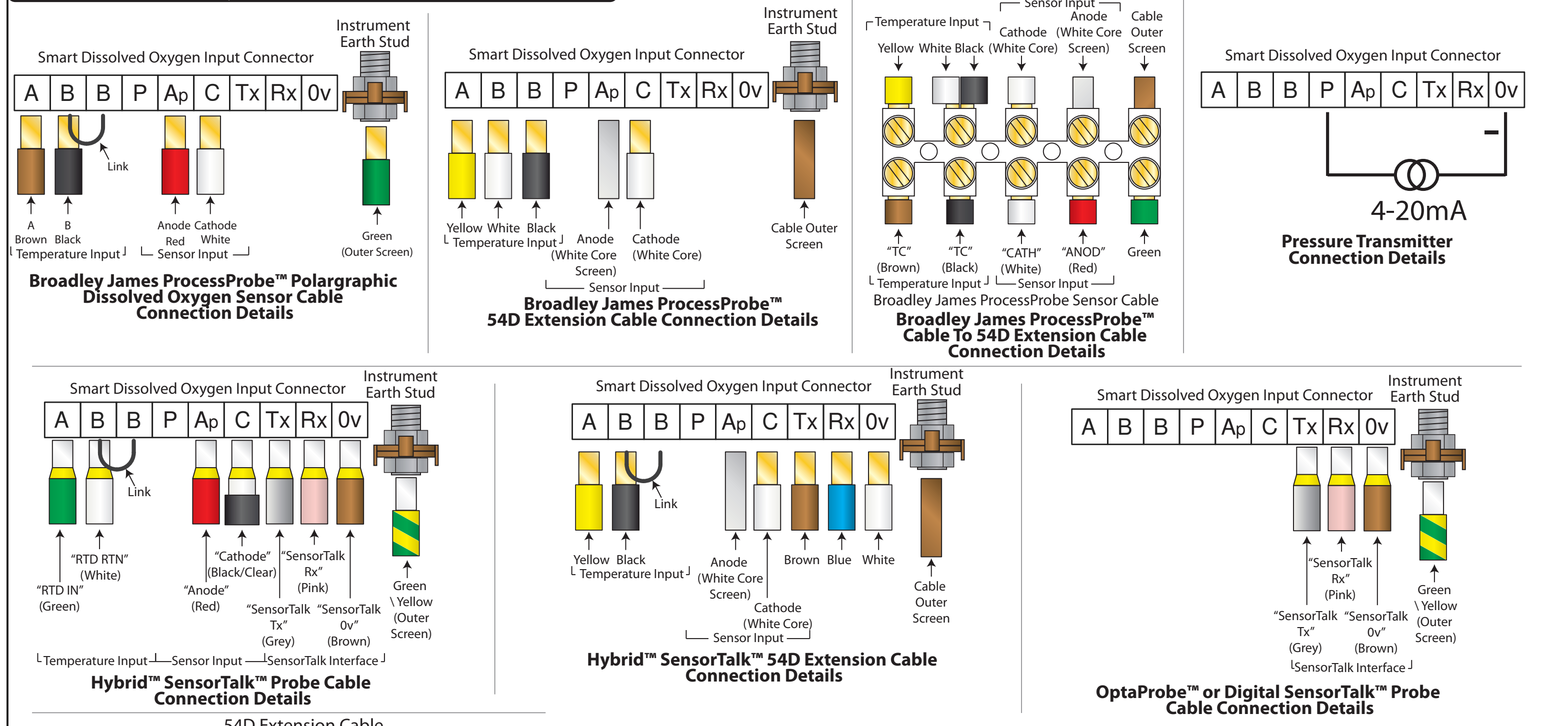
Electrodeless Conductivity Input Card Connection Details

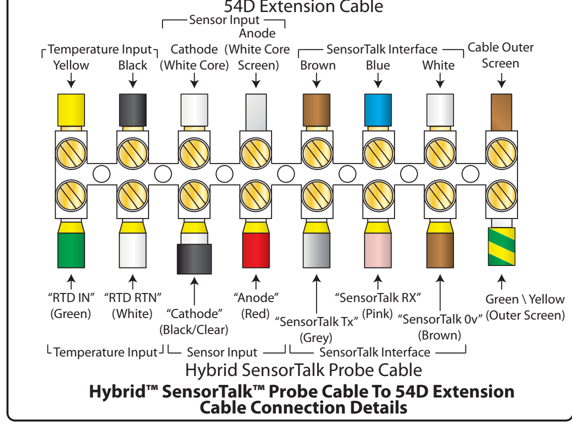


Auxiliary mA Input Card Connection Details

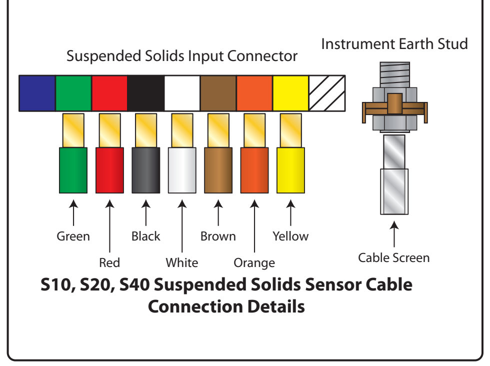


Smart Dissolved Oxygen Input Card Connection Details

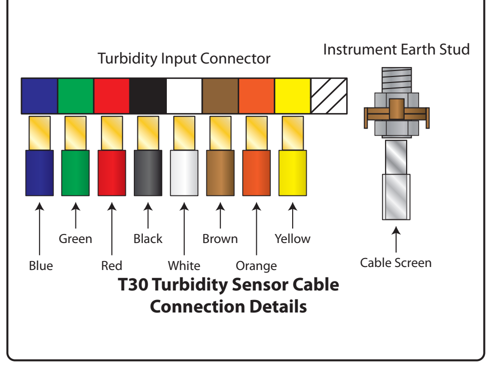




Suspended Solids Input Connection Details



Turbidity Input Card Connection Details



MXD73

Multi-parameter Monitor

Installation Guide

Preface

Product warranty

The MXD73 has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

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Fifth edition: March 2021

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Web : www.lth.co.uk

Manufacturing Standards

Electromagnetic compatibility

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

Safety

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

Restriction of Hazardous Substances

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

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2015. Certificate No: FM 13843

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

Disposal

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

Declaration of Conformity

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DECLARATION OF CONFORMITY

LTH Electronics Ltd

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

MXD73

conforms with all relevant United Kingdom regulations:

BS EN 61326-1 : 2013
(Electrical Equipment for Measurement, Control and Laboratory Use)

in accordance with the provisions of
the S.I. 2016/1091 (EMC) regulations.

BS EN 61010-1 : 2010 (Equipment Safety)

in accordance with the provisions of
the S.I. 2016/1101 (Equipment Safety) regulations.

BS EN IEC 63000 : 2018
(Electrical and Electronic Products)

in accordance with the provisions of
the S.I. 2012/3032 (RoHS) regulations.

Issued in the United Kingdom on
08th March 2021 for the company by:

Neil Adams
Managing Director

LTH Electronics Ltd

Directors:
N.Adams (Managing), S.Wotton, H. Thom
Registered Office: As Above
Registered No. 908792 England
ISO9001:2015
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Contents

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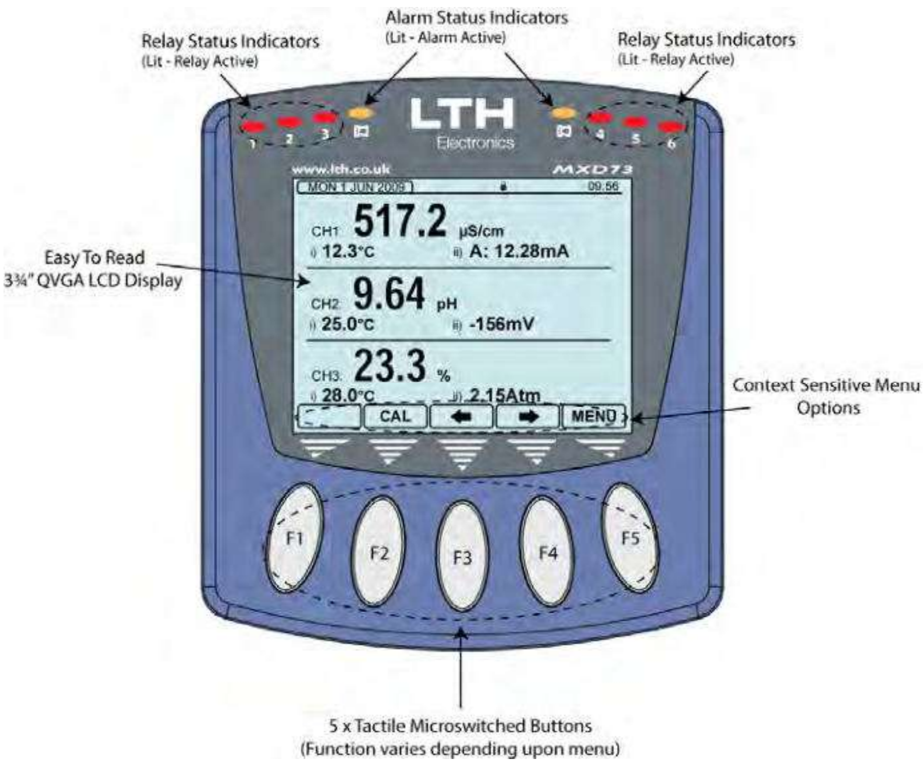
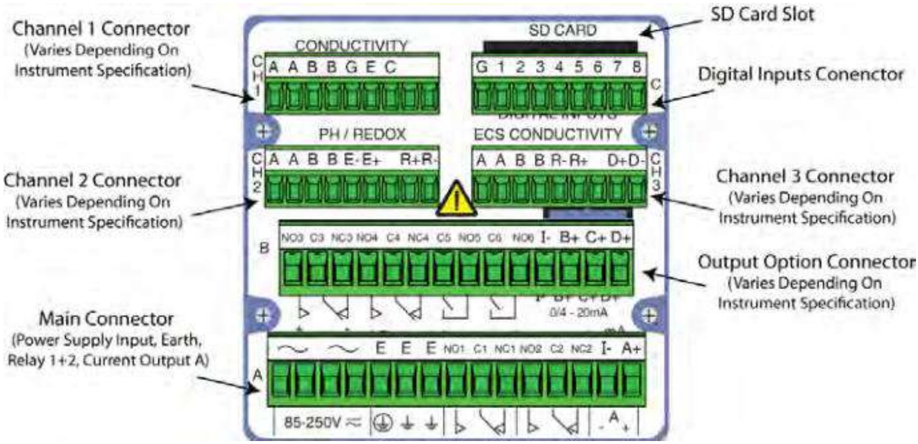
Introduction

The MXD73 is a microprocessor controlled multi-parameter instrument that can be installed with a user selected combination of up to 3 Sensor Input Cards. The instrument may be subsequently modified to meet changing requirements by the installation of additional, or different, cards and the attachment of the appropriate sensor(s).
Utilising a multifunction easy to read QVGA LCD the instrument displays readings and provides feedback to the operator on the status of the sensors and instruments outputs.
In addition the instrument features, depending upon configuration, up to six control relays, up to six 0/4 – 20mA current outputs and an Modbus RS485 interface. These can be used to provide fully configurable control, alarm and feedback.
Finally the instrument also features an SD card interface which enables the user to backup and restore instrument settings, copy settings between instruments, log the sensor readings (optional extra) and to upgrade the instrument's software.



MXD73 Overview



MXD73 Rear Termination Overview

MXD73 Instrument Specification

Input Expansion Slots	3 slots, user configurable with any combination of available input add-in cards.
Output Expansion Slots	1 slot, user configurable with an additional output option add-in card.
Ambient Operating Temperature	-20°C to +50°C (-4°F to +122°F) for full specification.
Display	3 ¾" QVGA back lit LCD module.
Buttons	5 tactile feedback, micro-switched, silicone rubber.
Alarm LED's	2 Yellow LED's located above the main display area for instrument's alarm status, lit = active.
Digital Inputs	8 contact closures for remote activation of user defined operations. Can be configured to operate in either normally open or normally closed modes.
Current Output Options	1 as standard, expandable up to a total of 4 or 6 depending on the number of relays.
Current Output Specification	Each selectable 0-20mA or 4-20mA into 750 ohms max, fully isolated to 2kV. Expandable up to 5% of any operating range and offset anywhere in that range.
Current Output Adjustment	±0.01mA, 3 point 0/4-20 mA for remote monitor calibration.
Setpoints and Control Relays Options	2 change over relays as standard, expandable up to a total of either 4 change over relays, or 4 change over relays + 2 normally open relays depending on the number of current outputs.
Setpoints and Control Relays Specification	Fully configurable setpoints with volt free contacts for each relay. Rated at 5A @ 30V DC / 5A @ 250V AC.
Setpoint LED's	6 Red LED's located above main display area for setpoint status indication, lit = relay energised.

Setpoint Modes	On/Off, Time Proportioning, Pulse Proportioning, Band and Latch. Delay timer adjustable from 00:00 to 59:59 mm:ss. Hysteresis 0 to 9.9%. Dose alarm timer, with supplementary initial charge function. Both adjustable from 00:00 to 59:59 mm:ss. Adjustable cycle time and proportional band in proportional modes.
Setpoint Cleaning	Cleaning mode with adjustable duration (max 10m) and interval times (max 24h), auto offline function with recovery timer.
Setpoint Alarm	Unit or channel alarm mode, whereby the relay can be energised under certain set conditions.
Modbus RS485 Interface (Optional)	Supports RTU and ASCII formats Node Address: 1 to 247 Baud Rates (Bits Per Second) : 300, 600, 1200, 2400, 4800, 9600, 19200, 31250, 38400 Parity Options: Even, Odd, None
SD Card Interface	Enables backing up and restoring of instrument configuration, log the sensor readings (optional extra) and on site upgrading of instrument software. SD, SDHC and SDXC-FAT32 cards supported.
EMC	S.I. 2016/1091 & 2014/30/EU using BS EN 61326-1: 2013.
Low Voltage Directive	S.I. 2016/1101 & 2014/35/EU using BS EN 61010-1: 2010.
Power Supply	Universal 80-265V AC or DC, 15W max. LV Option 18 – 32 V AC or DC, 20W max.
Instrument Housing	UL 94-V0 PC/ABS.
Ingress Protection Rating (IEC 60529 Protection Rating)	IP66 to the front when panel mounted.
Weight	Maximum 880 grams (instrument only).
Dimensions Front	128 x 116 x 23 mm (H, W, D).
Dimensions Rear	89 x 89 x 161 mm (H, W, D), including connectors.

Installation – Safety & EMC

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

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

Wiring Installation

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

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

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

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

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

❖ The rear input card cover of the panel mount unit must be correctly re-assembled and securely fastened to maintain a continuous electro-magnetic shield around the instrument.

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

Noise suppression

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

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

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

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

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

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

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

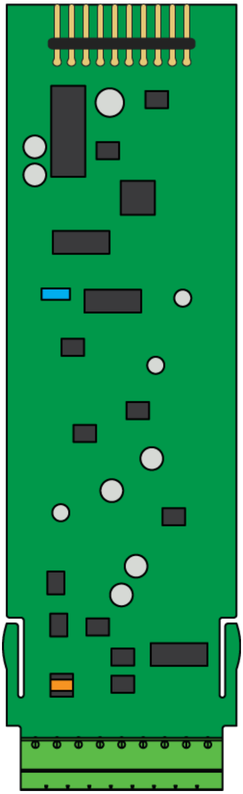
❖ Fit an in-line mains filter close to the power terminals of the instrument.

❖ In cases of very high background RF and HF noise environments, LTH can supply a length of proprietary RF suppressing mains cable.

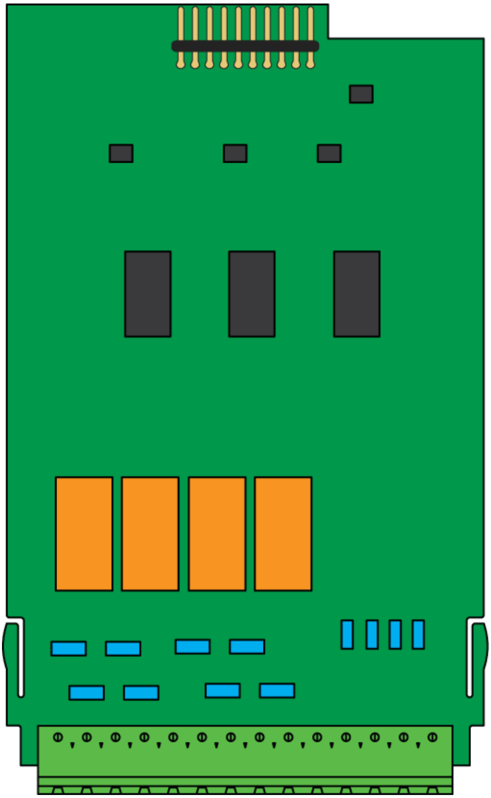
MXD73 Add-in Cards Installation

The MXD73 is designed to be expandable by the use of add-in cards; these add-in cards can take the form of either a sensor input add-in card or an output option add-in card. The MXD73 can be fitted with up to 3 sensor input cards and 1 output option card. The sensor input cards are designated Input Card 1, Input Card 2 and Input Card 3. On the instrument display these are designated Channel 1, Channel 2 and Channel 3.

L Electrostatic precautions must be taken when handling the Add-in cards.



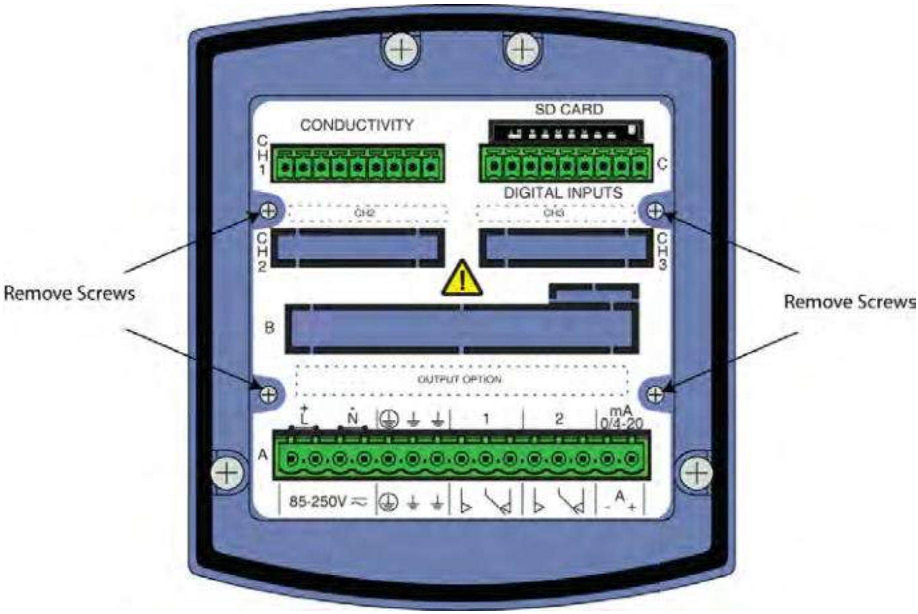
Sensor Input Card Profile



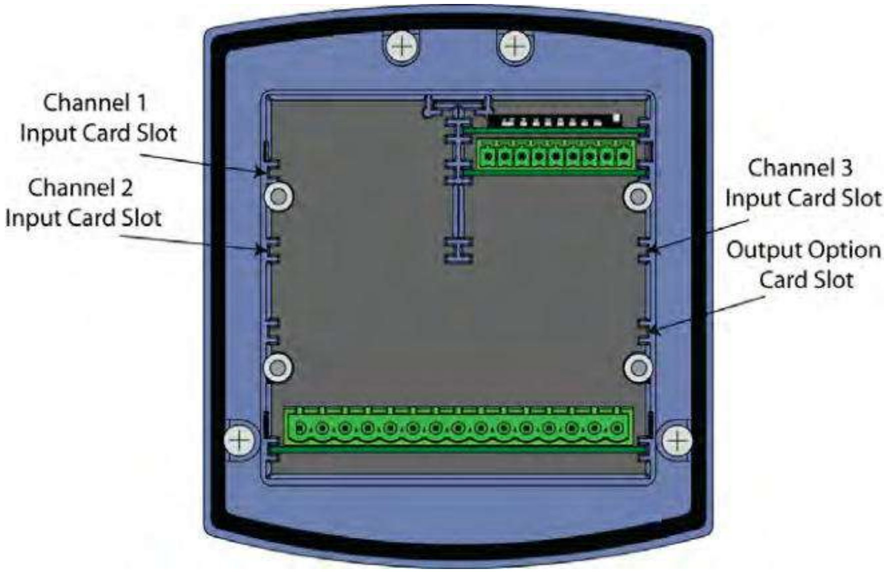
Output Option Card Profile

N.B. Cards must be inserted with the green connector towards the rear of the instrument case.

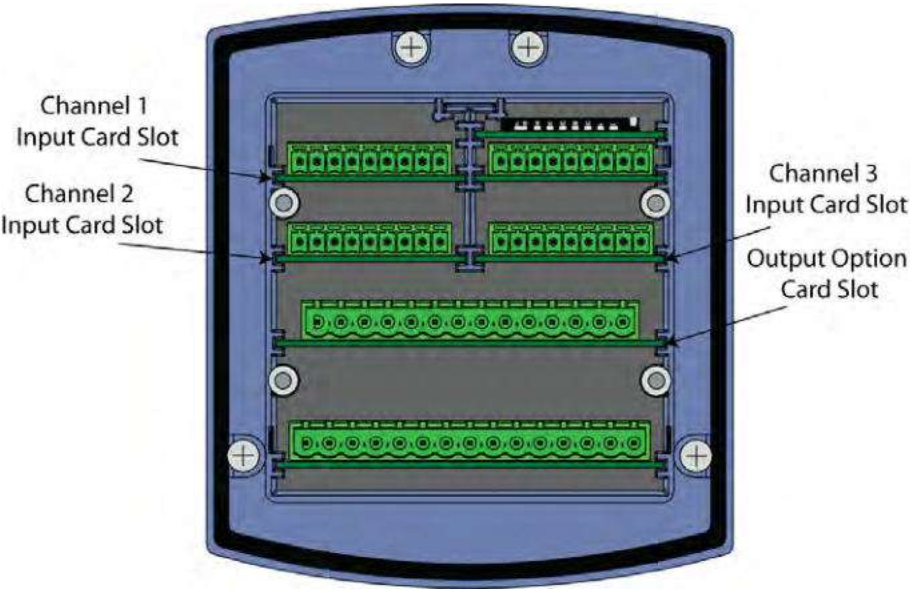
To install the new card into the instrument, first remove all existing connectors from the rear of the instrument. Then remove the four screws shown on the following diagram.



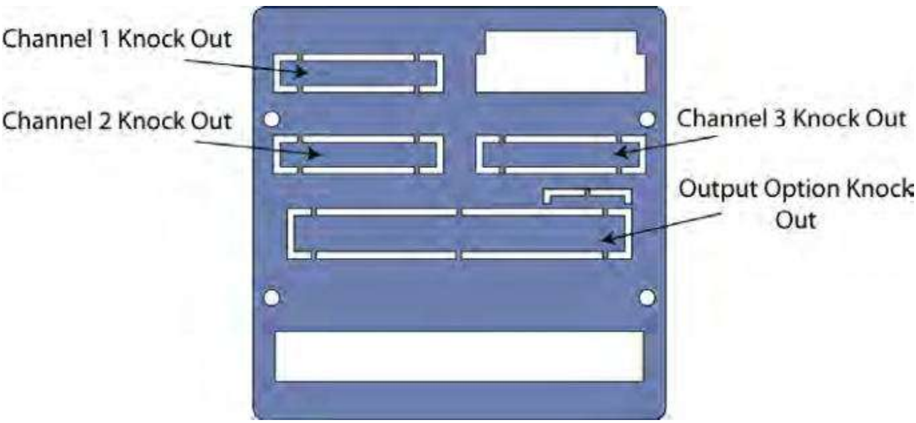
Remove the rear cover and the instrument should look like the next figure, note depending on the configuration of the instrument the add-in card slots may already be populated.



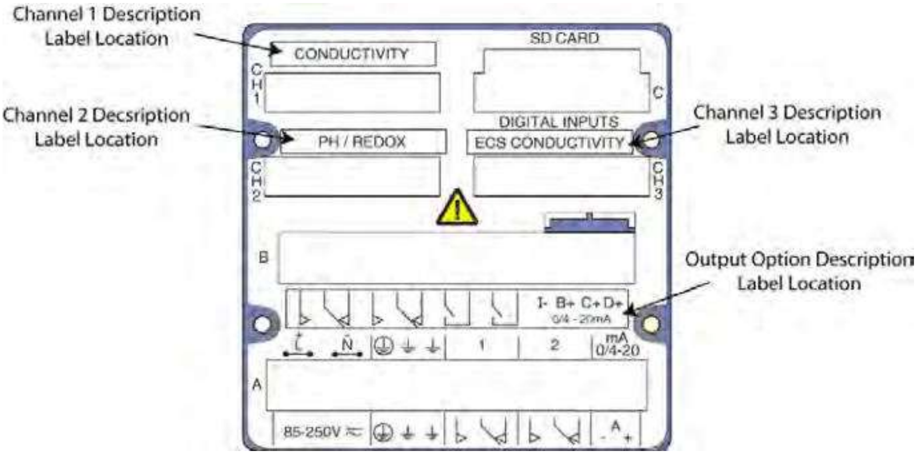
The add-in cards are inserted into the instrument with the edge of the card positioned down the middle of guide, and with the green connector towards the rear of the instrument case. Insert the card all the way in until the far connector is fully home. The following figure demonstrates the instrument with all three channel slots and the output option slot occupied.



Next remove the required knock-outs from the rear cover.



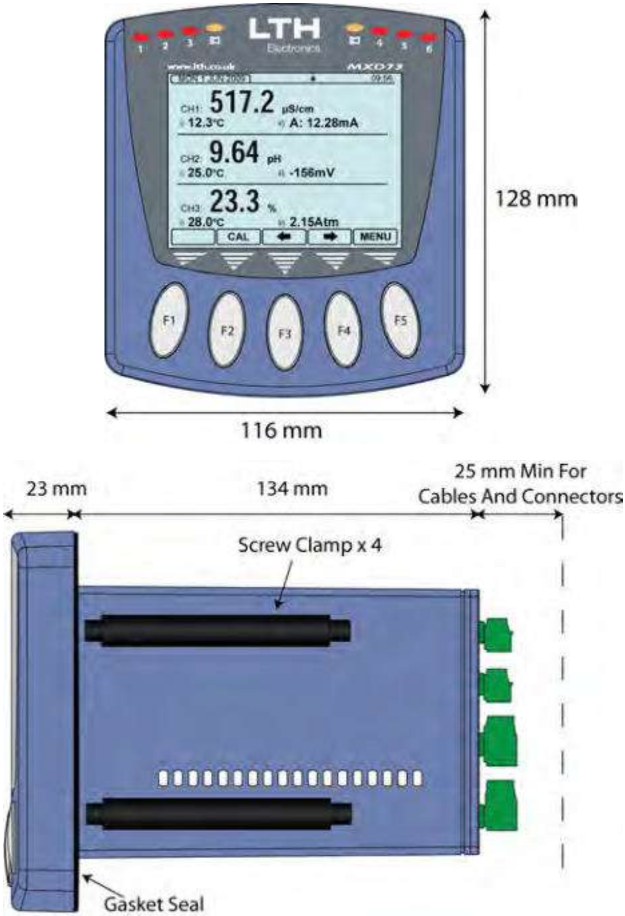
Then depending upon the options installed affix the accompanying add-in description labels to the rear cover in the locations shown.



Finally put the rear cover back on the unit, screw the 4 screws and plug the connectors back in.

Installation – MXD73

The MXD73 panel mount instrument is designed to be flush mounted and sealed in a square cut-out panel, and is held in place with the four screw clamps provided.



MXD73 Overall Dimensions

❖The panel cut-out for the instrument should be 92 mm x 92 mm (+1.0 -0.0)

❖Take care to ensure that the gasket is correctly positioned before tightening the clamps. A badly fitted gasket will not give a good seal to the specified IP rating.

Four screw clamps are supplied with the instrument and are fitted from the back of the instrument.

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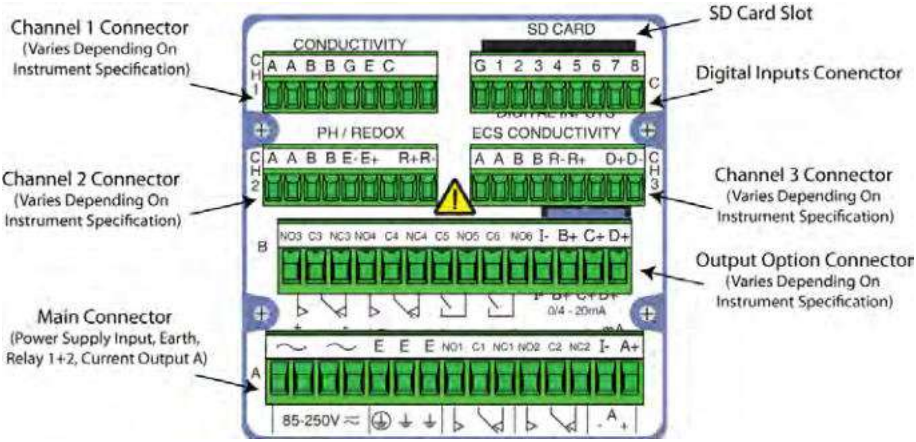
MXD73 Connections

Connections to the MXD73 panel mount instrument are made with up to six plug and socket terminal blocks, accessible to the rear of the unit. The availability of the terminals will vary depending upon which options are installed.

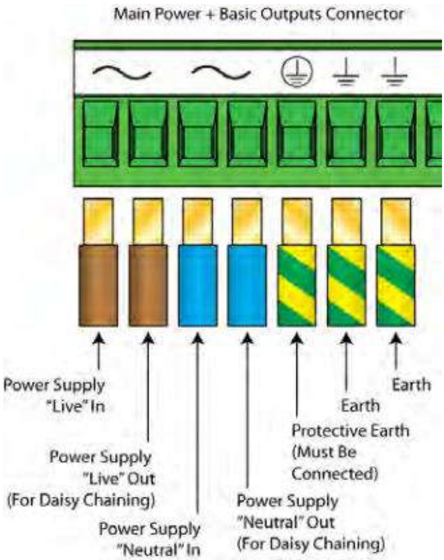


MXD73 Connections

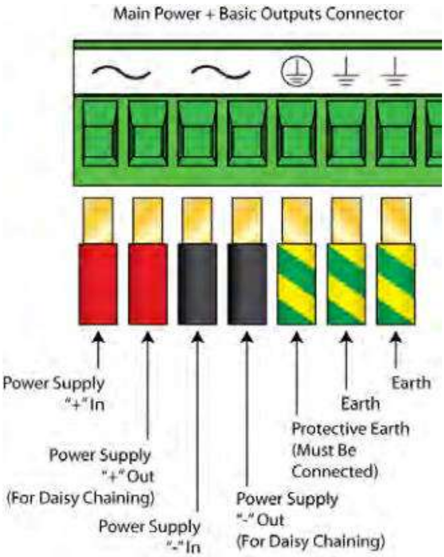
The bottom connector houses the power input and the basic current and relay outputs. The output option connector above this provides additional relay current outputs. The top right connector houses the digital inputs and SD card slot. Finally the remaining three connectors provide the sensor inputs to channels 1, 2 & 3.

Supply Voltage Connections

The MXD73 can be powered from either an AC or DC supply voltage. The unit provides two terminals for each of the input connections ("Live" & "Neutral" for an AC input**,** or **+** & **-** for a DC Input), plus an "Earth" terminal. This allows the supply to be "daisy chained" to the relay contacts and/or other instruments. The instrument uses a universal power supply that accepts a wide range of voltage and frequency inputs**. Refer to the label adjacent to the power supply terminals for the input voltage limits. Exceeding these limits may damage the instrument.**



85-265V AC/DC
Power Connections

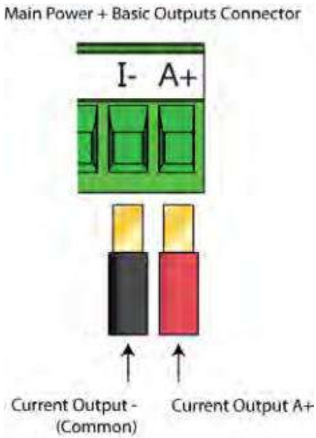


18-32V AC/DC
Power Connections

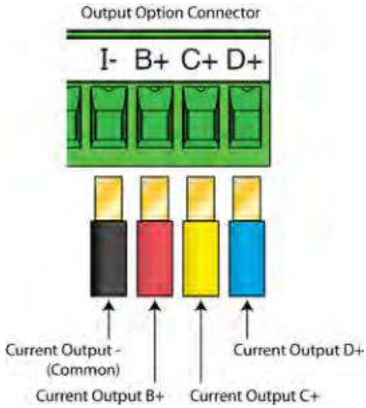
The power supply should be taken from an isolated spur and fused to a maximum of 3 Amps. If the relays require greater current, then a separate 5A fuse will be required. The incoming Earth connection must be connected to the "Protective Earth" terminal.

Current Output Connections

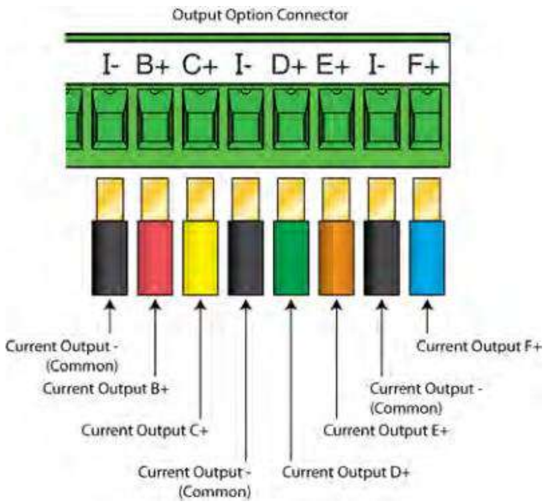
The MXD73 can be supplied with up to 6 current outputs designated A to F, which can terminate into a load resistance not exceeding 750Ω. For best noise immunity use a screened twisted pair cable, with the screen connected to Earth at one end. Use a sufficiently large cable to avoid a high resistance in the overall current loop.



Current Output A Connection Detail.



Current Outputs B - D Connection Details.



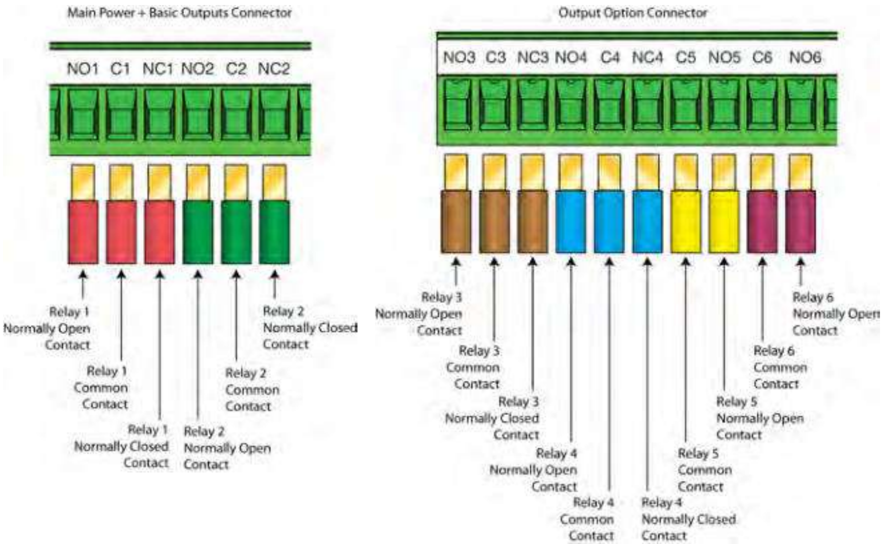
Five Current, Two Relays Output Expansion Card.
Current Outputs B - F Connection Details.

(N.B. Available Current Outputs Varies Depending Upon Instrument Configuration)

Connections

Relay Connections

The MXD73 can be supplied with up to 6 relays designated 1 to 6, 1 to 4 are change over relays while 5 to 6 are normally open relays The relay contacts are connected to the terminals only and are electrically isolated from the instrument itself. **They must be connected in series with a 5 Amp fuse.** A contact arc suppressor may be required to prevent excessive electrical noise, depending upon the load. To switch more than 5 Amps will require a slave relay. For convenience, the power can be looped across from the supply connections.



Relays 1 -2
Connection Details

Relays 3 -6
Connection Details

(N.B. Available Relays Varies Depending Upon Instrument Configuration)

Modbus RS485 Connections

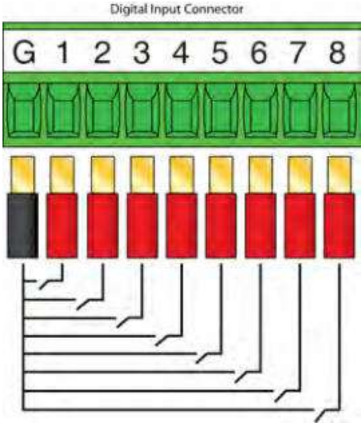
For information regarding connecting the Modbus RS485, please see the wiring section in the accompanying Modbus RS485 handbook.

Sensor Connections

For information regarding connecting the various compatible sensors to the unit see the wiring section in the input card's accompanying handbook.

Digital Inputs

The MXD73 features 8 digital inputs, which can be used to initiate a user configurable instrument operation by use of a volt free link, switch or relay. The instrument can be configured to initiate the appropriate action when the contact either closes or opens.

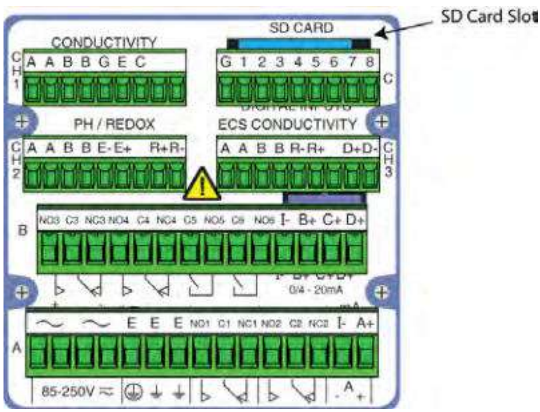


Digital Input Connection Details.

SD Card Interface

The MXD73 features a SD card interface which is compatible with SD, SDHC and SDXC formatted cards (N.B. SDXC cards may need formatting by the MXD73 before use – see user interface guide). The card can be removed whilst the instrument is on but only when the disk icon  is not shown at the top of the display.

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



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.

Index

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MXD75

Multi-parameter Monitor

Installation Guide

Preface

Product warranty

The MXD75 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.

There are no user serviceable parts, including fuses etc., within the unit. Any attempt to dismantle the instrument will invalidate the warranty.

Disclaimer

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

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

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Sixth edition: March 2021

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Manufacturing Standards

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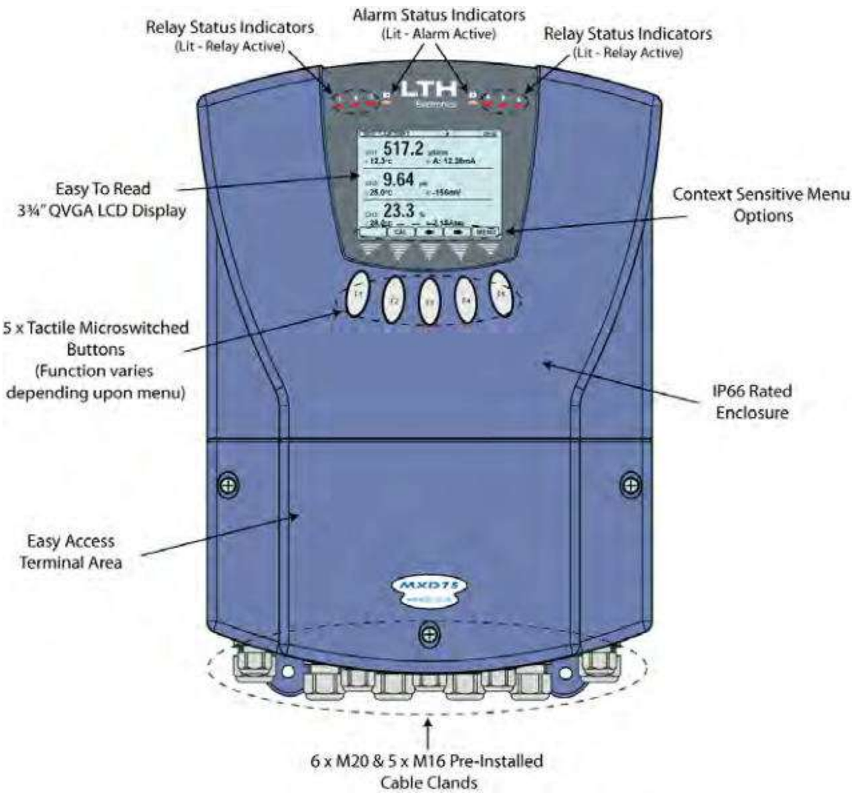
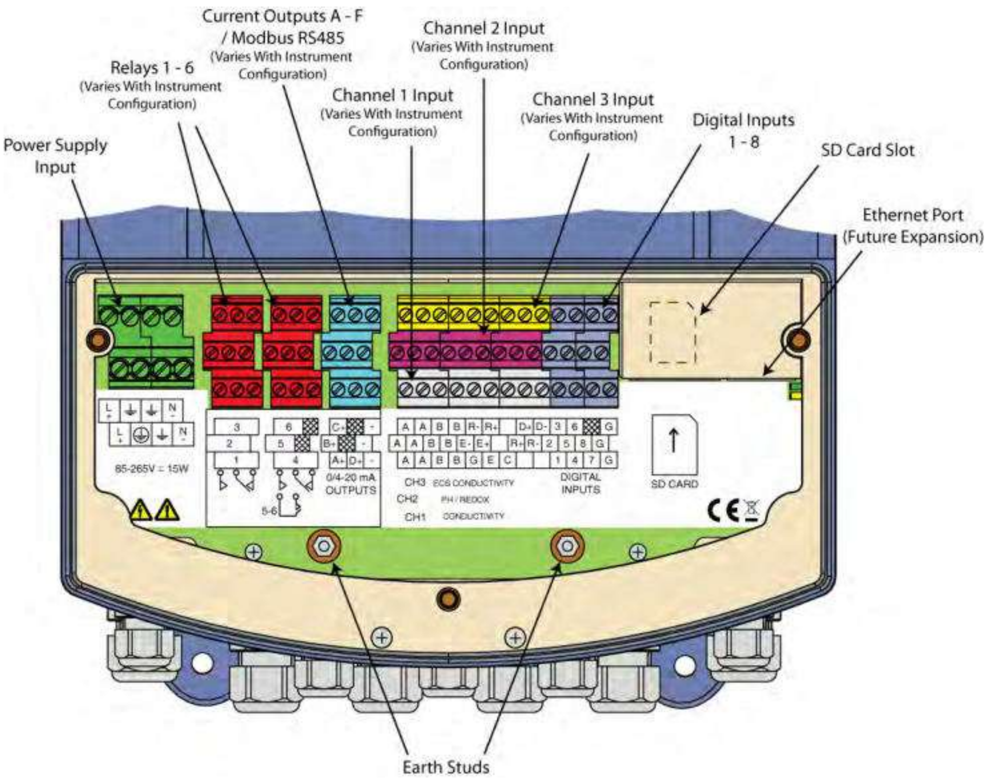
Introduction

The MXD75 is a microprocessor controlled multi-parameter instrument that can be installed with a user selected combination of up to 3 Sensor Input Cards. The instrument may be subsequently modified to meet changing requirements by the installation of additional, or different, cards and the attachment of the appropriate sensor(s).
Utilising a multifunction easy to read QVGA LCD the instrument displays readings and provides feedback to the operator on the status of the sensors and instruments outputs.
In addition the instrument features, depending upon configuration, up to six control relays, up to six 0/4 – 20mA current outputs and an Modbus RS485 interface. These can be used to provide fully configurable control, alarm and feedback.
Finally the instrument also features an SD card interface which enables the user to backup and restore instrument settings, copy settings between instruments, log the sensor readings (optional extra) and to upgrade the instrument's software.



MXD75 Overview



MXD75 Termination Overview

MXD75 Instrument Specification

Input Expansion Slots	3 slots, user configurable with any combination of available input add-in cards.
Output Expansion Slots	1 slot, user configurable with an additional output option add-in card.
Ambient Operating Temperature	-20°C to +50°C (-4°F to +122°F) for full specification.
Display	3 ¾” QVGA back lit LCD module.
Buttons	5 tactile feedback, micro-switched, silicone rubber.
Alarm LED’s	2 Yellow LED’s located above the main display area for instrument’s alarm status, lit = active.
Digital Inputs	8 contact closures for remote activation of user defined operations. Can be configured to operate in either normally open or normally closed modes.
Current Output Options	1 as standard, expandable up to a total of 4 or 6 depending on the number of relays.
Current Output Specification	Each selectable 0-20mA or 4-20mA into 750 ohms max, fully isolated to 2kV. Expandable up to 5% of any operating range and offset anywhere in that range.
Current Output Adjustment	±0.01mA, 3 point 0-4-20 mA for remote monitor calibration.
Setpoints and Control Relays Options	2 change over relays as standard, expandable up to a total of either 4 change over relays, or 4 change over relays + 2 normally open relays depending on the number of current outputs.
Setpoints and Control Relays Specification	Fully configurable setpoints with volt free contacts for each relay. Rated at 5A @ 30V DC / 5A @ 250V AC.
Setpoint LED’s	6 Red LED’s located above main display area for setpoint status indication, lit = relay energised.

Setpoint Modes	On/Off, Time Proportioning, Pulse Proportioning, Band and Latch. Delay timer adjustable from 00:00 to 59:59 mm:ss. Hysteresis 0 to 9.9%. Dose alarm timer, with supplementary initial charge function. Both adjustable from 00:00 to 59:59 mm:ss. Adjustable cycle time and proportional band in proportional modes.
Setpoint Cleaning	Cleaning mode with adjustable duration (max 10m) and interval times (max 24h), auto offline function with recovery timer.
Setpoint Alarm	Unit or channel alarm mode, whereby the relay can be energised under certain set conditions.
Modbus RS485 Interface (Optional)	Supports RTU and ASCII formats Node Address: 1 to 247 Baud Rates (Bits Per Second) : 300, 600, 1200, 2400, 4800, 9600, 19200, 31250, 38400 Parity Options: Even, Odd, None
SD Card Interface	Enables backing up and restoring of instrument configuration, log the sensor readings (optional extra) and on site upgrading of instrument software. SD, SDHC and SDXC-FAT32 cards supported.
EMC	S.I. 2016/1091 & 2014/30/EU using BS EN 61326-1: 2013.
Low Voltage Directive	S.I. 2016/1101 & 2014/35/EU using BS EN 61010-1: 2010.
Power Supply	Universal 80-265V AC or DC, 15W max. LV Option 18 – 32 V AC or DC, 20W max.
Instrument Housing	UL 94-V0 PC/ABS.
Ingress Protection Rating (IEC 60529 Protection Rating)	IP66.
Weight	Maximum 2.7 kilograms (instrument only).
Dimensions	331 x 242 x 110 mm (H, W, D) excluding mounting brackets.

Installation – Safety & EMC

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

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

Wiring Installation

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

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

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

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

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

❖ The terminal cover of the surface mount unit must be correctly re-assembled and securely fastened to maintain a continuous electro-magnetic shield around the instrument.

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

Noise suppression

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

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

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

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

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

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

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

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

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

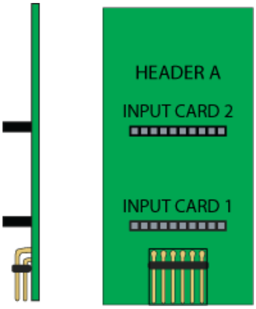
❖ In cases of very high background RF and HF noise environments, LTH can supply a length of proprietary RF suppressing mains cable.

MXD75 Add-in Cards Installation

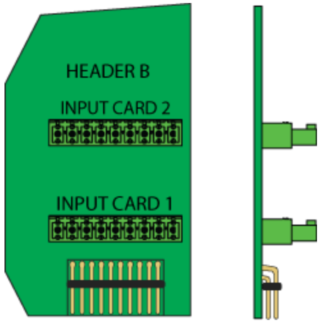
The MXD75 is designed to be expandable by the use of add-in cards; these add-in cards can take the form of either a sensor input add-in card or an output option add-in card. The MXD75 can be fitted with up to 3 sensor input cards and 1 output option card. The sensor input cards are designated Input Card 1, Input Card 2 and Input Card 3. On the instrument display these are designated Channel 1, Channel 2 and Channel 3.

L Electrostatic precautions must be taken when handling the Add-in cards.

Input cards 1 & 2 are installed via the use of headers A and B (supplied with instrument).

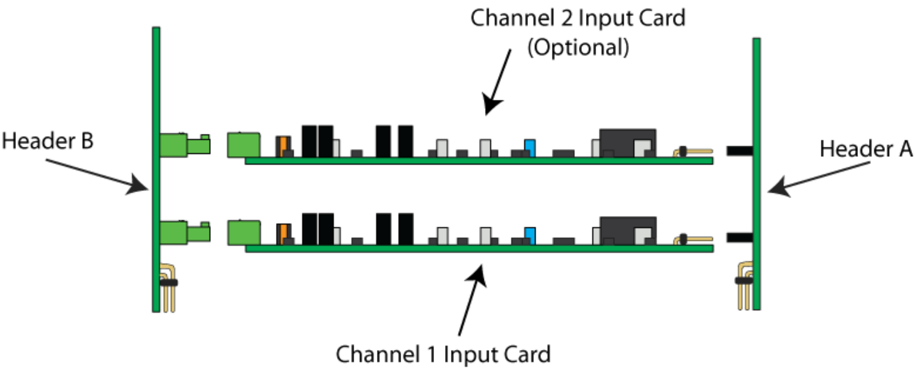


Header A

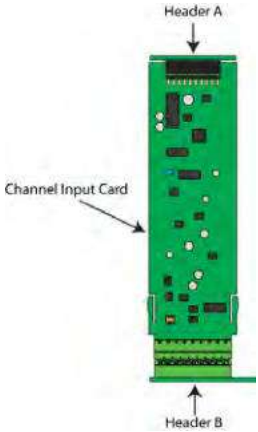


Header B

Insert the required input cards between the headers as shown in the following two diagrams, ensuring that the connectors are correctly aligned with the headers on the input cards.

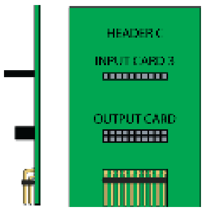


Input Card 1 & 2 Installation Side View

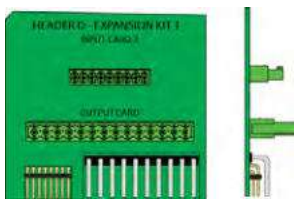


Input Card 1 & 2 Installation
Top View

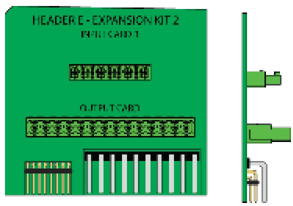
Input card 3 and the output option card are installed via the use of header C and either header D or E depending on the configuration of the output option card. (N.B. header's C, D and E are not supplied with the standard instrument and must be purchased separately if upgrading the unit after initial purchase).



Header C

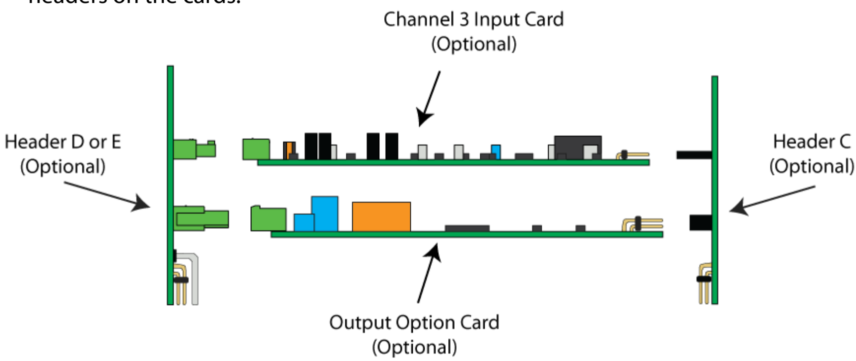


Header D

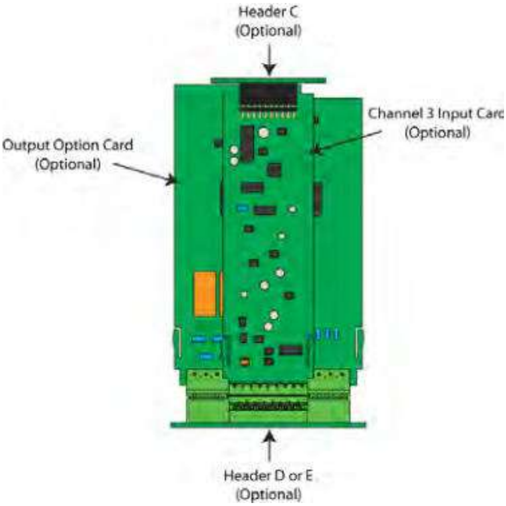


Header E

Insert the required input card or output option card between the headers as shown in the following two diagrams, ensuring that the connectors are correctly aligned with the headers on the cards.



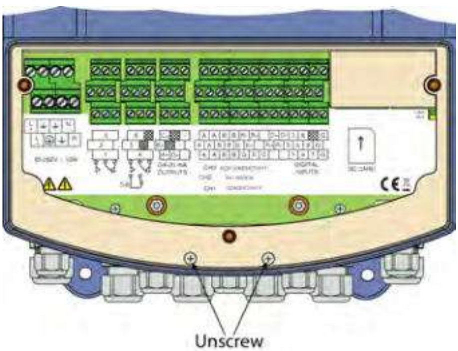
Input Card 3 & Output Option Card Installation Side View



Input Card 3 & Output Option Card Installation Top View

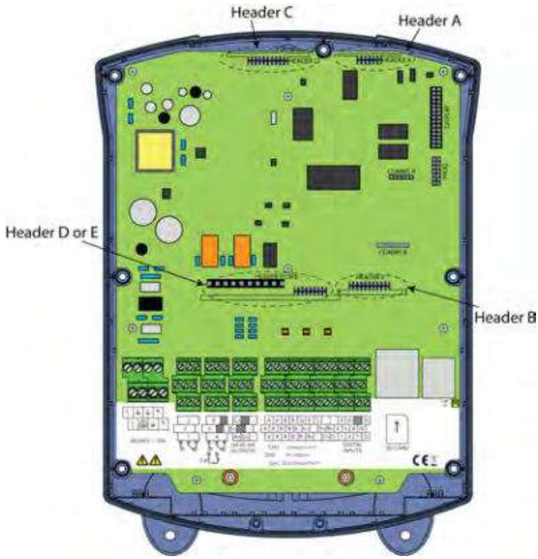
To install the cards and headers into the instrument, first remove the terminal cover.

Then remove the two revealed screws at the bottom of the case.

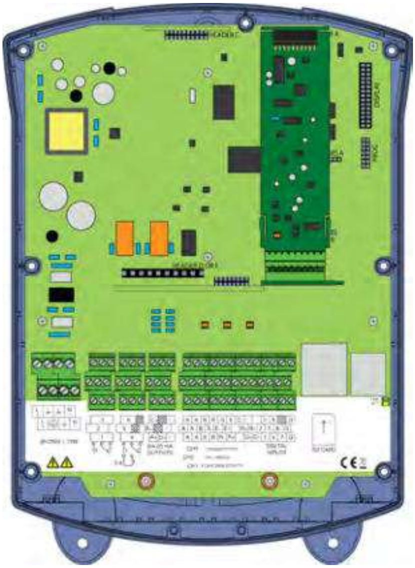


Then on the underside of the case remove the remaining seven screws. N.B. Do not lose the o-rings which may come off when removing the screws.

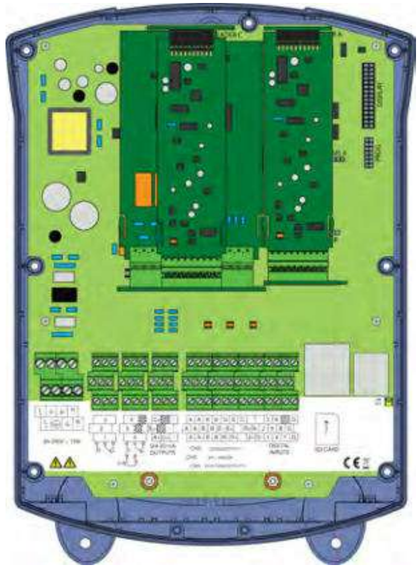
The headers with the cards attached must then be inserted into the instrument's main board connectors. Match the header's name with corresponding text on the board, as shown in the following figure. Care must be taken to align the header board with the dotted outline on the main board.



Once inserted the instrument should look as follows

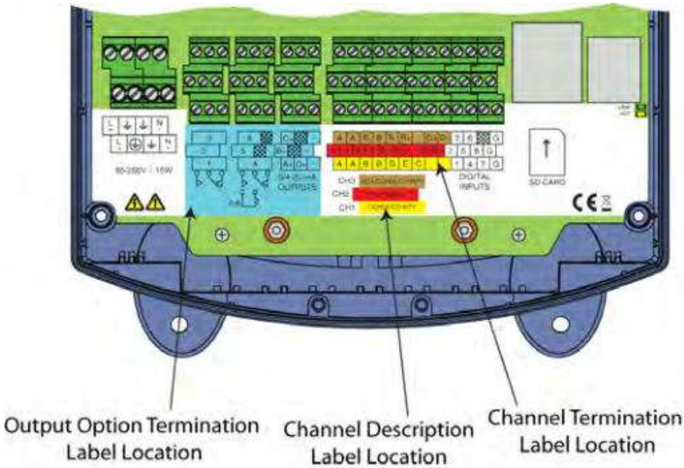


With Input Card 1 and 2

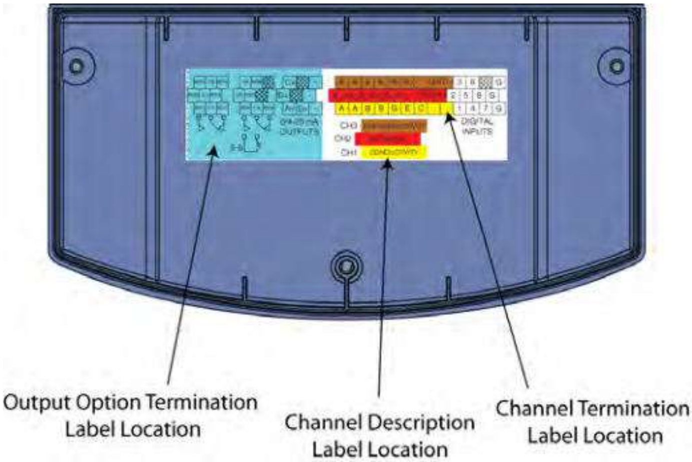


With Input Card 1, 2, 3 and Output Option Card

Now attach the supplied connection labels to the terminal area label and inside the terminal cover as shown.



Supplied Terminal Label Locations



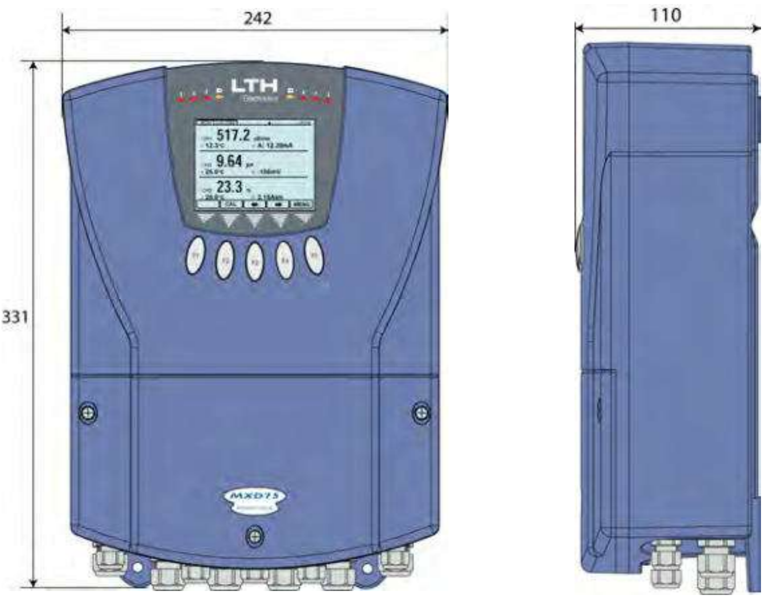
Supplied Terminal Cover Label Locations

Next reassemble the instrument case, ensuring all of the o-rings are in place on the back of the case and all of the screws are re-inserted. Connect the power (see Supply Voltage Connections section) and check that all of the new cards have been recognised by the instrument.

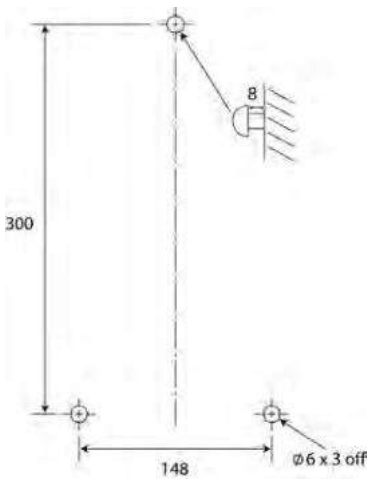
Now consult the appropriate wiring section for details of how to connect the sensors and outputs.

Installation – MXD75

The MXD75 Surface mount instrument is designed for fixing to a wall or other flat surface. Three 6.5mm diameter holes are provided for this purpose. Note that fasteners are not provided.



MXD75 Overall Dimensions

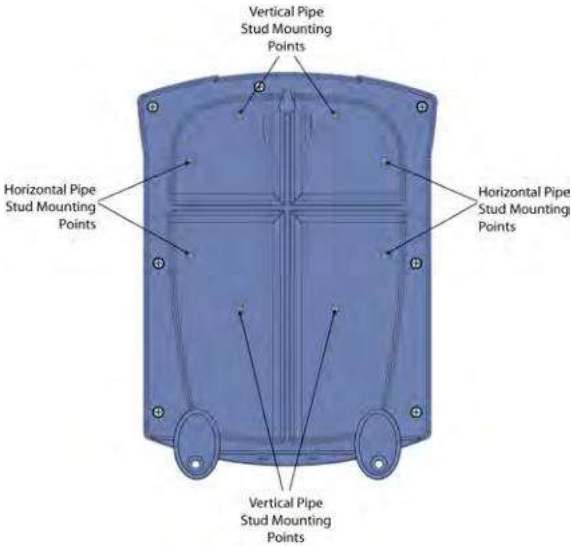


Drill Hole Dimensions

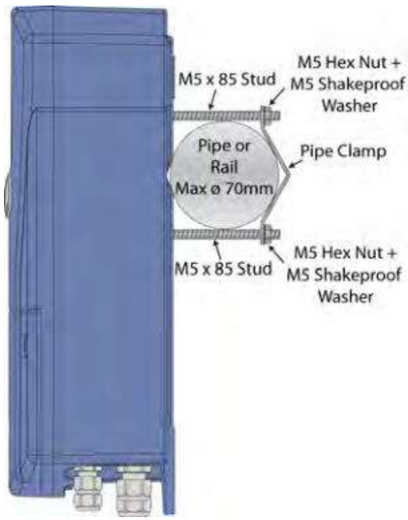
- ❖ LTH Recommends using No. 10 x 1¼ inch round head screws or similar for mounting.
- ❖ Ensure top screw head is 8mm proud.
- ❖ Care must be taken when fitting the unit on uneven walls or surfaces. Do not over stress the mounting lugs.
- ❖ Over tightening the mounting screws could also break the lugs.

Pipe Mounting

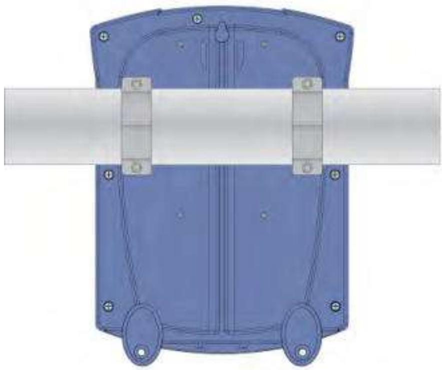
The handrail & pipe-mounting kit is designed for fixing to a vertical or horizontal handrail or pipe, of 25 – 70 mm outside diameter. (Optional – LTH Part No. 7599).



The instrument is then clamped using the mounting kit as follows.



Note: Care should be taken not to over tighten mounting, as damage may result to enclosure.



Horizontal Mounting

Vertical Mounting

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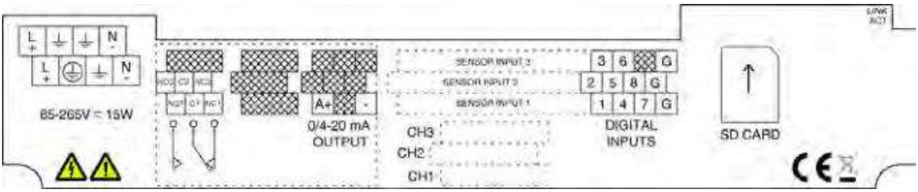
MXD75 Basic Connections

Having ensured that the main power is isolated from the instrument, remove the terminal cover by releasing the three front screws. (The terminal cover is the small cover at the bottom of the front panel). Once the cover has been removed the following terminal arrangement should be visible. N.B. the appearance of the label will vary depending upon which options are installed in the instrument.

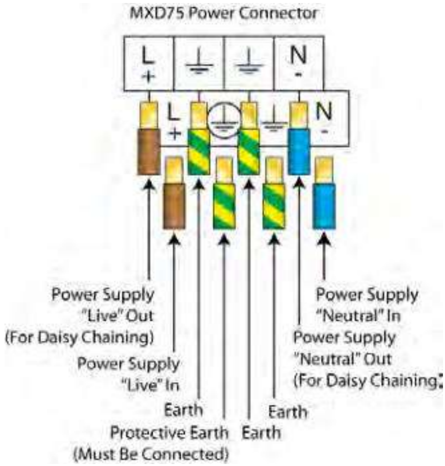


MXD75 basic terminal label

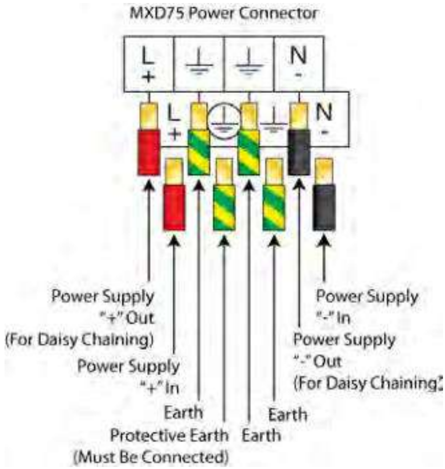
The cables should be fed through the cable glands. After each cable has been attached, pull most of the cable slack back through the cable gland to prevent any unwanted RF energy from being radiated inside the housing. Make sure not to strain the cable within the instrument. Tighten the cable gland onto the cable so that it grips sufficiently to seal and to prevent the cable from being pulled back through the gland.

Supply Voltage Connections

The MXD75 can be powered from either an AC or DC supply voltage. The unit provides two terminals for each of the input connections ("Live" & "Neutral" for an AC input**,** or **+** & **-** for a DC Input), plus an "Earth" terminal. This allows the supply to be "daisy chained" to the relay contacts and/or other instruments. The instrument uses a universal power supply that accepts a wide range of voltage and frequency inputs**. Refer to the label adjacent to the power supply terminals for the input voltage limits. Exceeding these limits may damage the instrument.**



85-265V AC/DC
Power Connections



18-32V AC/DC
Power Connections

The power supply should be taken from an isolated spur and fused to a maximum of 3 Amps. If the relays require greater current, then a separate 5A fuse will be required. The incoming Earth connection must be connected to the "Protective Earth" terminal.

Modbus RS485 Connections

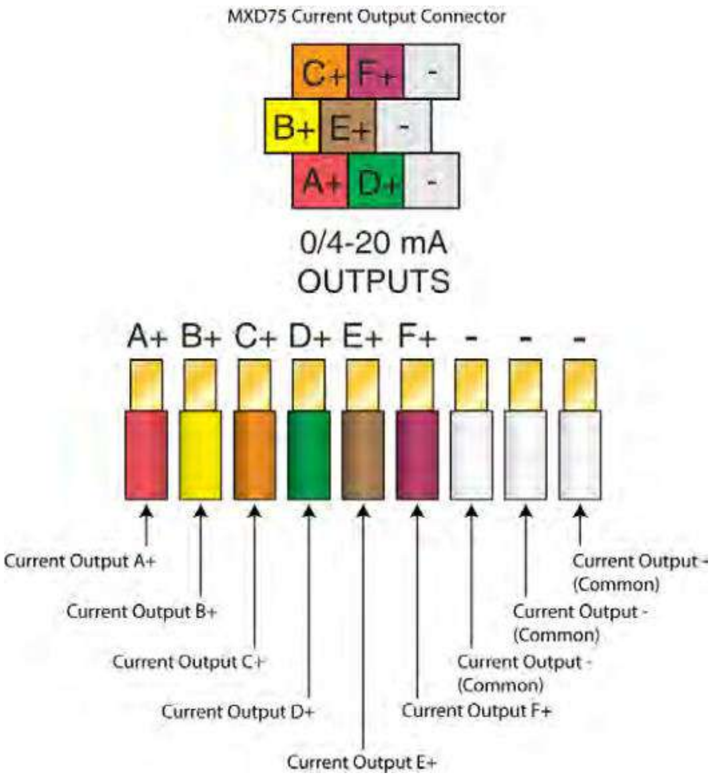
For information regarding connecting the Modbus RS485, please see the wiring section in the accompanying Modbus RS485 handbook.

Sensor Connections

For information regarding connecting the various compatible sensors to the unit see the wiring section in the input card's accompanying handbook.

Current Output Connections

The MXD75 can be supplied with up to 6 current outputs designated A to F, which can terminate into a load resistance not exceeding 750Ω. 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.

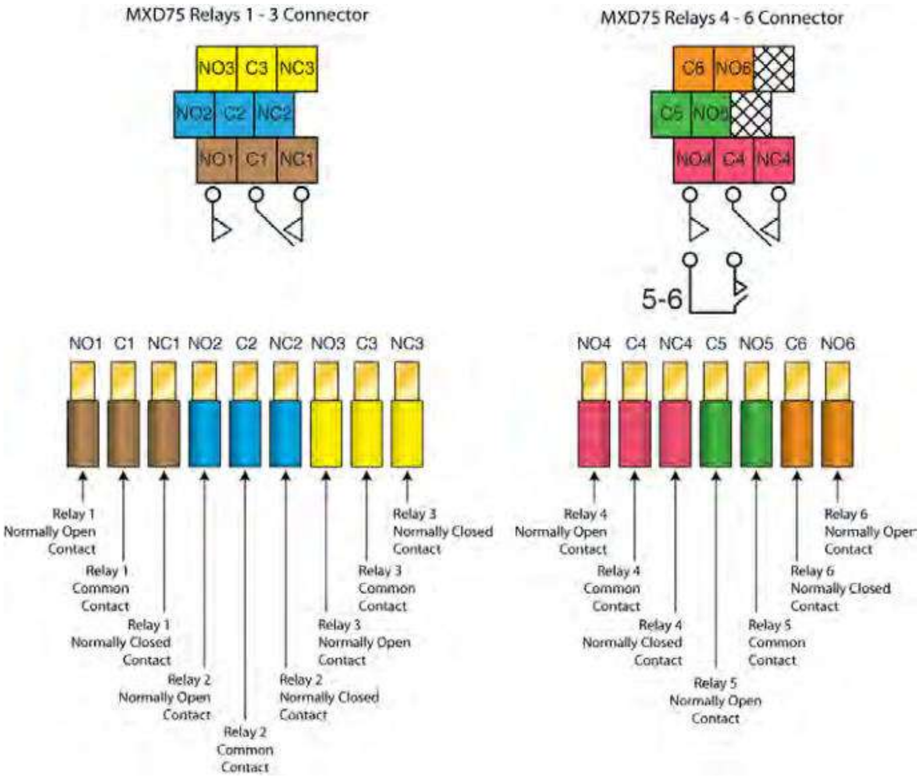


MXD75 Surface Mount Current Output Connection Detail.

(N.B. Available Current Outputs Varies Depending Upon Instrument Configuration)

Relay Connections

The MXD75 can be supplied with up to 6 relays designated 1 to 6, 1 to 4 are change over relays while 5 to 6 are normally open relays. The relay contacts are connected to the terminals only and are electrically isolated from the instrument itself. **They must be connected in series with a 5 Amp fuse.** A contact arc suppressor may be required to prevent excessive electrical noise, depending upon the load. To switch more than 5 Amps will require a slave relay. For convenience, the power can be looped across from the supply connections.

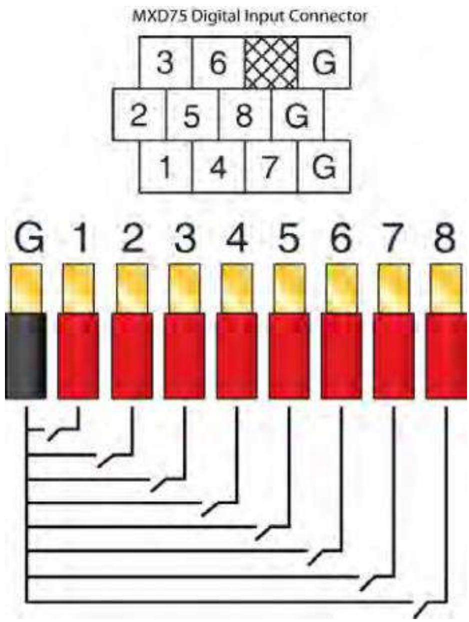


MXD75 Surface Mount Relay Connection Details.

(N.B. Available Relays Varies Depending Upon Instrument Configuration)

Digital Inputs

The MXD75 features 8 digital inputs, which can be used to initiate a user configurable instrument operation by use of a volt free link, switch or relay. The instrument can be configured to initiate the appropriate action when the contact either closes or opens.

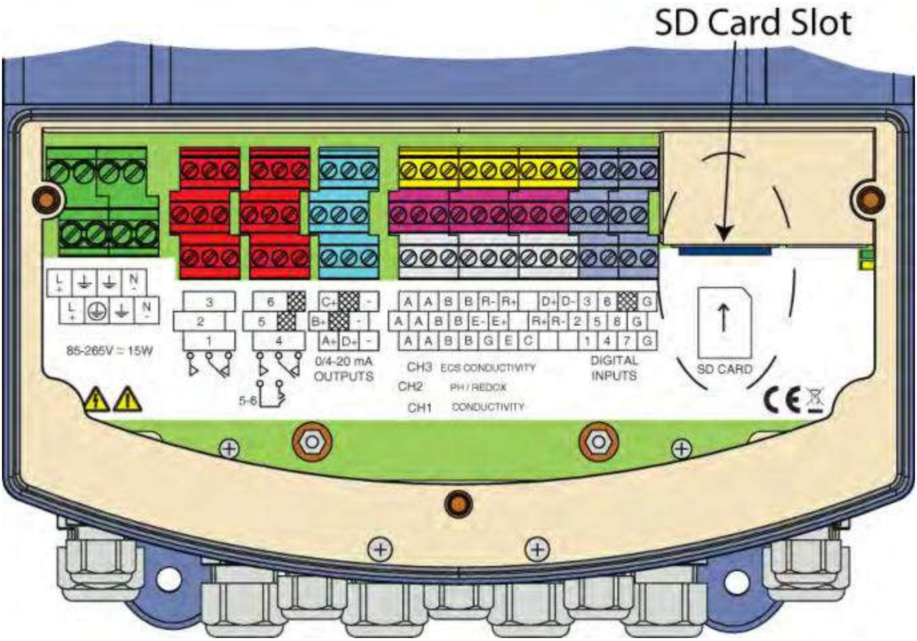


MXD75 Surface Mount Instrument Digital Inputs Connection Detail.

SD Card Interface

The MXD75 features a SD card interface which is compatible with SD, SDHC and SDXC formatted cards (N.B. SDXC cards may need formatting by the MXD75 before use – see user interface guide). The card can be removed whilst the instrument is on but only when the disk icon is <u>not</u> shown at the top of the display.

To insert the card ensure that the corner notch is on the top right of the card, and then just push it all the way in to the socket. To remove the card push it up then release and the card should then come out of the socket. N.B. When removing, it may be required to pull the card out of the last bit of the socket.



Guarantee and Service

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

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

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

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

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

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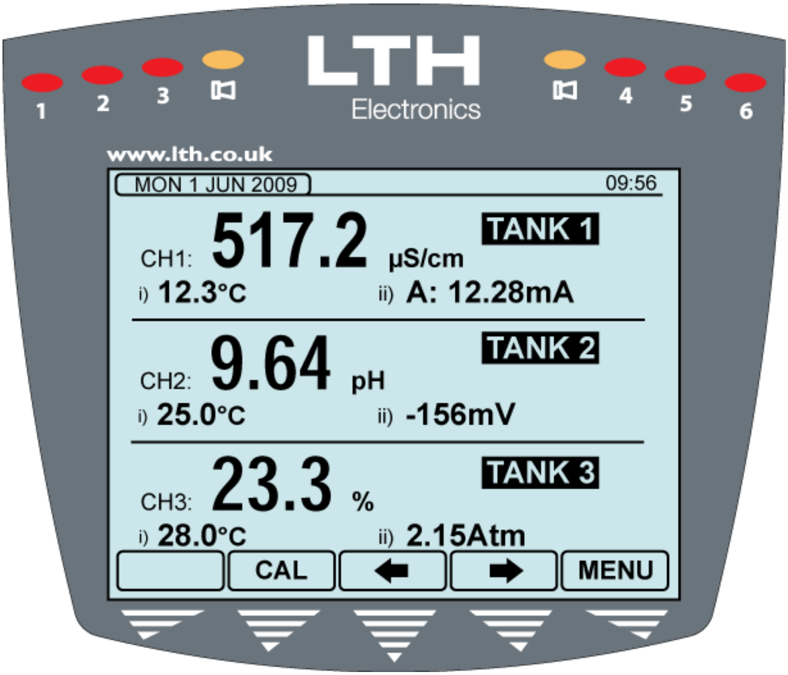
MXD70 SERIES

Multi-parameter Monitor



User Interface & Data Logging Guide

Preface

Product warranty

The MXD70 Series has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided ‘as is’ without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

Copyright and trademarks

Third edition: September 2013

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Web : www.lth.co.uk

Manufacturing Standards

CE

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. 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.

Contents

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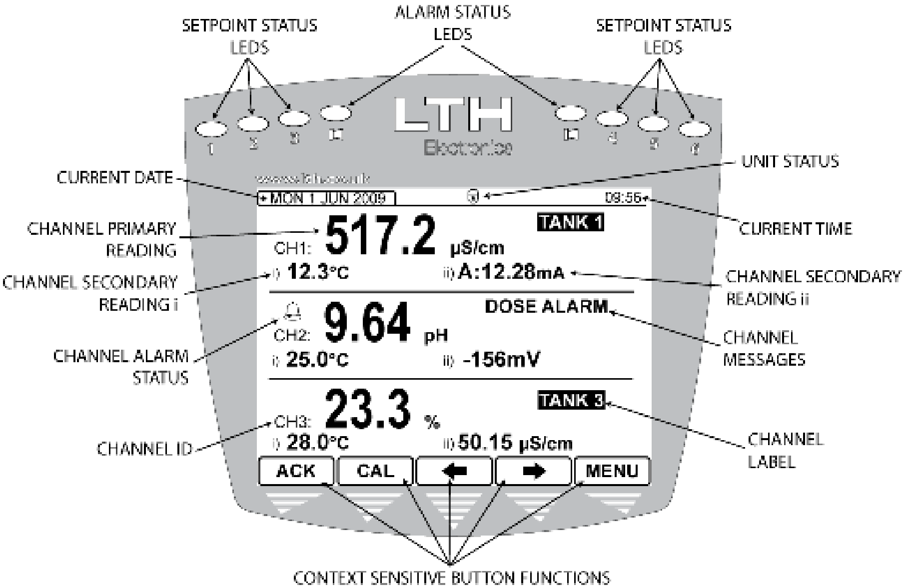
User Interface

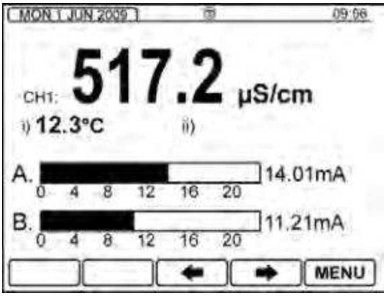
CAUTION! BEFORE PROCEEDING, ENSURE THAT THE INSTALLATION INSTRUCTIONS HAVE BEEN FOLLOWED CORRECTLY. FAILURE TO DO SO MAY RESULT IN AN ELECTRICALLY HAZARDOUS INSTALLATION OR IRREPARABLE DAMAGE TO THE INSTRUMENT.

The MXD70 Series uses a high quality backlit 3¾" QVGA LCD to display the channel readings and settings. This is accompanied by 5 control buttons whose function varies depending upon which screen the user is viewing. The button function is indicated by the control section at the bottom of the display. Also present are six Setpoint Status LEDs that when illuminated indicate which setpoint / relay is active. Located between the setpoint LEDs there are two Alarm Status LEDs which provide clear indication of a fault within the instrument.

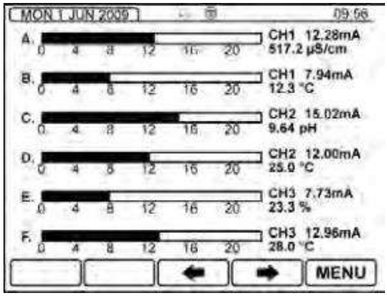


The Front Screen

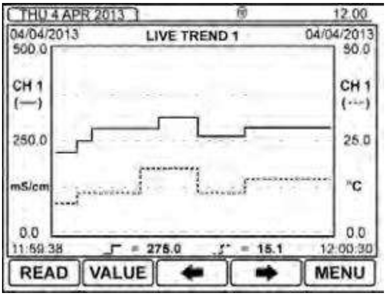
The MXD70 Series front screen has the capability of showing up to three sensor input channels. Each channel shows the main sensor reading, two secondary readings and a channel label, all of which can be customised to the user's requirement. If only one channel is displayed on the front screen then the ability to show up to two current output trends becomes available. Alternatively a current outputs trend screen is available or if purchased, three live trend screens which can show up to 200 readings. See Setup Front Screen on page 15 for more information.



Front Screen Trends



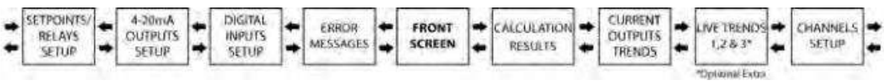
Current Output Trends



Live Trend (Optional Extra)

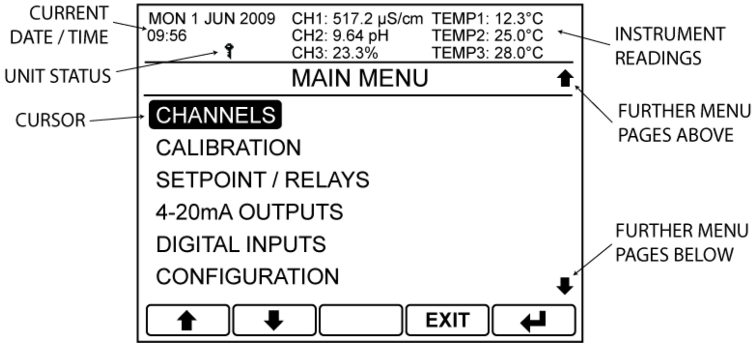
The Menu System

When the instrument is switched on it will complete a configuration check that will take approximately 20 seconds after this it will default to the front screen. The user interface is arranged in two ways, the first is a quick configuration overview which is accessible by scrolling left or right from the front screen as shown below.



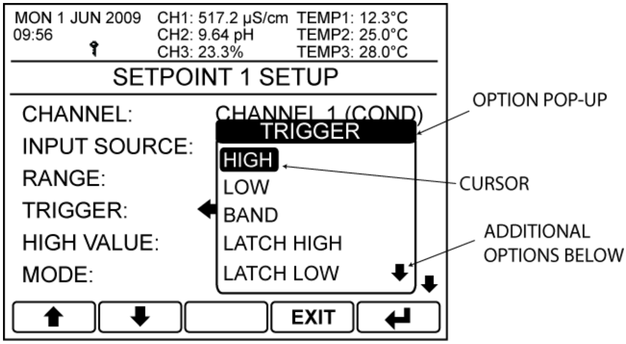
Scrolling Menu Layout

The second menu is accessible by pressing the menu button on the front screen. This then brings up the main menu from which the user can access the instruments settings.



The main menu is split into two main sections. The top shows the current time & date, the unit status and the instrument's current readings. The bottom section shows the current options for that menu which may be selected by moving the cursor with the arrow buttons and pressing the enter button. The exit button is used to return to the previous menu or alternatively if held down for 3 seconds will take the instrument straight back to the front screen. If no buttons are pressed after 2 minutes the instrument will default back to the front screen. To the right of the menu screen arrows will indicate if there are further menu pages above or below the current one.

When changing a setting an option pop-up will appear from which the user can select an option or alternatively enter in a value. Note when looking at a list of options an arrow in the top right or bottom right corner of the pop-up indicates further options above or below the ones currently shown.



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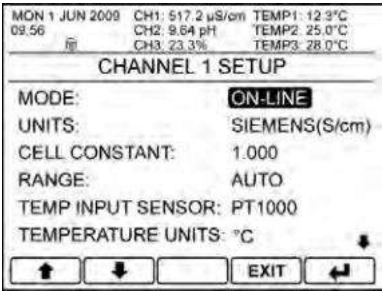
Security Code Access

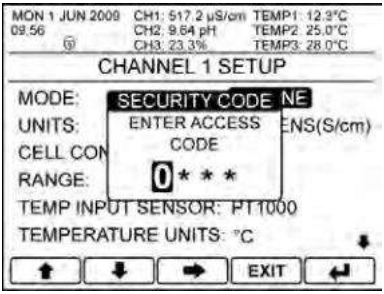
To protect the instrument setup from unauthorised or accidental tampering, a security access code system is present. This is implemented via the instrument's menu system which operates in two modes, "locked" as indicated by a padlock symbol and "unlocked" as indicated by a key symbol. The locked mode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

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



Select the option you wish to change and press enter to bring up the Security Code pop-up.

⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Chose Option



Enter the required Access Code.

If the code is incorrect the user will be prompted to try again.

If the code is correct the padlock at the top of the screen will turn to a key and the unit will be unlocked

⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Enter Code

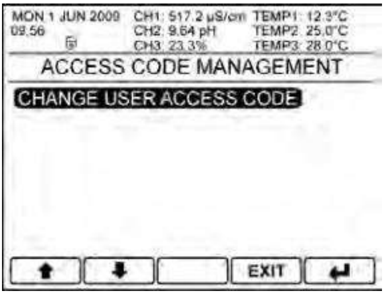
Access Code Management

The user can select their own access code in the access code management menu, or alternatively they can disable the security system permanently by changing the access code to 0000.

Main Menu

From the front screen press the menu button to show the main menu options and select Access Code Management.

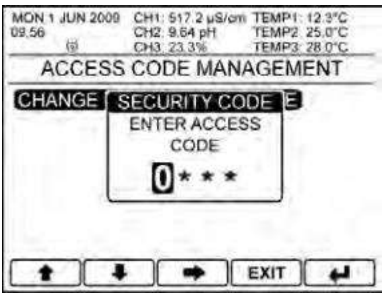
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Access Code Management

Select change user access code.

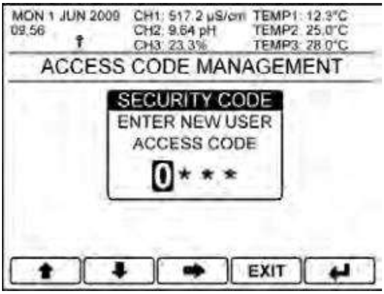
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Enter Current Code

The user is required to enter the existing security code before the new code can be entered.

⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Enter Code



Enter New Code

Enter the new security access code

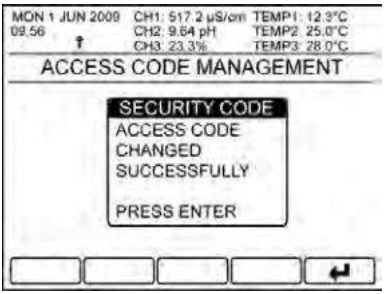
NB. Set the new code to 0000 to disable the security access system and permanently unlock the instrument.

⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Code

New Code Confirmation

Confirm the change of the security access code.

EXIT	– Cancel
↵	– Confirm Change



Change Confirmation

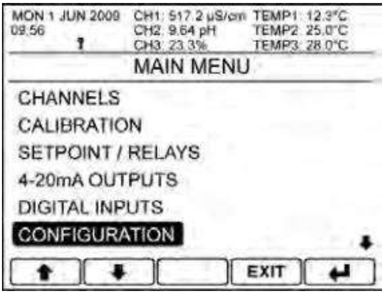
The instrument will then confirm that the security code has been successfully changed.

↵	– Exit

Blank Page

Configuration

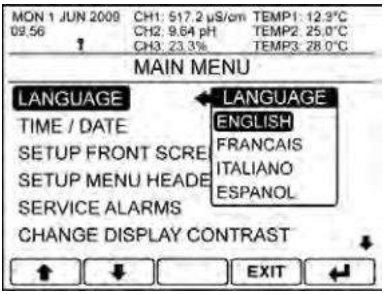
The configuration menu enables the user to configure the basic operating parameters of the instrument.



Main Menu

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

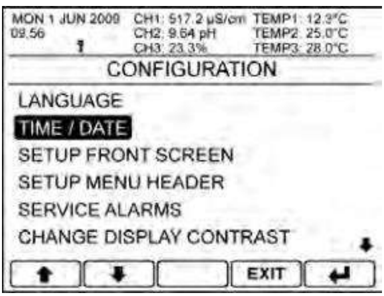
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Language

The MXD70 Series has the ability to support multilingual menus. The language of choice can be selected from this menu.

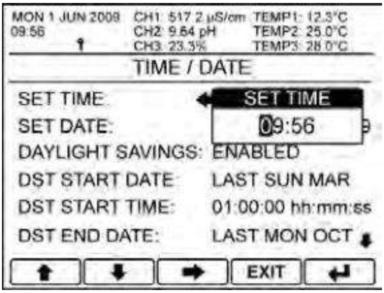
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Time / Date

Configure the internal battery backed clock.

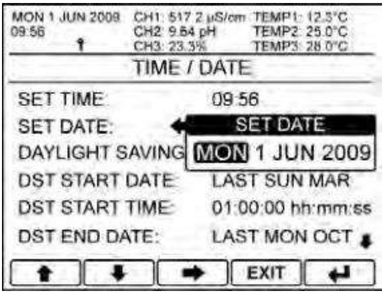
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Set Time

Sets the instruments time.

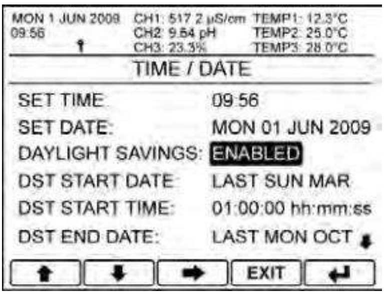
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Time



Set Date

Sets the instruments date.

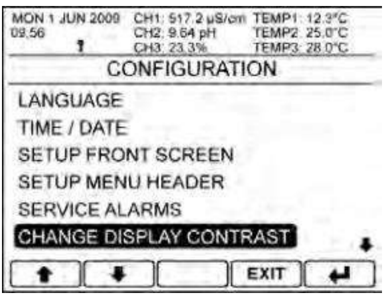
⬆/⬇	– Increase / Decrease item
➡	– Select Next item
EXIT	– Cancel
↵	– Save date



Daylight Savings

This allows the instrument to automatically adjust it's time for when daylight savings starts and ends. The start and end times may be adjusted to allow for local differences.

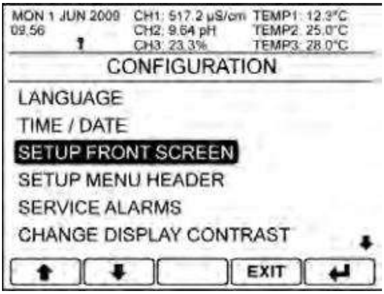
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Change Display Contrast

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

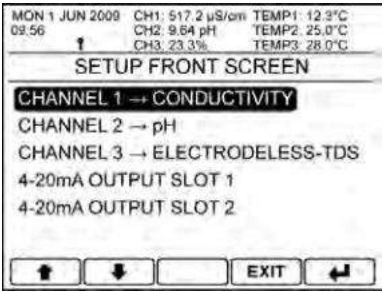
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Setup Front Screen

This allows the user to customise the information the front screen displays

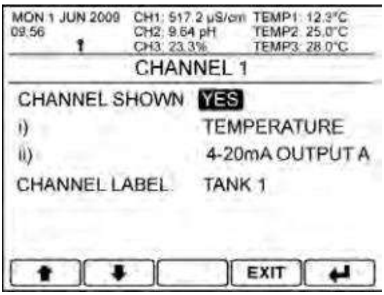
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Select Front Screen Channel

Select which front screen channel you wish to edit

⬆/⬇	– Select Option
EXIT	– Return to Configuration Menu
↵	– Enter Option



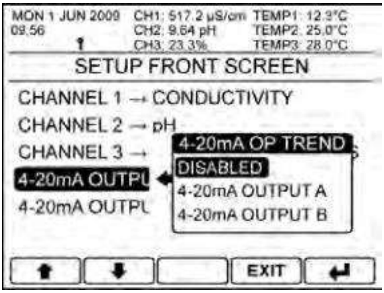
Channel Setup

- Channel shown – Select whether the channel is shown or not.

- i), ii) – Define which is displayed in the either of the two secondary reading slots. Available options depend on the selected input card type but include temperature, sensor current, pressure and any associated current output values.

- Channel Label – Define the channel label that appears on the front screen adjacent to the channel reading (7 characters maximum).

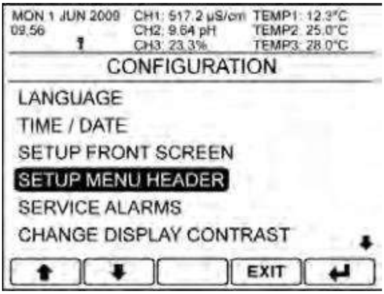
⬆/⬇	– Select Option
EXIT	– Return to Configuration Menu
↵	– Enter Option



Front Screen Trend

If only one channel is displayed on the front screen the user has the ability to show up to two current output trends called 4-20mA Output Slot 1, and 4-20mA Output Slot 2. Note, that you will only be able to select the current outputs that are associated with the displayed channel.

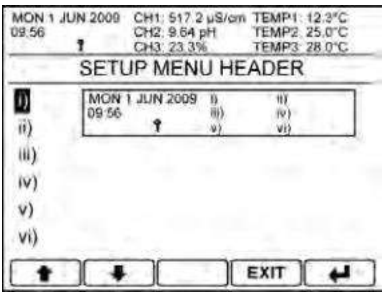
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Setup Menu Header

This allows the user to customise the information the menu header displays.

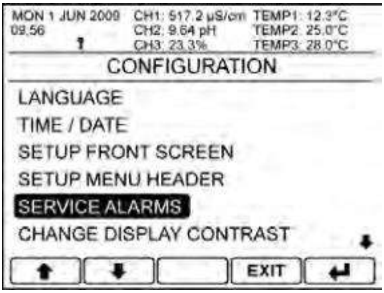
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Select Menu Header

By looking at the legend shown select which menu header location you wish to edit, then chose the value from the displayed pop-up.

⬆/⬇	– Select Option
EXIT	– Return to Configuration Menu
↵	– Enter Option



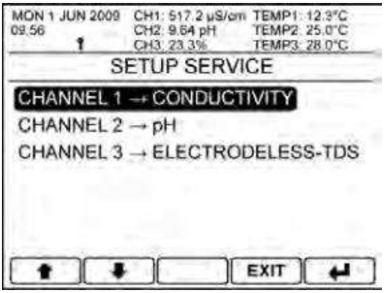
Service Alarms

The MXD70 Series has an inbuilt Service Alarm for each channel which will activate when the maintenance engineer's service interval has expired. Note. By default the alarms are disabled and can only be setup using the service access code which can be obtained from LTH Electronics.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



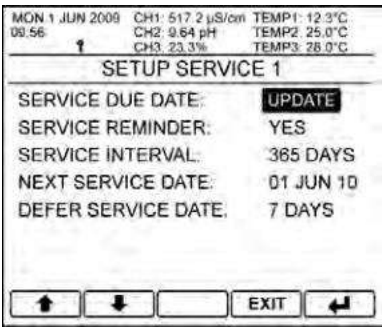
Select Service Alarm Channel

Select which service alarm the user wishes to edit.

⬆/⬇ – Select Option

EXIT – Return to Configuration Menu

↵ – Enter Option



Setup Service Alarm

Service alarm configuration:

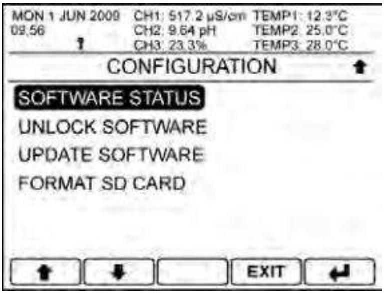
- Service Due Date: Update – Automatically increment the next service date by the service interval. Requires service security code prior to use.
- Service Reminder – Turn the service alarm on or off. Requires service security code prior to use.
- Service Interval – Set the Service Interval. Requires service security code prior to use.
- Next Service Date – Sets the exact service date. Requires service security code prior to use.
- Defer Service Date – Only appears once the service interval has expired. Increases the service interval by an extra 7 days. Requires standard security code prior to use.

⬆/⬇ – Select Option

EXIT – Return to Select Service Alarm Menu

↵ – Edit Option

Configuration



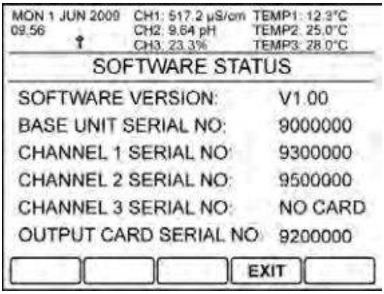
Software Status

Provides information about the software version and serial numbers of the instrument.

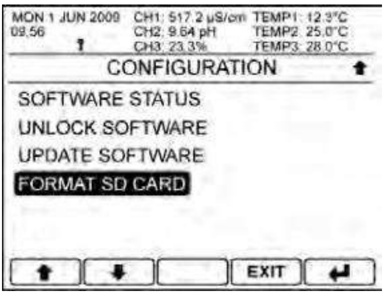
🡅/🡇 – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



EXIT – Return to Configuration Menu



Format SD Card

Allows the users to reformat SD cards which are incompatible with the instrument. For cards which are greater than 4GB this may take several minutes.

🡅/🡇 – Select Option

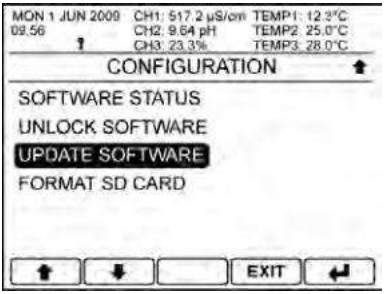
EXIT – Return to Main Menu

↵ – Enter Option

Update Software

The MXD70 Series operating software can be upgraded by saving the latest version from LTH onto a SD card, inserting it into the instrument and following the instructions below. All three files must be present on the SD card for the update to work. All units supplied after 1st October 2012 now support SDHC and SDXC cards using the fat32 format. If the card is not formatted correctly the instrument will inform the user, the card must then be reformatted using the Format SD Card function.

Caution! The MXD70 update may take up to 5 minutes, during which time the unit will not operate.



Update Software

Select the update software option from within the configuration menu.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option

Update Software

Verify that the new software is of a higher version than the current one shown. It is recommended that the entire unit is saved before the update is started. See the “Save Setup” section for instructions.

Select start to continue.

⬆/⬇	– Select Option
EXIT	– Return to Configuration Menu
↵	– Enter Option

Update Software

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

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

Once finished the instrument will restart automatically.

EXIT	– Return to Update Software Menu
↵	– Begin Update

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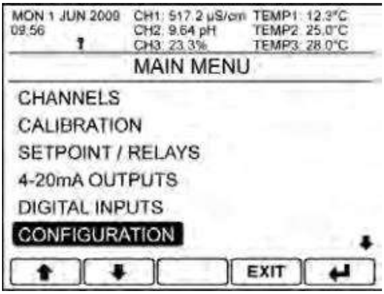
Optional Software Functions

The MXD70 series features optional software functions which when purchased will expand the instrument's capabilities. These functions by default are locked. They can be unlocked by LTH or your local distributor at the time of order. Alternatively the functions may be ordered after purchase by supplying LTH or your local distributor the serial number of your instrument along with the purchase order. In return they will supply you with an 8 digit unlock code that is unique to the instrument and the required function to be unlocked.

Unlocking Optional Software Functions



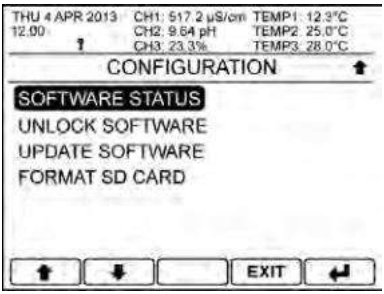
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



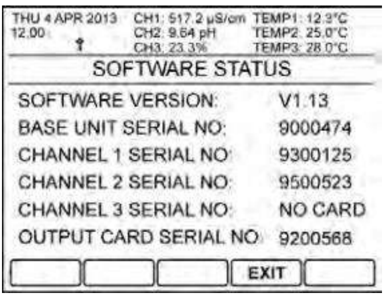
Software Status

Select Software Status.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

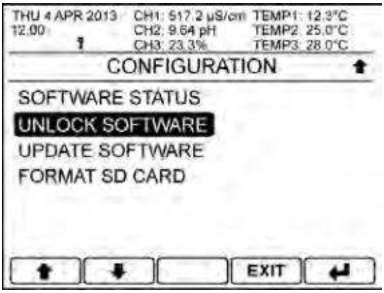
↵ – Enter Option



Software Status

Record the base unit serial number and supply it to LTH or your local distributor along with your purchase order.

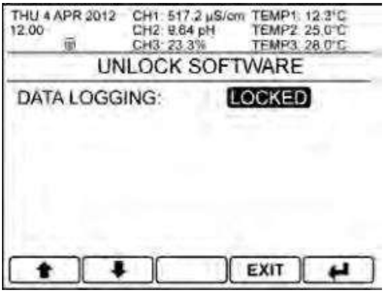
EXIT – Return to Configuration Menu



Unlock Software

Upon receipt of the unlock code return to the Configuration menu and select Unlock Software.

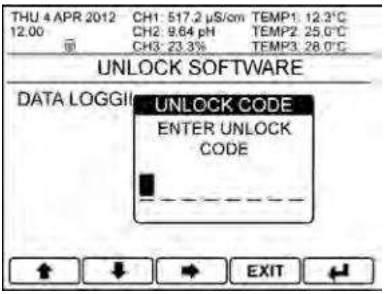
⬆/⬇ – Select Option
EXIT – Return to Main Menu
↵ – Enter Option



Unlock Software

Select the optional software function you wish to unlock.

⬆/⬇ – Select Option
EXIT – Return to Main Menu
↵ – Enter Option



Enter the required Unlock Code.

If the code is incorrect the user will be prompted to try again.

If the code is correct the function will now be unlocked

⬆/⬇ – Change Character
➡ – Select Next Character
EXIT – Cancel
↵ – Enter Code

Optional Software

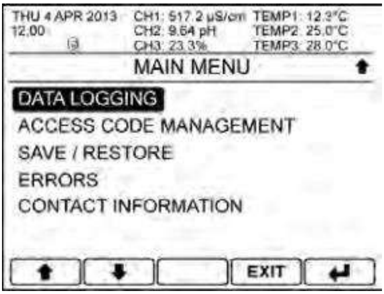
Data Logging

The Data logging optional software function expands the capabilities of the MXD70 series by allowing the user to record over time the status of the instrument. It consists of two separate sections, Live Trending and SD Card Data Logging, which together will help the user to analyse and improve the performance of their application. Please note by default this function is locked. It can be unlocked by LTH or your local distributor at the time of order or through purchasing an unlock code, see page 21 for further information.

Live Trending

Live Trending provides the user with 3 separate live trend screens adjacent to the front screen with each showing 2 readings; these enable the user to instantly view the last 50 samples of each reading. The live trend screen also features a review mode where by the user can further analyse the last 200 samples of each reading, If the user finds something of note the software provides a facility to save those 200 readings to an excel compatible file on the SD card. Further analysis is provided by optionally displaying the minimum, maximum and average value of the 200 samples. The number of readings, the source of the readings, the displayed scale and the sample interval rate are all configurable by the user.

Setup Live Trending



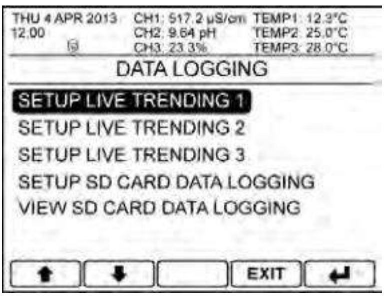
Main Menu

From the front screen press the menu button to show the main menu options and select Data Logging.

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



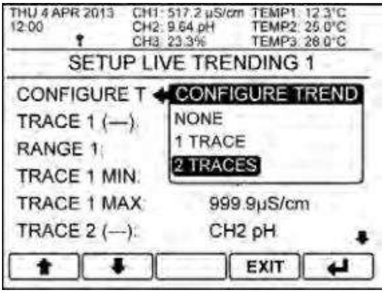
Data Logging

Select the live trend you wish to setup.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



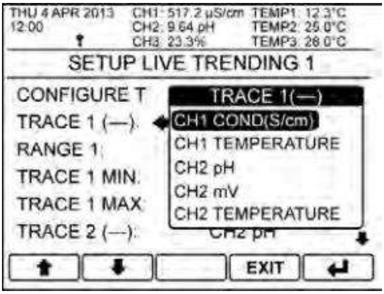
Configure Trend

Select the number of traces to display. By selecting none the live trend is disabled and no longer visible from the front screen.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



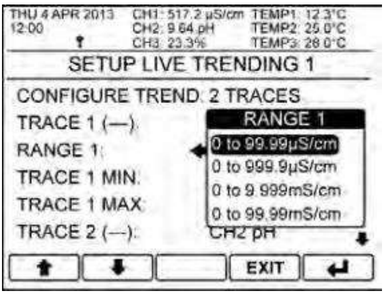
Trace 1 (——)

Select which measurement Trace 1 (left hand side axis) is to be associated with. The options shown depend on the configuration of the instrument.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



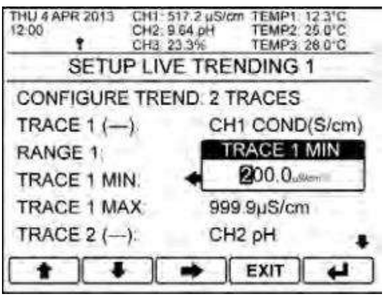
Range

If the trace's associated measurement is currently configured to use auto ranging then a fixed range will need to be assigned to the trace.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Trace Min

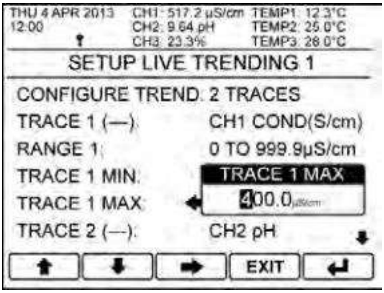
Enter the Trace's minimum displayed value. Adjust in conjunction with the maximum displayed value to increase the measurements displayed resolution.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Trace Max

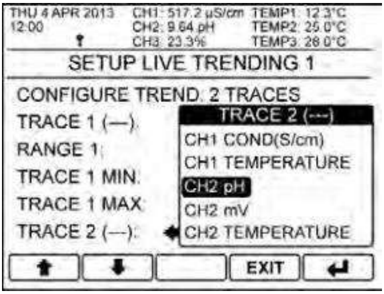
Enter Trace's maximum displayed value. Adjust in conjunction with the minimum displayed value to increase the measurements displayed resolution.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Trace 2 (----)

Select which measurement Trace 2 (right hand side axis) is to be associated with. The options shown depend on the configuration of the instrument. Then configure trace 2's min and max as before with trace 1.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Trend Interval

Enter the time interval between samples for both trace 1 and trace 2.

⬆/⬇ – Increase / Decrease Digit

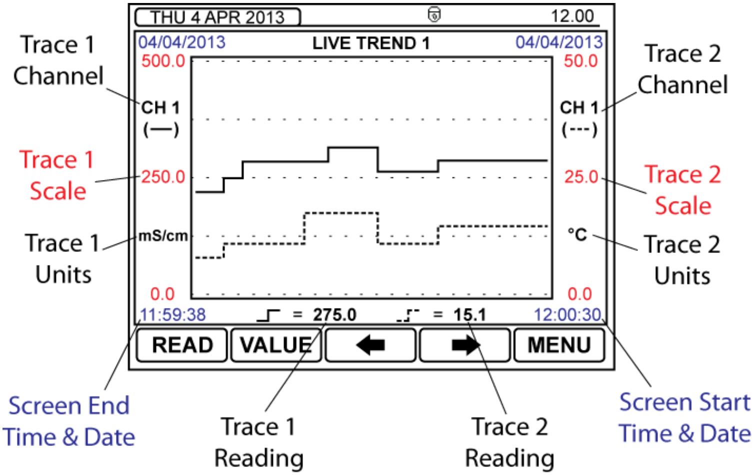
➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

Live Trend Screen

Once Configured the Live Trend screens can be found by moving right from the front screen. In addition the live trend screens will not "time out" back to the front screen. The screen operates in two modes "Live Mode" and "Review Mode", in Live Mode Screen shows the last 50 sampled readings whilst in Review Mode the user can scroll back through the last 200 readings.
Note. When in review mode the screen will no longer update with live readings, however the live readings are still being recorded and will be restored when review mode is exited.

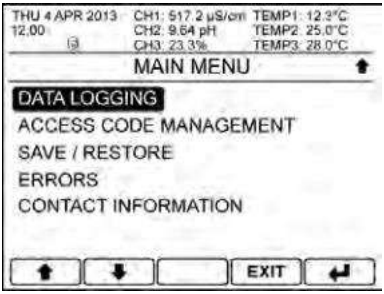


READ/ MIN/ MAX/ AVG	– Indicates the status of the Trace Readings at the bottom of the screen when in Live Mode. Press to cycle between the available options: READ = Current Reading MIN = The minimum value of the last 200 readings MAX = The maximum value of the last 200 readings AVG = The average value of the last 200 readings
LINE/ PAGE	– When in Review Mode toggles between the cursor moving a line at a time or at a page at a time.
VALUE	– Press to enter the live trend Review Mode. Review mode allows the user to scroll back through the last 200 readings.
EXIT	– When in Review Mode, press to exit and return to the Live Mode.
🡄 or 🡆	– When in Live Mode – return to the front screen or move on to the next live trend. – When in Review Mode - moves the cursor across the screen. The pointed to value will be displayed at the bottom of the screen and the time at the top.
MENU	– Enter the instruments main menu screen.
SAVE	– When in Review Mode and a SD card is present, saves a copy of the current 200 readings as a time stamped excel compatible file to the Live Trend folder on the SD card.

SD Card Data Logging

The SD Card Data Logging part of the data logging software enables the user to log over long periods the status of the instrument direct to the SD card. Variables logged include: the primary sensor readings, any secondary readings, the status of the setpoints, the current output readings, the status of the digital inputs and any error messages. This data can then be viewed either inside the instrument or removed and viewed in Microsoft Excel on a PC. Which channels are logged and logging interval are configurable by the user.

Setup SD Card Data Logging



Main Menu

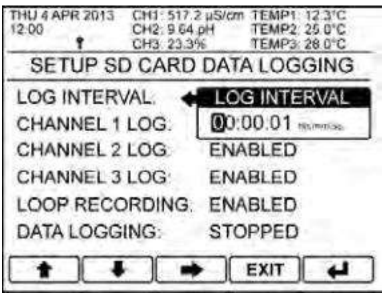
From the front screen press the menu button to show the main menu options and select Data Logging.

⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option

Data Logging

Select Setup SD Card Data Logging.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option

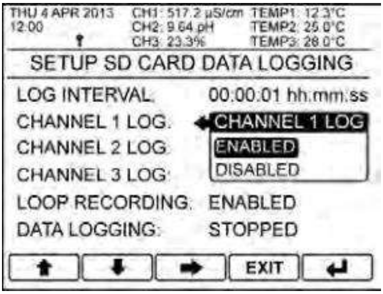


Log Interval

Enter the time interval of the SD card data logging.

Note. If logging at 1 sample per second, 1GB of space on the SD card will provide at least 40 Days of logging.

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



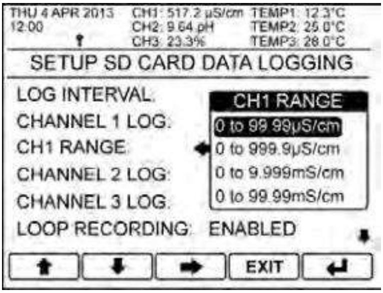
Channel Log

Enables / Disables the SD card data logging of the channel and any setpoints, current outputs, digital inputs and error messages associated with the channel.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



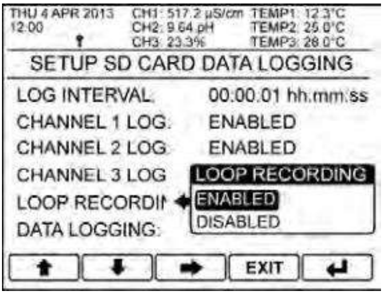
Range

If the associated measurement is currently configured to use auto ranging then a fixed range will need to be assigned to the log.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



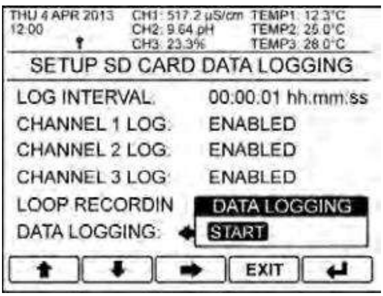
Loop Recording

If enabled, when the SD card becomes full the instrument will automatically delete the oldest data log file and then continue to log.
If loop recording is disabled the instrument will automatically stop recording if the SD card becomes full and set an error message.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Data Logging Start/Stop

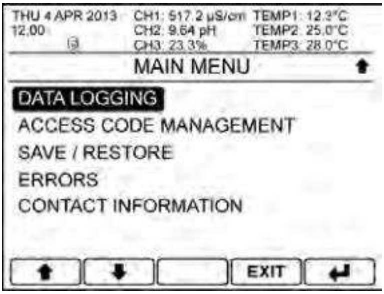
Shows the current status of the data logging (Stopped / Recording) and allows the logging to be started and stopped. When the data logging is active the SD card active symbol will be shown at the top of the screen.
Note: If a large number of files are present on the SD card there may be a delay whilst the software is searching the card for a clear space. Whilst the card is being searched the SD card active symbol will flash.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

View SD Card Data Logging



Main Menu

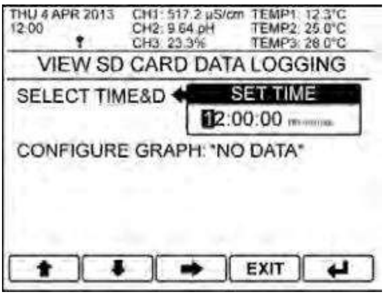
From the front screen press the menu button to show the main menu options and select Data Logging.

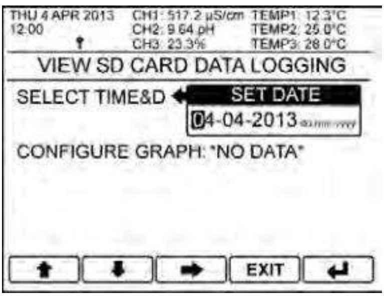
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option

Data Logging

Select View SD Card Data Logging.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



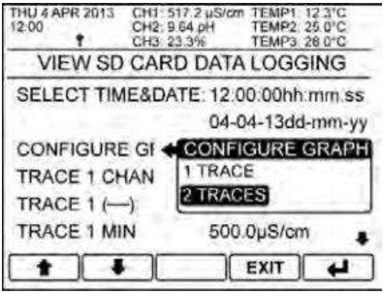


Select Time & Date

Enter the time and date of the data to be viewed. If the SD card contains no data at the selected time and date then the configure graph shows *No Data*.

Note. If the SD card contains many files then there may be a delay whilst the card is searched.

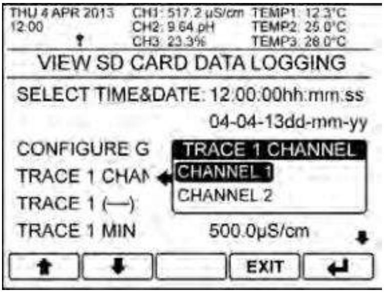
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Configure Graph

Select how many traces to show on the graph.

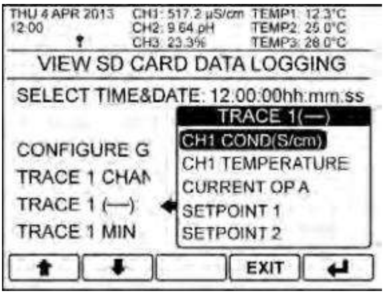
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Trace Channel

Select which channel the trace is assigned to. Available channels depend upon which channels have been recorded in the selected log.

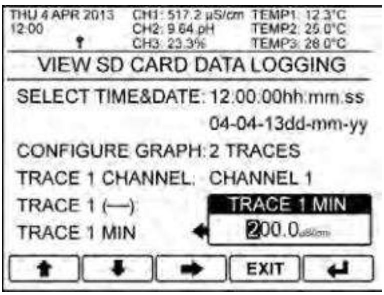
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Trace 1 (——)

Select which measurement Trace 1 (left hand side axis) is to be associated with. The options shown depend on the configuration of the instrument.

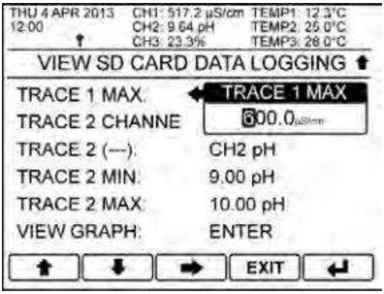
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Trace Min

Enter the Trace's minimum displayed value. Adjust in conjunction with the maximum displayed value to increase the measurements displayed resolution.

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



Trace Max

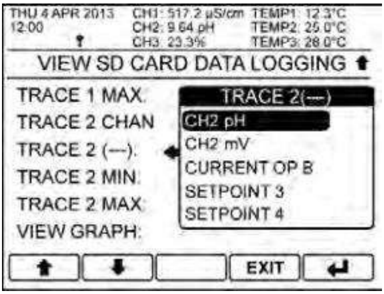
Enter the Trace's maximum displayed value. Adjust in conjunction with the minimum displayed value to increase the measurements displayed resolution.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



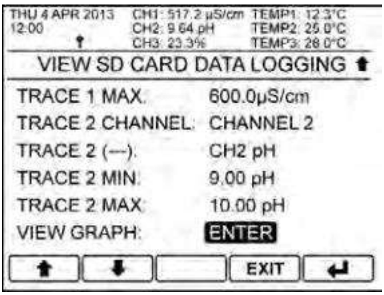
Trace 2 (---)

Select which measurement Trace 2 (right hand side axis) is to be associated with. The options shown depend on the configuration of the instrument. Then configure trace 2's min and max as before with trace 1.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



View Graph

View the configured graph.

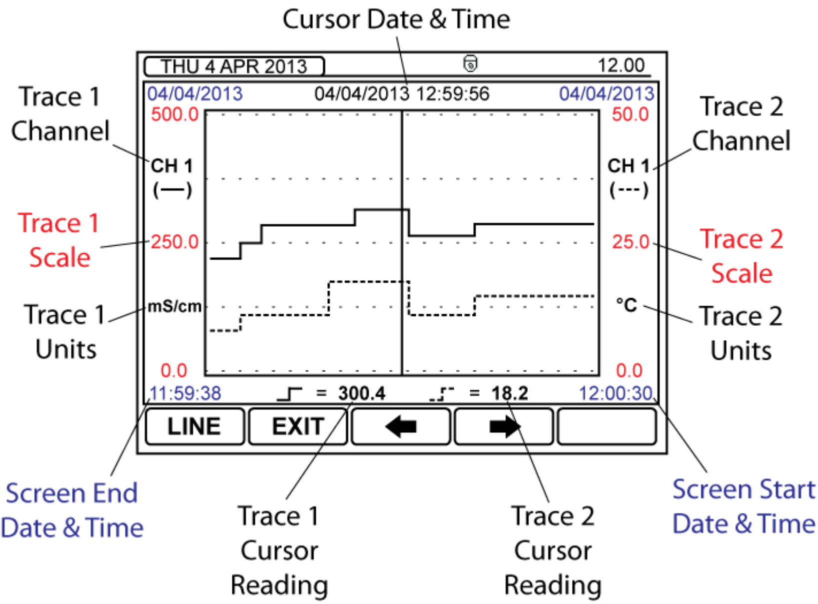
⬆/⬇ – Select Option

EXIT – Cancel

↵ – Enter Option

SD Card Data Logging Graph

Once Configured the SD card Data Logging Graph starts by showing the closest reading to the one selected by the time and date. The user can then use the cursor to scroll backwards and forwards in time through the log on the SD card. Each screen shows 50 readings. For faster scrolling the user can turn on page mode where by the screen jumps a page at a time through the readings. Where a break occurs in the trace you have reached the end of one file and the beginning of the next. Note: there may be a delay in scrolling when new data is loaded from the SD card.



LINE/ PAGE	– Toggles between the cursor moving a line at a time or at a page at a time.
EXIT	– Press to exit and return to View SD Card Data Logging menu.
🡄 or 🡆	– Moves the cursor across the screen. The pointed to value will be displayed at the bottom of the screen and the time at the top.

Viewing the SD Card Data Log on a PC

Before the user removes the card from the instrument they must first stop the SD Card data logging (see page 27) and the SD card active symbol must not be present at the top of the screen.
Once removed place the SD card in the card reader connected to the pc. Open the SD card in the file explorer and browse to either the Data Logging folder to view the SD card data logging or the Live Trend folder to view the live trend log saves.

Each file is limited to 65535 logs; when this limit is reached the instrument will automatically create a new file. The instrument will also automatically create a new file if the configuration of the instrument is changed whilst the data logging is active.

Each file name contains the date and time of when it was created. The data is stored as a comma separated variable (CSV), which can be read by Microsoft Excel.

The first column of data contains the date and time of each sample. Note: by default Excel hides the seconds value, to display this you need to apply a custom format to the column as follows: dd/mm/yyyy hh:mm:ss.

The proceeding columns contain:

- The main sensor reading and units,
- Any secondary readings and units i.e. temperature.
- The status of any setpoints associated with the logged channels, where 0 = off, 100 = fully on. When using a proportional control mode this number represents the setpoint output as a percentage of the proportional band.
- The output level of any current output associated with the logged channels.
- The status of any digital input associated with the logged channels, where 0 = inactive and 1 = active.
- Any active error messages.

! Beware the file is not protected; changes can be made and may be irreversible. If any changes are made it may affect the ability for the instrument to read the file if it is placed back into the instrument.

Blank Page

Error Messages

If the internal diagnostics have detected an error condition then the error LEDs will illuminate. This is accompanied by an alarm bell either next to the associated channel or in the unit status area. By pressing the left arrow on the front screen or by selecting the errors option in the main menu, the list of currently active errors can be seen. By selecting an error and pressing the help button a more detailed description of the error is shown along with suggested solutions to the possible causes of the error.

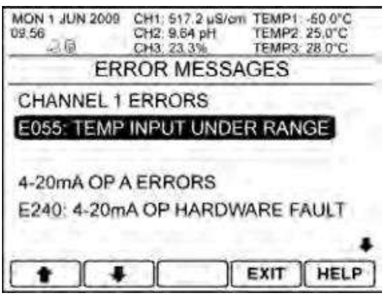
Error Menu Access

The error menu can be accessed by either pressing the scroll left button whilst on the front screen.

⬅	– Scroll Left (To Error Menu)
➡	– Scroll Right
Menu	– Access Main Menu

Or by selecting the Errors option from the main menu.

⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Error Messages

For more information regarding each error message select the required message and press the help button.

⬆/⬇	– Select Error
EXIT	– Return to Main Menu
HELP	– Extended Information

Blank Page

Save, Restore & Reset

The MXD70 Series features the ability to save and restore the current configuration of a channel and its associated setpoints, current outputs, and digital inputs, into either one of two save slots inside the instrument. Alternatively the configuration can be saved and restored via an SD card inserted into the unit, which allows the instruments configuration to be backed up. It also provides the ability to copy the configuration from one instrument to another, providing that the input card type for each channel is the same on the second instrument.

The save and restore menu also features the ability to reset either the whole instrument or each channels configuration, user calibration; and it's associated setpoints, current outputs and digital inputs, back to their factory settings.

Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option

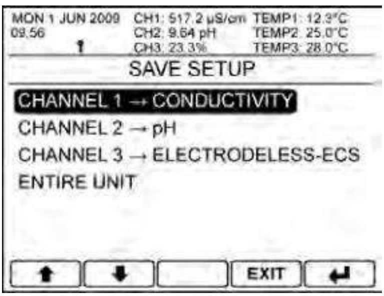
Save / Restore Menu

Select the operation you wish to carry out.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Select Target

Select which channel or alternatively the whole unit.

⬆/⬇ – Select Option

EXIT – Return to Save / Restore Menu

↵ – Enter Option

Select Location

Select either Save A or Save B to access the instruments internal stores. Alternatively if inserted select SD Card A-H to use one of the 8 SD card saves.

If a save location is already being used, as indicated by a time - date stamp, then information about that save can be accessed by selecting it and pressing the INFO button.

⬆/⬇	– Chose Location
INFO	– Location Information
EXIT	– Return to Save / Restore Menu
↵	– Select Location

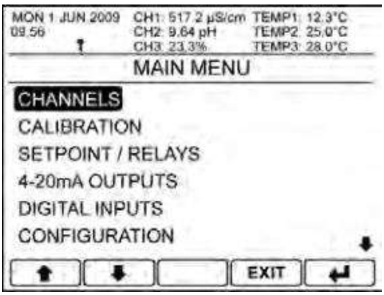
Calculation

The MXD70 Series features the ability to calculate a measurement from the input of multiple sensor channels. This result can then be used to activate the instruments setpoints / relays and drive the current outputs.

The following mathematical functions are supported:

Function	Calculation Formula	Result Range	Result Units
Difference	X-Y or Y-X	Same as input variables.	Same as input variables.
Average	$\frac{X+Y}{2}$	Same as input variables	Same as input variables
Ratio	$\frac{X}{Y}$	-19.99 to 19.99	None
Passage	$\frac{Y}{X} \times 100$	-199.9 to 199.9	%
Rejection	$(1 - \frac{Y}{X}) \times 100$	-199.9 to 199.9	%
Deviation	$(\frac{Y}{X} - 1) \times 100$	-199.9 to 199.9	%

Calculation Setup Menus



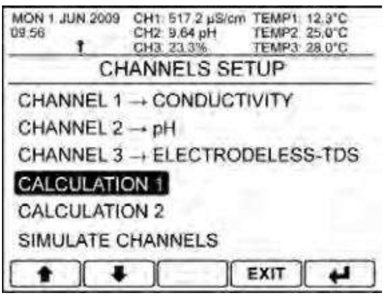
Main Menu

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

🡅/🡇 – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



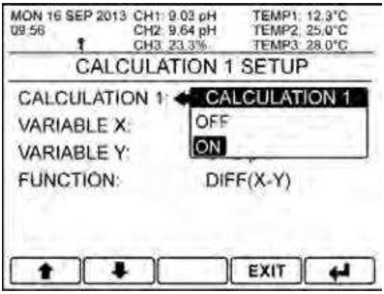
Select Calculation

Select the calculation you wish to edit.

🡅/🡇 – Select Option

EXIT – Return to Main Menu

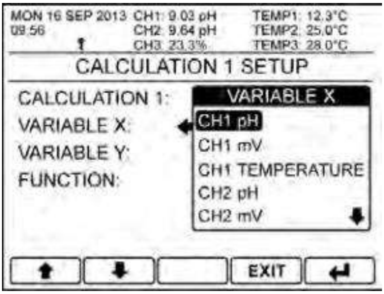
↵ – Enter Option



Enable Calculation

Turn the calculation function on or off.

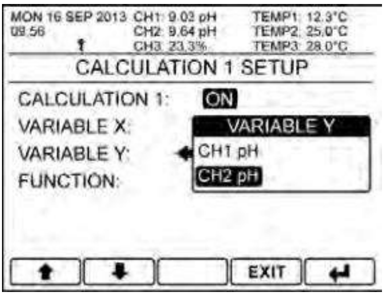
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Variable X

Select which sensor variable is used as the X term in the calculation function.

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

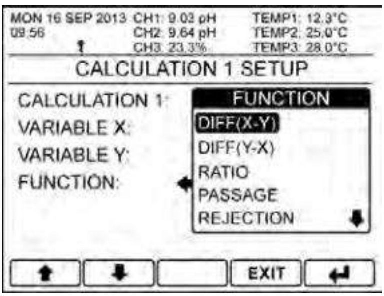


Variable Y

Select which sensor variable is used as the Y term in the calculation function.

Note. Only available variables which are identical to the X term will be shown.

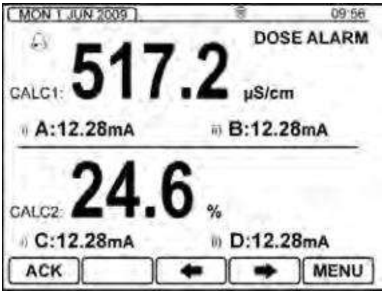
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Function

Select the mathematical function to perform with the two variables.

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



Calculation Result Screen

Once configured and enabled the result of the calculation can be seen either on the main front screen or if there is not enough room, on the calculation result screen located to the right of the main front screen.

The channel label and secondary reading slots can be configured in the setup front screen menu (see page 15)

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- SD Card A
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MXD70 SERIES

Multi-parameter Monitor

Conductivity
Setup and Operating
Guide

Preface

Product warranty

The MXD70 Conductivity Input Card has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. 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.

Contents

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Conductivity Input Card Specification

Conductivity Sensor	Any LTH conventional conductivity cell. Other manufacturer's cells can be accommodated.
Connection Cable	Up to 100 meters of LTH 54D cable.
Ranges of Measurement	0-0.999 µS/cm to 0-999.9 mS/cm (K= 0.01 to 10.0). 0-99.99 KΩ/cm to 0-99.99 MΩ/cm (K= 0.01 to 1.0). 0-0.999 ppm to 0-99.99 ppt. (parts per thousand). See the following range / cell constant table for further information.
Cell Constant Adjustment	Fully adjustable from 0.005 to 15.00.
Cell Constant Calibration	± 50% of nominal cell constant.
Conductivity Accuracy	±0.5 % of range.
Linearity	±0.1 % of range.
Repeatability	±0.1 % of range.
Operator Adjustment (Conductivity)	±10 % slope (gain) adjustment for solution calibration.
Temperature Sensor	Pt100 or Pt1000 RTD. Up to 100 meters of cable. Temperature sensor can be mounted in the conductivity cell or separately.
Range of Temperature Measurement	-50 °C to +160 °C (-58 °F to +320 °F) for full specification.
Temperature Accuracy	0.2 °C (When using a 4 wire PT1000)
Operator Adjustment (Temperature)	± 50 °C or ± 122 °F
Range of Temperature Compensation	-10 °C to +150 °C (+14 °F to +302 °F) for full specification.
Temperature Compensation Type	Fixed UPW curve plus variable slope 0 - 3.9 %/°C over -10 to +150 °C. Selectable In or Out.
Temperature Compensation Base	Selectable at 20 °C or 25 °C.
USP Function	USP monitoring available on associated setpoints. USP pre-trigger facility also available.

Range & Sensor Compatibility Tables

CONDUCTIVITY RANGE	NOMINAL CELL CONSTANT			
	0.010	0.100	1.000	10.00
0 to 9.999 µS/cm	✓	✓	×	×
0 to 99.99 µS/cm	✓	✓	✓	×
0 to 999.9 µS/cm	×	✓	✓	✓
0 to 9.999 mS/cm	×	×	✓	✓
0 to 99.99 mS/cm	×	×	Note 1	✓
0 to 999.9 mS/cm	×	×	×	Note 1

RESISTIVITY RANGE	NOMINAL CELL CONSTANT			
	0.010	0.100	1.000	10.00
0 to 99.99 kΩ-cm	×	✓	✓	×
0 to 999.9 kΩ-cm	✓	✓	×	×
0 to 9.999 MΩ-cm	✓	✓	×	×
0 to 99.99 MΩ-cm	✓	×	×	×

TOTAL DISSOLVED SOLIDS RANGE	NOMINAL CELL CONSTANT			
	0.010	0.100	1.000	10.00
0 to 9.999 ppm	✓	✓	×	×
0 to 99.99 ppm	✓	✓	✓	×
0 to 999.9 ppm	×	✓	✓	✓
0 to 9999 ppm	×	×	✓	✓
0 to 99.99 ppt	×	×	✓	✓

Note 1: Maximum measurement range will be limited by solution temperature. With the temperature compensation slope set to 2%/°C derate linearly from full scale at 25°C to 50% of scale at 100°C.

Total Dissolved Solids in ppm = µS/cm * F, where F = TDS Factor (0.50 - 0.90)

Installation and Choice of Conductivity Sensors

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

The following criteria are of great importance during selection:

- The choice of the best method of measurement
- Selection of the correct (optimum) cell constant
- Use of the correct materials for corrosion resistance
- Position of sensor for robustness and service access
- Ensuring a representative, uncontaminated solution sample

The following tips might be useful. The range of measurement will determine the cell constant. The epoxy resin castings are extremely resistant to most acids and alkalis. A number of sensors have stainless steel bosses and these should be avoided in the presence of chlorides, e.g. HCl.

There is also a growing tendency to passivate new pure water systems during commissioning, it is imperative that any sensors are removed from the pipework prior to this because it forms a non-conductive coating on the surface of the electrodes.

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

- The solution between the cell electrodes or around the sensor is representative of the solution as a whole.
- A moderate flow is maintained to provide an “up to date” sample. Excessive flow rates, however, can cause cavitations and turbulence within the sensor, which will result in inaccurate readings.
- The sensor is mounted so that air bubbles do not lodge within it - displacing solutions and affecting the sample volume (air is not conductive).
- Similarly it must be in a position so that sludge and particulate matter does not collect within the sensor.
- Conventional conductivity cells can suffer problems associated with direct electrical contact with the solution where large electrical currents may be flowing, for example in electroplating tanks.

It is not uncommon for a cell to require cleaning on a weekly or daily basis, due to the nature of chemicals used and the presence of scale in hard water areas, experience will determine the correct maintenance periods.

Care and Maintenance of Conductivity Sensors

Conductivity measuring systems are designed to be trouble free in use and reliable measurements can be expected during their operating life. However, some maintenance is required. In particular, the cell and cable connections should be checked for security and freedom from corrosion. The sensor will also require periodic cleaning, depending on the quality of the water passing through it and the type of sensor employed. A dirty sensor will always give a low conductivity reading.

The area of the cell which is sensitive to fouling is the electrode surfaces which must fully "wet" to ensure accurate measurements. Moulded cells are often used in applications where a high level of contamination may be expected.

Some of these contaminants do not contribute directly to the measured conductivity, e.g. organics, rust and suspended solids, but may form deposits on the electrode surface. In general these may be cleaned with the bristle brush provided and a weak detergent solution mixed with scouring powder.

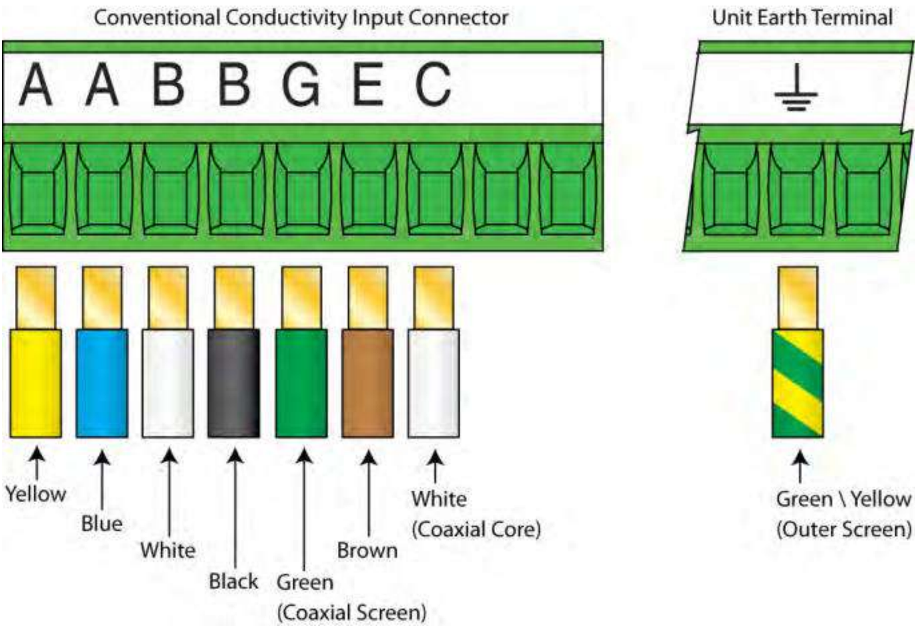
Problems may occur in hard water areas where the gradual formation of scale will reduce the active area of the electrodes. Simple brush cleaning alone will not remove a hard deposit from the electrode surface. If scaling is suspected the cell should be removed from the system and treated with a 10% solution of hydrochloric or formic acid. The presence of bubbles will indicate that scale is being dissolved. Cleaning is completed when bubbles cease and usually takes 2-3 minutes. The cell must be thoroughly rinsed to remove all traces of acid before it is replaced in the system.

Note: Follow the supplier's data sheet when handling acids and dispose of as instructed by your local authority regulations.

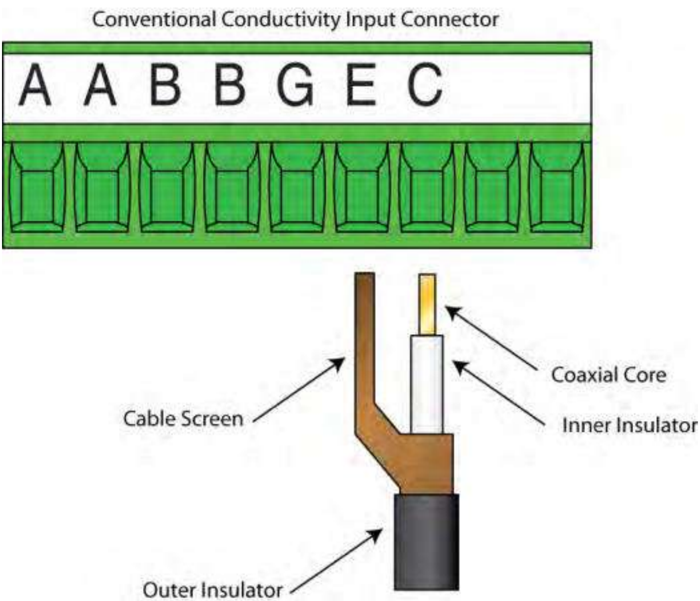
Cells with stainless steel electrodes are generally used in applications where a low conductivity is combined with a low level of organic contamination and cleaning is rarely necessary. Errors in measurements can often be traced to faulty connections or incorrect setting on the instruments. However if contamination is suspected the cell should be removed from the system and cleaned if necessary.

Handling of the cell electrodes will leave residues of oils and greases which will affect the wetting of the surfaces, leading to inaccurate readings. After touching the electrodes, wash them with a weak detergent solution and rinse thoroughly. After rinsing check that the surfaces 'wet' properly, that is, they maintain a complete film of water for approximately 10 seconds.

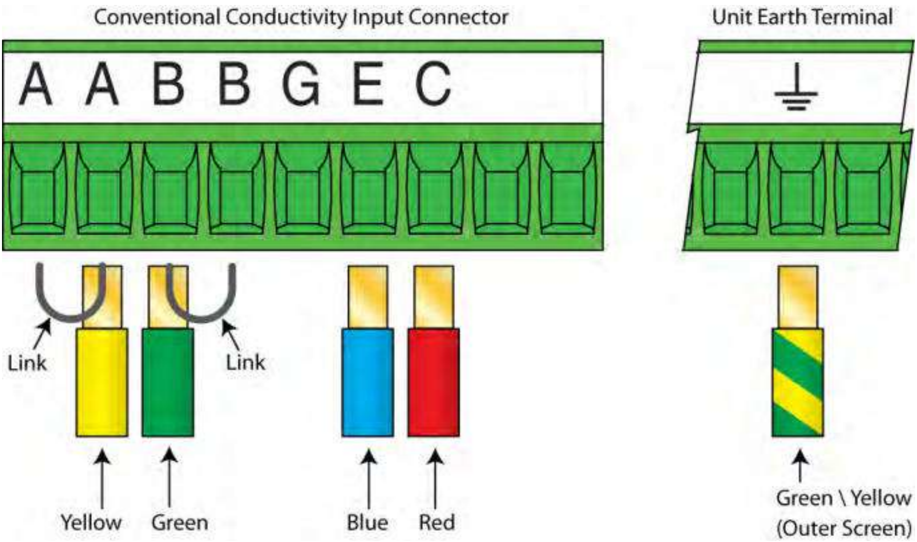
MXD73 Termination Information



Conventional Conductivity 54D Cable Connection Details

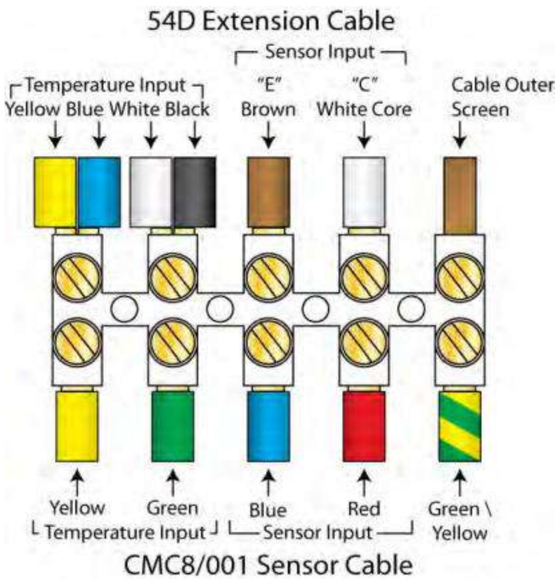


Conventional Conductivity Coax Cable (CMC8/01 & CMC8/10) Connection Details

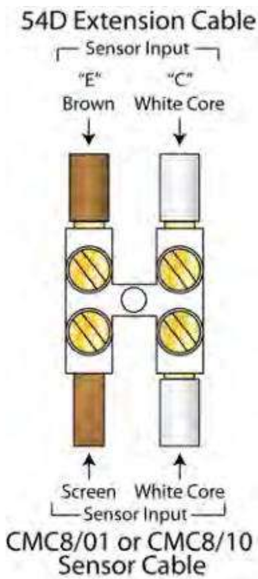


Conventional Conductivity Cable (CMC8/001) Connection Details

MXD73 Extension Cables

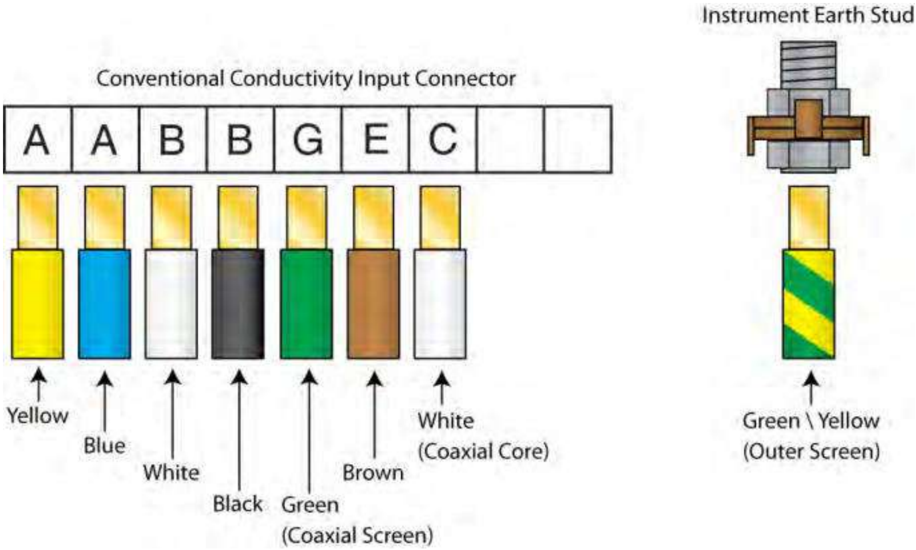


CMC8/001 Cable To 54D Extension Cable Connection Details

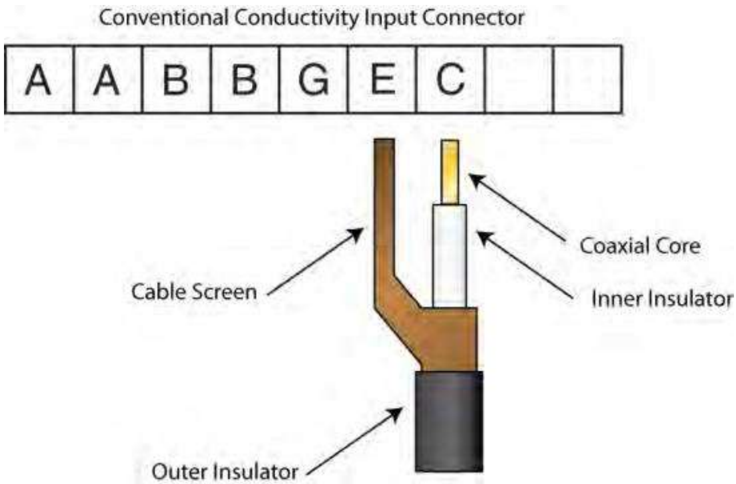


CMC8/01 or CMC8/10 Cable To 54D Extension Cable Connection Details

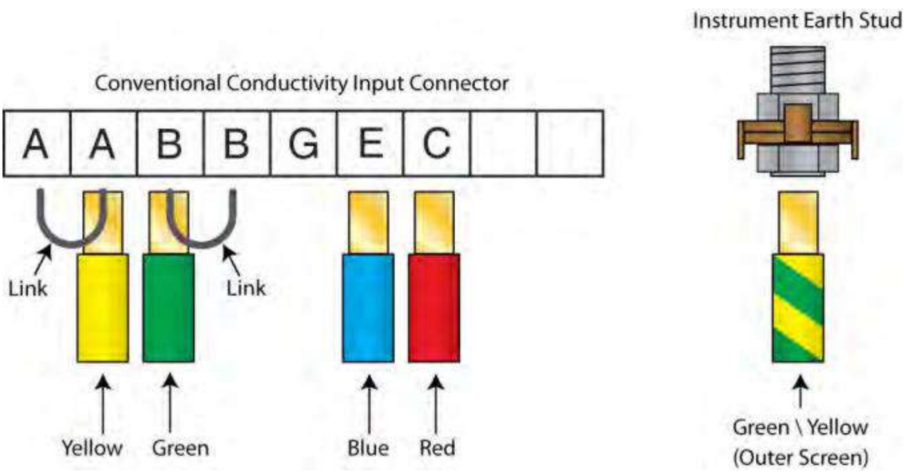
MXD75 Termination Information



Conventional Conductivity 54D Cable Connection Details

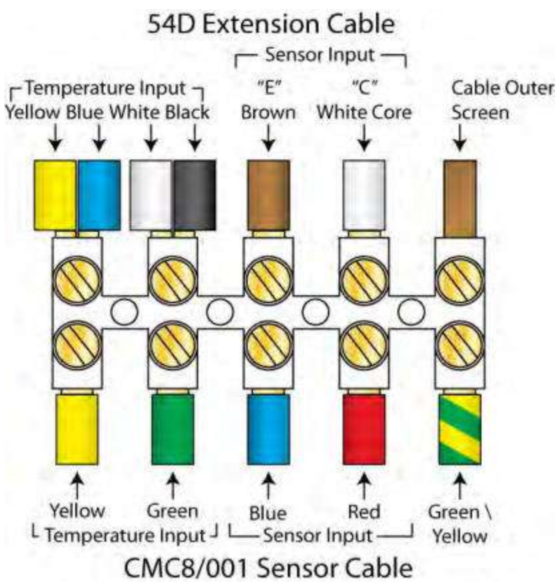


Conventional Conductivity Coax Cable (CMC8/01 & CMC8/10) Connection Details

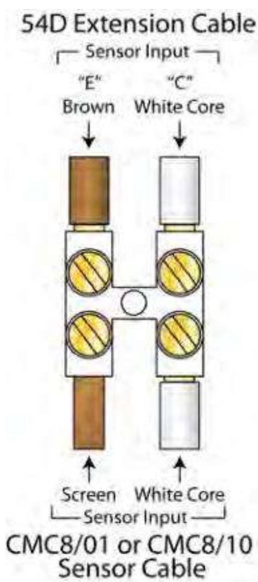


Conventional Conductivity Cable (CMC8/001) Connection Details

MXD75 Extension Cables

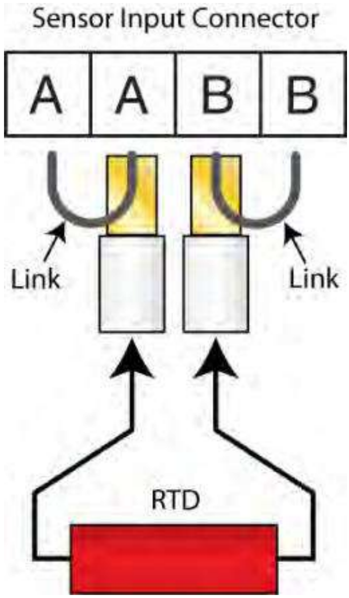


CMC8/001 Cable To 54D Extension Cable Connection Details

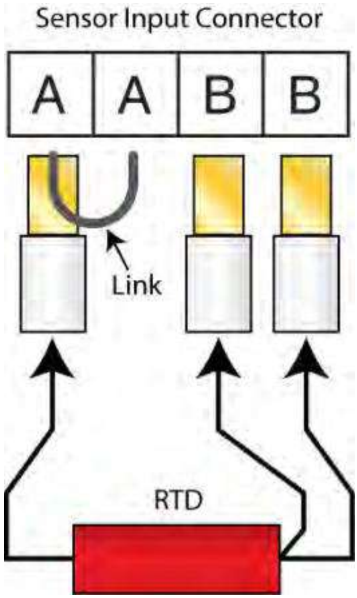


CMC8/01 or CMC8/10 Cable To 54D Extension Cable Connection Details

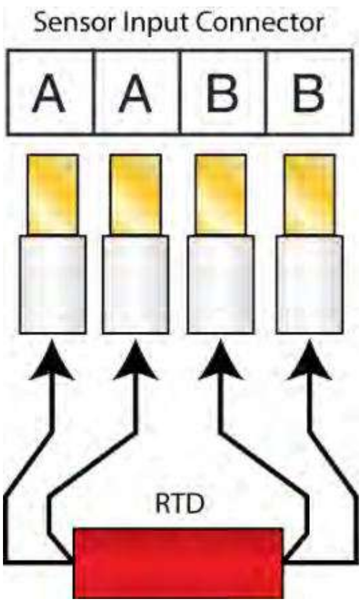
Temperature Sensor Connections



2 Wire RTD Temperature Connection



3 Wire RTD Temperature Connection



4 Wire RTD Temperature Connection

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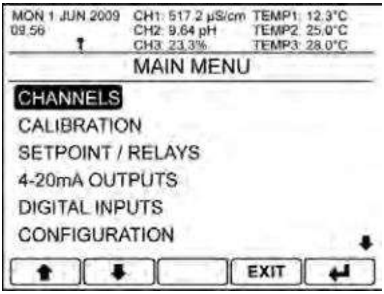
Conductivity Input Channel Setup

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

The default security access code is 1000



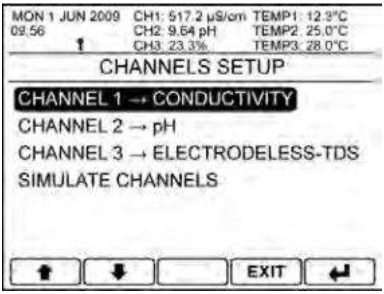
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



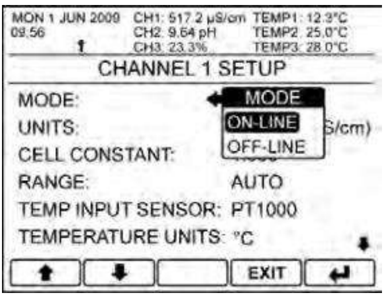
Select Channel

Select the conductivity input channel you wish to edit.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

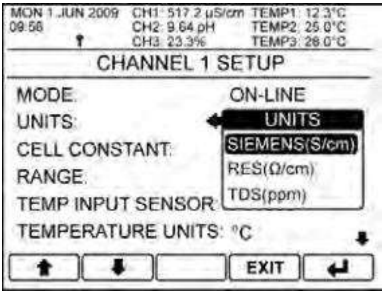
When the unit is placed in an off-line state "off-line" will appear in the channel messages section on the front screen.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

⬆/⬇ – Select Option

EXIT – Cancel

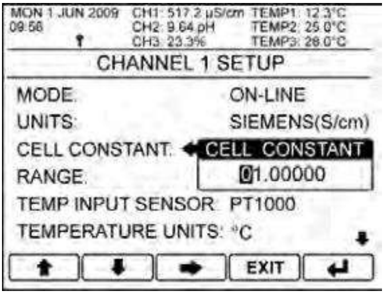
↵ – Save Selection



Units

The channel can be setup to display conductivity in Siemens/cm, resistivity in Ohms/cm or TDS (Total Dissolved Solids) in ppm.

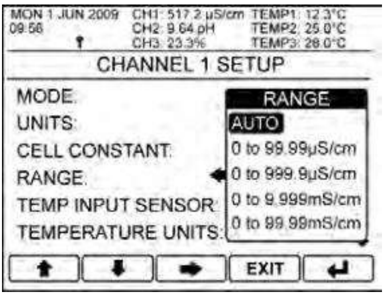
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Cell Constant

The input channel is designed to use any one of LTH conventional conductivity sensors. This menu item enables the user to enter the cell constant which should be marked on the sensor.

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

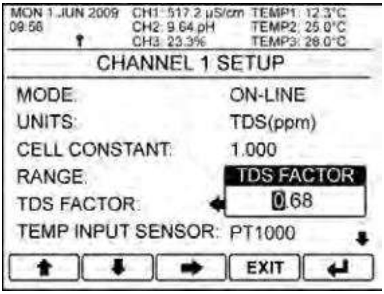


Range

Select the desired operating range for the input or select auto to let the instrument select the appropriate operating range. Available options depend upon the cell constant selected, see Range & Sensor Compatibility Tables for more details.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently defining the operating range.

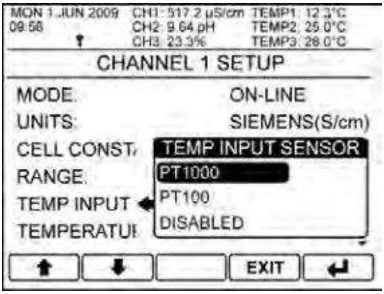
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



TDS Factor

When TDS is selected as the operating units the instrument will display the conductivity as "ppm" using a factor which can be adjusted between 0.50 and 0.90.

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



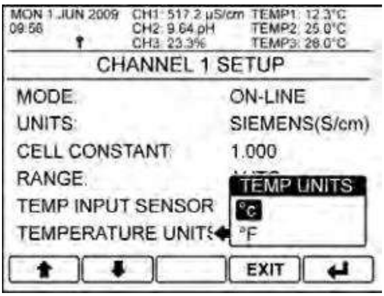
Temperature Input Sensor

Select the input channel's temperature sensor type for use with the sensor measurement's automatic temperature compensation.

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

Note. Even when disabled is set a manual temperature compensation can be used.

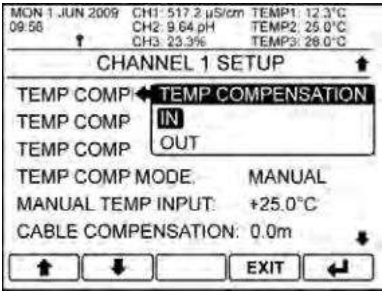
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Temperature Units

Sets the temperature units used.

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



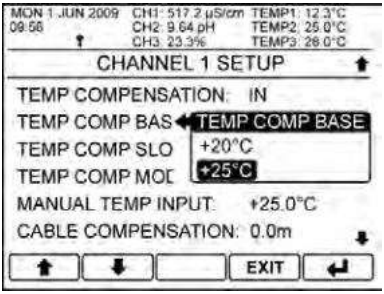
Temperature Compensation

Temperature compensation is enabled by setting this to “In”.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



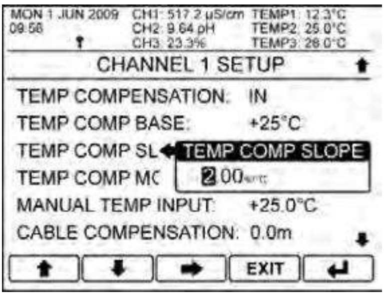
Temperature Compensation Base

Sets the temperature compensation base. See Appendix B - Temperature Coefficient for more information. Only Available if Temperature Compensation is set to in.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Temperature Compensation Slope

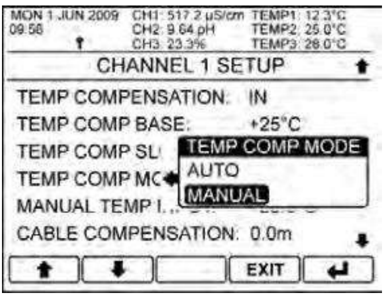
Sets the temperature compensation slope. See Appendix B - Temperature Coefficient for more information. Only Available if Temperature Compensation is set to in.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



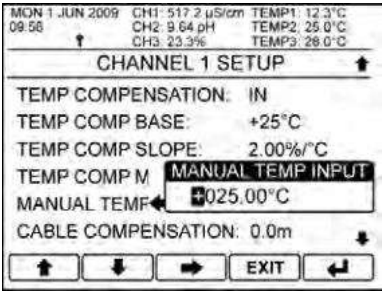
Temperature Compensation Mode

To use temperature compensation from a measured input select “Auto”, else select “Manual” to enable a fixed value entry. Only Available if Temperature Compensation is set to in.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Manual Temperature Input

The fixed temperature value used for manual temperature compensation.

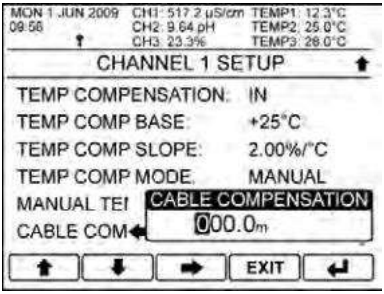
Only available when temperature compensation mode is set to “manual”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Cable Length Compensation

At high conductivities the series resistance in the cell connection cable can have a significant effect on the conductivity measurement. By entering the cable length here the instrument can estimate the extra series resistance and subtract it from the displayed conductivity measurement.

This will greatly reduce the error, however to achieve even greater accuracy the user can do the following.

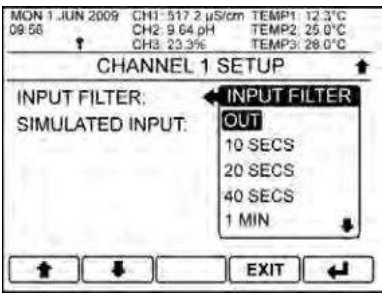
Attach a 10Ω resistor to the cable at the sensor end and set the cable length to zero. Observe the instrument reading (in mS/cm) and use that reading to determine the cable length using the following formula.
Cable Length= { [(1/Reading)-10]/0.0725}

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



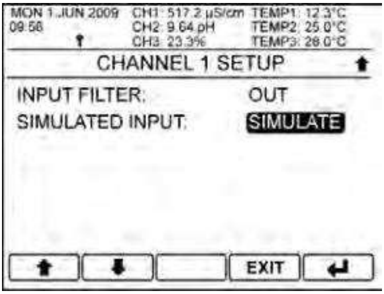
Input Filtering (Averaging)

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

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Simulated Input

See Simulated Channels section of the Setpoints, Current Outputs, Digital Inputs Configuration Guide for more information.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option

Calibration

Best Practice for Fine Tuning the MXD70 Series Conventional Conductivity Input

The MXD70 provides a facility for the operator to fine tune the calibration of the conductivity or resistivity measurement, the temperature measurement and the current output. The amount of adjustment is quite small because the factory calibration is accurate and with modern electronics, drift is very low. If it is found that during a calibration there is insufficient adjustment then it is probable that there is a problem with either the calibration procedure, or a fault with the instrument, sensor or cabling. The most common causes of inaccurate conductivity readings are contaminated electrode surfaces and air trapped within the cell. Both of these will always give a low conductivity (high resistivity) reading. Refer to the sections in this Appendix on Care and Maintenance and Installation of Conductivity Cells for more information.

Calibration of Conductivity or Resistivity Readings

Conductivity measurements are very temperature dependent so it is essential that an understanding of the complex relationship between conductivity and temperature is understood when calibrations are made. It is possible to make several different types of calibration.

Resistance calibration of the instrument only

This is the most accurate method of calibrating the instrument but it will not take into account any variations due to the cell constant variation or coatings of contaminants. Calibration is at a single point only so a value close to the normal operating conditions is preferable. The resistance should be connected between the C and E terminals. (See the table of values on page 22). It is recommended that any extended lengths of cell cable are left in during this calibration, as cable resistance will have some effect on the overall calibration accuracy. This is increasingly significant at high values of conductivity (low resistivity).

The temperature compensation must be switched out when making these adjustments and the relevant cell constant noted. The resistance accuracy will determine the overall accuracy of the calibration. A non-inductive resistance must be used below 100 ohms.

LTH can provide a conductivity simulator with traceable certification to perform this calibration. A table of values for specific calibration points is given on page 22.

Calibration with Standard Solutions

This calibration must be carried out under strictly controlled conditions due to the temperature effect on conductivity measurements and the possibility of contamination of the standard solution. The advantage of this calibration method is that the sensor and cable are an integral part of the calibration. LTH strongly recommends a lower limit of 500µS/cm for this type of calibration. Conductivity is a very sensitive measurement and even trace contamination of the standard solution will be detected, for example exposing the solution to air will add 1µS/cm to the standard solution due to absorption of CO_2.

Most standards are made up from a solution of KCl dissolved in high purity water. BS EN 60746-3 provides details of the concentrations of KCl necessary to produce industry standard conductivity solutions. Ready made solutions are available from LTH with traceable certification if required.

Standard solutions will be supplied with a conductivity value quoted at a reference temperature. This temperature is the base temperature and the calibration should be performed at that temperature, with the temperature compensation switched out. Alternatively, the temperature compensation should be switched on and a temperature slope and base temperature equal to that of the calibration solution can be used to configure the instrument. For example this would be 1.76%/°C for a KCl solution between 1000 to 10,000µS/cm. For more details on calculating the slope of a different solution, refer to Appendix B - Temperature Coefficient (page 35).

Calibration by Comparison with Another Instrument
This can provide the easiest method for in-situ calibrations but has the disadvantage of only being able to check a single measurement point. LTH recommends this method for ALL pure water (<10 µS/cm) calibration checks and has developed a portable system specifically for this purpose. As measurements are made by comparison of the readings taken in the same solution, temperature effects are less critical. However, it is essential that settings for temperature compensation are the same on both instruments. For more information on the measurement of pure water refer to Appendix A - Ultra Pure Water (page 33).

Calibration of the Cell Constant
LTH conductivity cells are supplied with a nominal cell constant value, e.g 0.1, 1.0. The actual cell constant could be up to ±2% from this value. It is possible for LTH to measure the actual cell constant of each cell and provide traceable certification. The user can then program this value into the instrument eliminating the errors contributed by manufacturing variations in the cell geometry. Use the cell constant menu in the channel setup menu to enter the specified cell constant.

Table of calibration resistance values

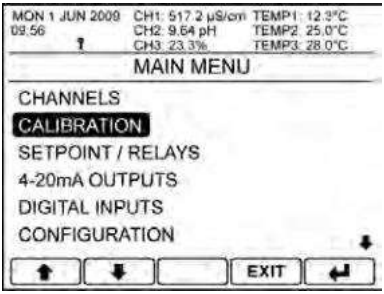
Conductivity Display Reading	Nominal cell constant K=0.01	Nominal cell constant K=0.10	Nominal cell constant K=1.00	Nominal cell constant K=10.0	Resistivity Display reading
0.050 µS/cm	200K				20.00 MΩ-cm
0.100 µS/cm	100K				10.00 MΩ-cm
0.200 µS/cm	50K				5.000 MΩ-cm
0.500 µS/cm	20K				2.000 MΩ-cm
1.000 µS/cm	10K	100K			1.000 MΩ-cm
2.000 µS/cm	5K	50K			500.0 KΩ-cm
5.000 µS/cm	2K	20K			200.0 KΩ-cm
10.00 µS/cm	1K	10K	100K		100.0 KΩ-cm
20.00 µS/cm	500R	5K	50K		50.00 KΩ-cm
50.00 µS/cm	200R	2K	20K		20.00 KΩ-cm
100.0 µS/cm	100R	1K	10K	100K	10.00 KΩ-cm
200.0 µS/cm		500R	5K	50K	
500.0 µS/cm		200R	2K	20K	
1000 µS/cm		100R	1K	10K	
2.000 mS/cm			500R	5K	
5.000 mS/cm			200R	2K	
10.00 mS/cm			100R	1K	
20.00 mS/cm			50R	500R	
50.00 mS/cm			20R	200R	
100.0 mS/cm			10R	100R	
200.0 mS/cm				50R	
500.0 mS/cm				20R	
1000 mS/cm				10R	

This list of calibration resistance values will allow the user to check or modify the calibration of the instrument. Temperature compensation **MUST** be turned off during the test or adjustment.

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



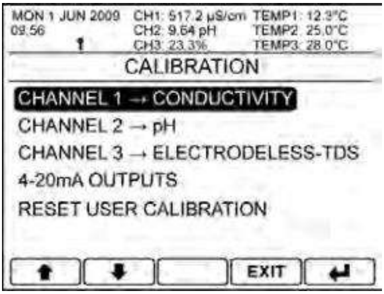
Main Menu

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

🡅/🡇 – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



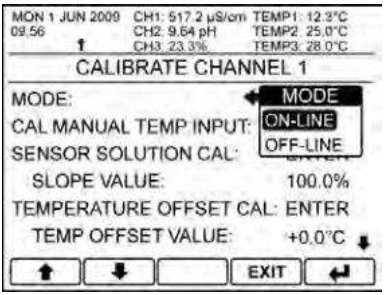
Select Channel

Select the conductivity input channel you wish to edit.

🡅/🡇 – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

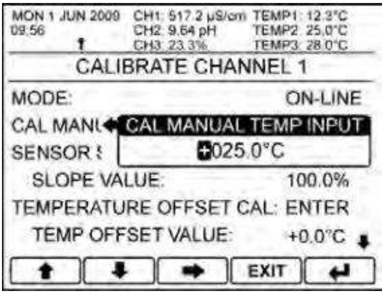
When the unit is placed in an off-line state "off-line" will appear in the channel messages section on the front screen.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Manual Temperature Input

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

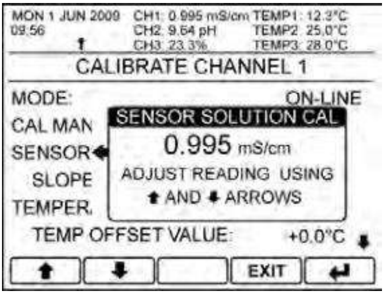
Only available when the temperature compensation mode has been set to manual in the channel setup menu.

🡅/🡇 – Increase / Decrease Digit

🡆 – Select Next Digit

EXIT – Cancel

↵ – Save Value



Sensor Solution Calibration

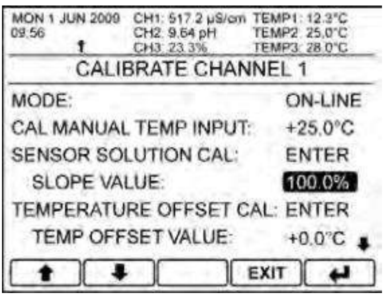
The sensor solution calibration enables the user to adjust the sensor reading to match a known input.

The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration. The calculated slope is shown in the next menu entry.

🡅/🡇 – Adjust the Reading Up or Down

EXIT – Cancel

↵ – Save Calibration



Sensor Slope Value

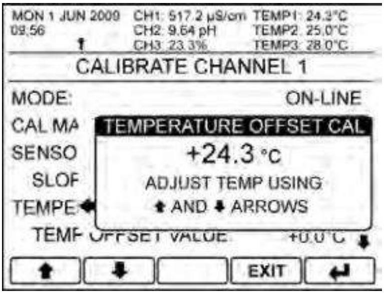
The sensor slope value currently being used. The value will change depending on the result of the sensor solution calibration.

Cannot be edited

A value of 100% indicates that no adjustment has been made to the sensor calibration.

A value of greater than 100% indicates that the sensor reading has had to be increased to match the known input.

A value of less than 100% indicates that the sensor reading has had to be decreased to match the known input.



Temperature Offset Calibration

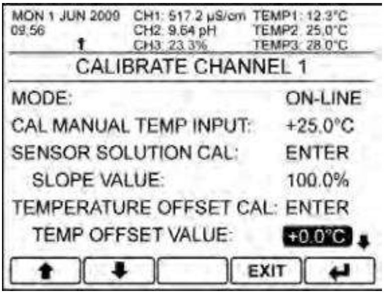
The temperature offset calibration enables the user to adjust the temperature reading to match a known input.

The current temperature reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration. The calculated offset is shown in the next menu entry.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

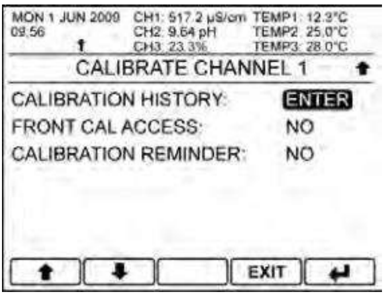
↵ – Save Calibration



Temperature 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

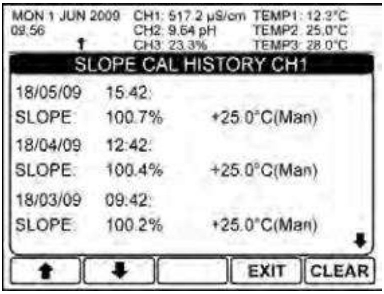


Enter Calibration History

The MXD70 series has a calibration history feature which allows the user to review the record of sensor solution calibrations.

To enter the calibration history menu press enter.

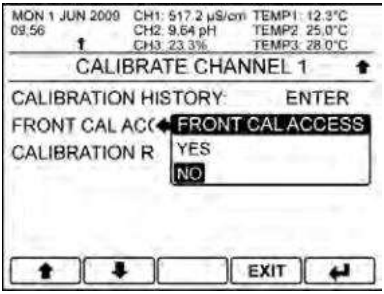
↵ – Enter Calibration History



Calibration History

The calibration history page provides a record of all sensor solution calibrations carried out. The data includes the date and time of the calibration, the calculated sensor slope and the temperature compensation reading at the time.

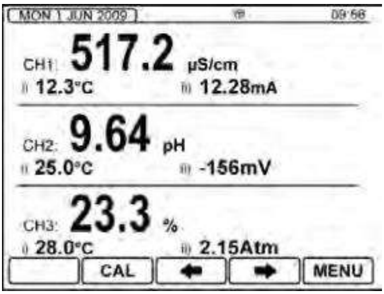
⬆/⬇	– Move To Next Page Up or Down
EXIT	– Return To Calibration Menu
CLEAR	– Clear All of the Calibration History



Front Screen Calibration Access Enable

When enabled front calibration access allows direct entry into the calibration menu from the front screen. It also disables the security access system within the calibration menu enabling the calibration functions without having to enter the security access code.

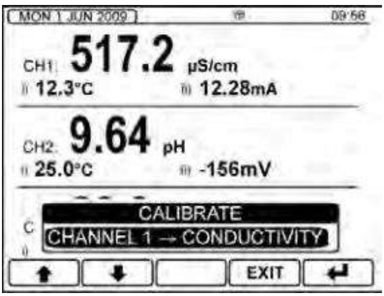
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Front Screen Calibration Access

When the calibration access is enabled press the "CAL" button to bring up pop-up to select which channel to calibrate.

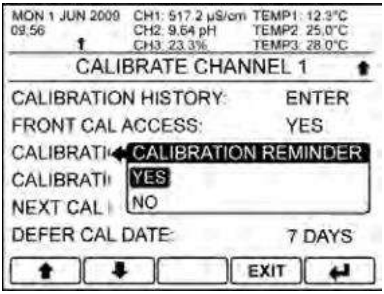
CAL	– Enter Calibrate Channel Select Menu
⬅/➡	– Scroll Around Menus
Menu	– Access Main Menu



Select Channel to Calibrate

From the pop-up select the channel the user wishes to calibrate. Only channels whose front calibration access has been enabled will appear.

⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Enter Menu



Calibration Reminder

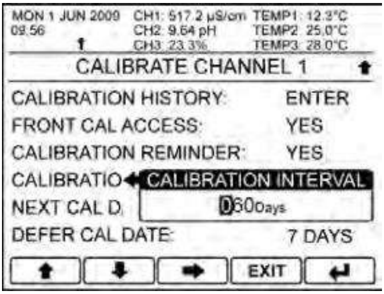
By enabling the calibration reminder the user can configure a calibration interval, which when expired will activate an alarm and channel message on the front screen.

At the end of a sensor solution calibration, if calibration reminder is enabled, the user will be prompted to update the cal due date by the calibration interval and so clearing an alarm if active.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Interval

Sets the interval time for the calibration alarm.

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

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value

Next Calibration Date

Sets the exact date of the next calibration alarm.

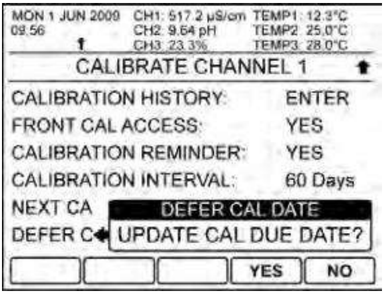
The Calibration Interval will update to show the number of days to the next calibration date.

⬆/⬇ – Increase / Decrease Digit or Text

➡ – Select Next Item

EXIT – Cancel

↵ – Save Entry



Defer Calibration Date

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

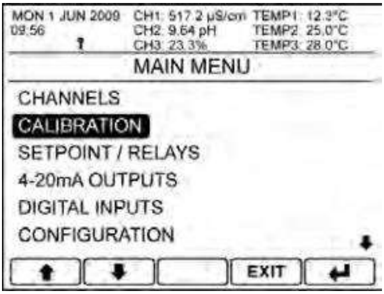
Only appears once the calibration interval has expired.

YES – Increase Interval

NO – Cancel

Resetting the User Calibration

If required the user can reset the user calibrations to their default states.



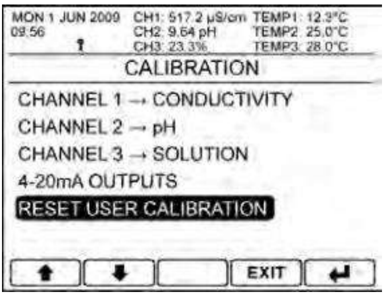
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



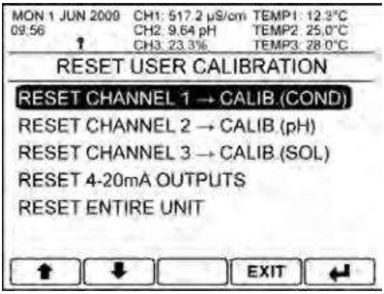
Calibration

Select Reset User Calibration.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

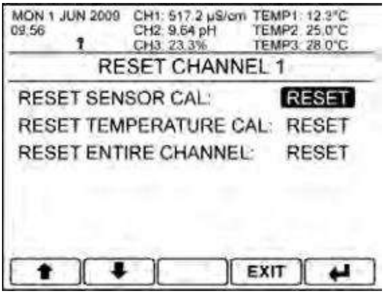
↵ – Enter Option



Reset User Calibration

Select the required conductivity input channel.

⬆/⬇	– Select Option
EXIT	– Return to Calibration
↵	– Enter Option



Reset Channel User Calibration

Select whether to reset the sensor calibration, the temperature calibration or reset all of the channel's user calibrations.

⬆/⬇	– Select Option
EXIT	– Return to Reset User Calibration
↵	– Enter Option

Blank

Conductivity USP Operation

US Pharmacopoeia is used by all pharmaceutical companies as a standard set of procedures to ensure that they will comply with FDA requirements. This is applied to conductivity measurements (Section 645), which are used to determine if the water used as either a washing solution or as part of the product being manufactured meets strict quality standards.

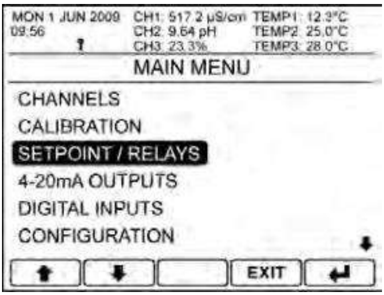
The Directive

Conductivity is used as the first (Stage 1) test and can be an on-line measurement. The measurement is used to determine the maximum level of dissolved minerals that are in the solution, which it is ideally suited to do. However the conductivity of a solution varies with temperature as well as the contaminants in it, and this temperature dependence varies with the type of contaminant. In order to compensate for this most conductivity instrument s apply a temperature compensation factor, usually 2%/°C, but due to the wide variation in the quality of different manufacturers temperature compensation systems USP has specified that all measurements must be made uncompensated. The table below lists the maximum allowed conductivity values at a series of different temperatures.

µS/cm	°C	µS/cm	°C	µS/cm	°C
0.6	0	1.4	30	2.2	60
0.8	5	1.5	35	2.4	65
0.9	10	1.7	40	2.5	70
1.0	15	1.8	45	2.7	75-90
1.1	20	1.9	50	2.9	95
1.3	25	2.1	55	3.1	100

USP Operation

Any setpoint which is assigned to a conductivity input channel can be set to activate in accordance with the limits specified in the USP standard.



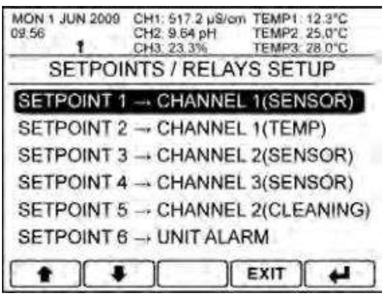
Main Menu

From the front screen press the menu button to show the main menu options and select Setpoint / Relays.

🡅/🡇 – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



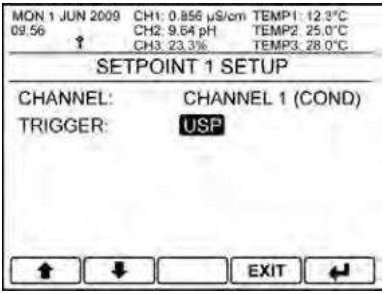
Select Setpoint

Select the Setpoint you wish to edit.

🡅/🡇 – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



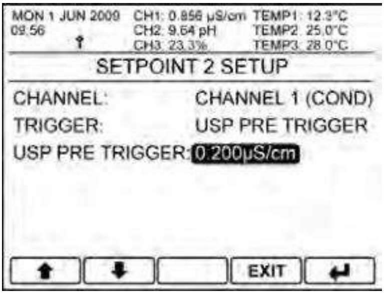
Setup Setpoint

Set “Channel” to the required conductivity input channel and “Trigger” to USP.

This causes the setpoint to operate to the USP levels stated. It will also force the selected channel’s units to “Siemens”, the cell constant to “0.01” the display range to “9.999µS” and Temperature Compensation to “Out”

Note. The rest of the menus for this setpoint will be disabled.

🡅/🡇	– Select Option
EXIT	– Return to Setpoint Channel Menu
↵	– Enter Option



USP Pre-Trigger

In addition any other setpoint assigned to the same channel as the USP setpoint can be configured as a pre-trigger and will cause the setpoint to activate by the pre-trigger amount before the USP level.

Example. If the USP setpoint 1 was due to activate at 1.300µS/cm and the pre-trigger setpoint 2 was set to 0.200µS/cm then setpoint 2 would trigger at 1.100µS/cm.

🡅/🡇	– Select Option
EXIT	– Return to Setpoint Channel Menu
↵	– Enter Option

Appendix A - Ultra Pure Water

UPW cell positioning, flow rate and sampling

This summary of ASTM D5391-93, combined with LTH application notes applies to ultra-pure water applications only. These applications are very specific in nature and require great care to avoid errors in measurement.

Pure water conductivity or resistivity must be measured with a cell and temperature sensor in a flowing, closed system to prevent trace contamination from wetted surfaces and from the atmosphere. Specialised temperature compensation can be used to correct the measurement to a reference temperature of 20 or 25°C taking into account the temperature effects on the ionisation of water, the contaminates and interactions between the two.

The cell constant for the precision cell has been determined with a secondary standard cell that has a cell constant determined by ASTM D1125.

Conductivity or resistivity can be used for detecting trace amounts of ionic contaminants in water. It is the primary means of monitoring the performance of demineralisation and other high purity water treatment operations.

It is used to detect ionic contamination in boiler waters, microelectronics rinse waters, pharmaceutical process waters and to monitor and control the level of boiler and power plant cycle treatment chemicals.

Exposure of the sample to atmosphere will cause changes in the conductivity or resistivity due to loss or gain of dissolved gases. CO_2 can reach an equilibrium concentration in water of about 1 mg/l and add up to 1 µS/cm to the conductivity due to the formation of carbonic acid. This process is quite fast, depending upon conditions.

Cell, flow chamber and sample line surfaces will slowly leach trace ionic contaminates, evidenced by increasing conductivity readings with very low or zero flow rate. There must be sufficient flow to keep these contaminates from accumulating to the point where they can significantly affect the measurement. The large and convoluted surface of platinised cells precludes their use for high purity measurements for this reason.

Samples containing dissolved gases must have sufficient flow through the cell so that bubbles cannot accumulate and occupy sample volume within the cell, causing low conductivity (high resistivity) readings.

High purity conductivity measurement must not be made on a sample downstream of pH sensors due to the possible contamination of the sample with traces of reference electrolyte salts. Use a dedicated sample line or place the conductivity cell up stream from the pH sensors.

Conductivity cells mounted downstream from ion exchangers are vulnerable to catching ion exchange resin particles between the cell electrodes.

Resin particles are sufficiently conductive to short circuit the cell and cause high off scale conductivity or extremely low resistivity readings.

Resin retainers must be effective and the cell must be installed so that it is accessible for cleaning. If this is a problem with the CMC26/001/PT43 cell use the CMC34/001/PT43 which has wider spaced electrodes of greater than 1.5 mm. This has been found to be less likely to trap such particles.

Conductivity cells if subjected to de-mineraliser regeneration reagents require excessive rinse time to obtain satisfactory results, therefore, locate the cell where it will be isolated during regeneration. The cell should not be used to measure high ionic content samples of greater than 20 µS/cm (less than 0.05 MΩ.cm) since it can retain ionic contaminates and require excessive rinse down time for valid measurements.

The instrument incorporates an electronic guard to minimise the effect of cable capacitance and a 4 wire temperature measurement system to allow accurate measurements. LTH 54D or similar cable must be used to ensure correct operation.

The cell must be located in an active flowing part of the piping. Stagnant areas or dead legs must be avoided to ensure a representative sample and prevent any bubbles from adhering to the cell surfaces.

Sample lines must be designed to maintain sample integrity. Do not expose the sample to atmosphere to prevent absorption or loss of gases, particularly $C0_2$ which will affect conductivity.

The sample should be continuous at a stable flow rate of at least 100 ml/min and should be maintained to enable sample line wetted surfaces to reach equilibrium with sample conditions. Do not make measurements following changes to sample flow rate for the period of time required to recover from transient effects on the particular sampling system.

Appendix B - Temperature Coefficient

Calculating the temperature coefficient of a solution

If the temperature coefficient of the solution being monitored is not known, the MXD70 series can be used to determine that coefficient. You should set the conductivity input channel to a suitable range and the temperature coefficient to 0.0%.

The following measurements should be made as near to the normal operating point as practical, between 5°C and 70°C for the highest accuracy. Immerse the measuring cell in at least 500 ml of the solution to be evaluated, allow sufficient time to stabilise, approximately one or two minutes, and then record both the temperature and conductivity readings. Raise the solution temperature by at least 10°C and again record the temperature and conductivity readings. Using the following equation, the temperature compensation slope can be calculated in percentage terms:

$$\alpha = \frac{(Gx-Gy) \times 100\%}{Gy(Tx-25) - Gx(Ty-25)} \qquad \text{(base temperature 25°C)}$$

Note: If base temperature is set to 20°C, then replace 25 with 20 in the above equation.

Term	Description
Gx	Conductivity in µS/cm at temperature Tx
Gy	Conductivity in µS/cm at temperature Ty

Note: One of these measurements can be made at ambient temperature.

Set the temperature compensation slope to the calculated value. The temperature compensation is now set up for normal operation.

If it is difficult or impossible to evaluate the temperature compensation slope using this method, a 2.0 % / °C setting will generally give a good first approximation until the true value can be determined by independent means.

Temperature Data

The table below lists approximate resistance values of temperature sensors that may be used with the MXD70 Series. Not all options are available on all models.

Temperature (°C)	PT1000 RTD	PT100 RTD	1K Thermistor	3K Balco
0	1000.0Ω	100.00Ω	2691Ω	2670Ω
10	1039.0Ω	103.90Ω	1779Ω	2800Ω
20	1077.9Ω	107.79Ω	1204Ω	2930Ω
25	1097.3Ω	109.73Ω	1000Ω	3010Ω
30	1116.7Ω	111.67Ω	833.7Ω	3070Ω
40	1155.4Ω	115.54Ω	589.0Ω	3160Ω
50	1194.0Ω	119.40Ω	423.9Ω	3320Ω
60	1232.4Ω	123.24Ω	310.5Ω	3470Ω
70	1270.7Ω	127.07Ω	231.0Ω	3570Ω
80	1308.9Ω	130.89Ω	174.5Ω	3740Ω
90	1347.0Ω	134.70Ω	133.6Ω	3830Ω
100	1385.0Ω	138.50Ω	103.6Ω	4020Ω

Appendix C - Instrumentation Configuration

Instrument Configuration

Instrument Type		Serial Number		Software Version	
Power Supply Type					
Channel 1 Input Card Type		Serial Number			
Channel 2 Input Card Type		Serial Number			
Channel 3 Input Card Type		Serial Number			
Output Expansion Card Type		Serial Number			
Software Expansion		Unlock Code			
Software Expansion		Unlock Code			

Instrument Settings

Security Access Code					
Language					
Front Screen Ch1 Shown		Front Screen Ch1 Secondary Reading i)		Front Screen Ch1 Secondary Reading ii)	
Front Screen Ch2 Shown		Front Screen Ch2 Secondary Reading i)		Front Screen Ch2 Secondary Reading ii)	
Front Screen Ch3 Shown		Front Screen Ch3 Secondary Reading i)		Front Screen Ch3 Secondary Reading ii)	
Front Screen Ch1 Label					
Front Screen Ch2 Label					
Front Screen Ch3 Label					
4-20mA Output Slot 1		4-20mA Output Slot 2			
Menu Header i)		Menu Header ii)		Menu Header iii)	
Menu Header iv)		Menu Header v)		Menu Header vi)	

Channel Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Description			
Units			
Sensor / Probe Type			
Cell Constant			
Range			
Linearisation Source			
TDS Factor			
Membrane Correction Factor			
Bias Voltage			
mA Input: Loop Mode			
mA Input: Input Mode			
Set 0mA Input			
Set 4mA Input			
Set 20mA Input			
Temperature Input Sensor			
Temperature Units			
Temperature Compensation: In/Out			
Temperature Compensation Slope			
Temperature Compensation: Auto / Manual			
Fixed Temperature Input			
Input Salinity			
Pressure Compensation: Auto / Manual			
Pressure Mode: Input / 24V Loop			
Pressure Units			
Pressure 4mA Input			
Pressure 20mA Input			
Fixed Pressure Input			
Cable Compensation			
Input Filter			

Setup

Setup

Curve Setup (available options vary with card type and configuration)

	Channel 1		Channel 2		Channel 3	
Curve A						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						
Curve B						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						

Channel Calibration Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Calibration Principle			
Calibration Manual Temp Input			
Calibration Units			
Calibration Manual Pressure Input			
Span Cal Point			
Enable Auto Span Cal			
Offset Value			
Slope Value			
Temperature Offset			
Sensor Condition			
Front Calibration Access			
Calibration Reminder			
Calibration Interval			

Setpoints Setup (available options vary with card type and configuration)

	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5	Setpoint 6
Channel						
Input Source						
Trigger						
High Value						
Low Value						
USP Pre-Trigger						
Mode						
Cycle Time						
Proportional Band						
Delay						
Hysteresis						
Dose Alarm						
Dose Alarm Time						
Initial Charge						
Charge Time						
Charge Access						
Alarm Mode						
Clean Duration						
Clean Interval						
Clean Mode						
Clean Recovery						
Clean Delay						

Current Output Setup (available options vary with card type and configuration)

	Current Output A	Current Output B	Current Output C	Current Output D	Current Output E	Current Output F
Channel						
Input Source						
Output 0 – 20mA / 4 - 20mA						
Zero						
Span						
On Error						

Digital Inputs (available options vary with card type and configuration)

	Digital Input 1	Digital Input 2	Digital Input 3	Digital Input 4	Digital Input 5	Digital Input 6	Digital Input 7	Digital Input 8
Channel								
Function								
Range Change								
Switch Store								
Cleaning Setpoint								
Polarity								
4-20 Output Level								

Service Alarms

	Channel 1	Channel 2	Channel 3
Service Reminder			
Service Interval			
Next Service Date			

Appendix D - Error Messages

Internal Error Messages

E001	**UNIT**	**Processor RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E002	**UNIT**	**External RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E003	**UNIT**	**Internal Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, Reset Whole unit from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E004	**UNIT**	**Output Card Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E005	**UNIT**	**Internal Outputs Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E006	**UNIT**	**For Future Use**
E007	**UNIT**	**Unit Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the whole unit from the Load Default Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E008	**UNIT**	**Unit Store A Checksum Error** The data in Unit Store A has been corrupted. Save the current setup back to Unit Store A in the Save/Restore menu.
E009	**UNIT**	**Unit Store B Checksum Error** The data in Unit Store B has been corrupted. Save the current setup back to Unit Store B in the Save/Restore menu.
E010 to E013	**UNIT**	**Maths Error** There has been an internal maths calculation failure. As such, it should not appear if the software is functioning properly. The error message should clear after approx. 5 seconds. If the error continues to be displayed consult with your supplier, as this unit may require to be returned for repair.
E014	**UNIT**	**Contrast Chip Error** The Contrast Chip is not operating correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E015	**UNIT**	**Unit SD Card Checksum Error** The SD Card store from which the entire unit was restored from has become corrupted. Check the unit's settings and then save the settings again to the SD card store.
E016	**UNIT**	**SD CARD FULL** The SD card has become full. To continue use, either replace with a blank SD card or remove existing files from SD card

Input Channel Errors

E030 E080 E130	CH1 CH2 CH3	**Input Card Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E031 E081 E131	CH1 CH2 CH3	**Setup Checksum Error** The current channel's configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists reset the current channel from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E032 E082 E132	CH1 CH2 CH3	**Store A Checksum Error** The data in the channel's Store A has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store A in the Save/Restore menu.
E033 E083 E133	CH1 CH2 CH3	**Store B Checksum Error** The data in the channel's Store B has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store B in the Save/Restore menu.
E034 E084 E134	CH1 CH2 CH3	**Factory Cal Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E035 E085 E135	CH1 CH2 CH3	**User Cal Checksum Error** The Channel's User Cal has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the Channel from the Reset User Calibration option in the Calibration menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E036 E086 E136	CH1 CH2 CH3	**Sensor Cal Out Of Spec** The last Sensor Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E037 E087 E137	CH1 CH2 CH3	**Sensor Zero Cal Out Of Spec** The last Sensor Zero Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E038 E088 E138	CH1 CH2 CH3	**Sensor Span Cal Out Of Spec** The last Sensor Span Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E039 E089 E139	CH1 CH2 CH3	**No Signal** No Sensor connected or there is 'zero' detector current. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E040 E090 E140	CH1 CH2 CH3	**Signal Overload** The gain step is equal to 0 and the A/D output is over 255. This cannot happen in a liquid but could happen if the sensor is in full sunlight. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.

E041 **E091** **E141**	**CH1** **CH2** **CH3**	**Partial Depletion** Large difference between the detectors, i.e. one very dirty. This alarm will come up if there is a difference of 3:1 between the detectors. Remove sensor and clean sensor fingers. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E042 **E092** **E142**	**CH1** **CH2** **CH3**	**Full Depletion** Attenuation too high or the real probe signal goes above 14000. The probe sensor units (PSU) will be set to 16000. If this message persists, please consult with your supplier.
E043 **E093** **E143**	**CH1** **CH2** **CH3**	**Sensor User Offset At Limit** The last Sensor Offset Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E044 **E094** **E144**	**CH1** **CH2** **CH3**	**Sensor User Slope At Limit** The last Sensor Slope Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E045 **E095** **E145**	**CH1** **CH2** **CH3**	**Sensor User Slope < Spec** The last Sensor Slope Calibration was less than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E046 **E096** **E146**	**CH1** **CH2** **CH3**	**Sensor User Slope > Spec** The last Sensor Slope Calibration was greater than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E047 **E097** **E147**	**CH1** **CH2** **CH3**	**Sensor Open Circuit** The sensor input is at open circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E048 **E098** **E148**	**CH1** **CH2** **CH3**	**Sensor Short Circuit** The sensor input is at short circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E049 **E099** **E149**	**CH1** **CH2** **CH3**	**Sensor Positive Saturation** The sensor input is greater than the maximum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E050 **E100** **E150**	**CH1** **CH2** **CH3**	**Sensor Negative Saturation** The sensor input is less than the minimum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E051 **E101** **E151**	**CH1** **CH2** **CH3**	**Sensor Input Over Range** The sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E052 **E102** **E152**	**CH1** **CH2** **CH3**	**Sensor Input Under Range** The sensor reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.

E053 **E103** **E153**	**CH1** **CH2** **CH3**	**Temp Sensor Fault** The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check that the temperature sensor is set to the correct type in the channel setup menu. Under this condition, the unit will default to the fixed temperature setting for compensation purposes. If the message persists please consult with your supplier.
E054 **E104** **E154**	**CH1** **CH2** **CH3**	**Temp Input Over Range** The temperature sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E055 **E105** **E155**	**CH1** **CH2** **CH3**	**Temp Input Under Range** The temperature reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E056 **E106** **E156**	**CH1** **CH2** **CH3**	**Temp Comp Outside Limits** The temperature reading is less than 0.0C or greater than 150.0C, leading to an error in compensation.
E057 **E107** **E157**	**CH1** **CH2** **CH3**	**Polar Zero Cal At Limit** The last Polargraphic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E058 **E108** **E158**	**CH1** **CH2** **CH3**	**Polar Span Cal At Limit** The last Polargraphic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E059 **E109** **E159**	**CH1** **CH2** **CH3**	**Galvanic Zero Cal At Limit** The last Galvanic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E060 **E110** **E160**	**CH1** **CH2** **CH3**	**Galvanic Span Cal At Limit** The last Galvanic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E061 **E111** **E161**	**CH1** **CH2** **CH3**	**Pressure Sensor Over Range** The pressure sensor reading is greater than the specified limit for the probe.
E062 **E112** **E162**	**CH1** **CH2** **CH3**	**Pressure Sensor Under Range** The pressure sensor reading is less than the specified limit for the probe.
E063 **E113** **E163**	**CH1** **CH2** **CH3**	**Pressure Above 20mA** The pressure sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E064 **E114** **E164**	**CH1** **CH2** **CH3**	**Pressure Below 4mA** The pressure sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E065 **E115** **E165**	**CH1** **CH2** **CH3**	**AUX mA Input Above 20mA** The sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.

E066 **E116** **E166**	**CH1** **CH2** **CH3**	**AUX mA Input Below 4mA** The sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E067 **E117** **E167**	**CH1** **CH2** **CH3**	**Sensor 0mV Cal Out of Spec** The pH 0mV calibration for this channel is outside recommended specifications.
E068 **E118** **E168**	**CH1** **CH2** **CH3**	**Calibration Due** The time since the last calibration was performed on this channel has exceeded the time set in the calibration menu.
E069 **E119** **E169**	**CH1** **CH2** **CH3**	**Planned Service Due** The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
E070 **E120** **E170**	**CH1** **CH2** **CH3**	**SD Card Checksum Error** The SD Card store from which this channel was restored from has become corrupted. Check the channel's settings and then save the settings again to the SD card store.
E071 **E121** **E171**	**CH1** **CH2** **CH3**	**Gain Error** The sensor gain has been exceeded. If this message persists, please consult with your supplier.
E072 **E122** **E172**	**CH1** **CH2** **CH3**	**Invalid Linearisation Curve** A minimum of 2 linearisation points are required. Please check linearisation curve settings in the channel setup menu for this channel.
E073 **E123** **E173**	**CH1** **CH2** **CH3**	**Linearisation Over-Range** The linearisation result is greater than 9999 (or 100.0% when using %).
E074 **E124** **E174**	**CH1** **CH2** **CH3**	**Linearisation Under-Range** The linearisation result is less than 0.
E075 **E125** **E175**	**CH1** **CH2** **CH3**	**Curve Low Limit** The incoming probe signal is less than the lowest point in the linearisation curve.
E076 **E126** **E176**	**CH1** **CH2** **CH3**	**Curve High Limit** The incoming probe signal is greater than the highest point in the linearization curve.
E077 **E127** **E177**	**CH1** **CH2** **CH3**	**Custom Error** Contact your supplier for details.

Setpoint Errors

E180 **SP1** **E190** **SP2** **E200** **SP3** **E210** **SP4** **E220** **SP5** **E230** **SP6**		**Dose Alarm Error** The Setpoint has been dosing for longer than the Dose Alarm time as defined in the setpoint menu.
E181 to E184 **E191 to E194** **E201 to E204** **E211 to E214** **E221 to E224** **E231 to E234**	**SP1** **SP2** **SP3** **SP4** **SP5** **SP6**	**For Future Use**
E185 **SP1** **E195** **SP2** **E205** **SP3** **E215** **SP4** **E225** **SP5** **E235** **SP6**		**Store A Checksum Error** The Store A Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E186 **SP1** **E196** **SP2** **E206** **SP3** **E216** **SP4** **E226** **SP5** **E236** **SP6**		**Store B Checksum Error** The Store B Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E187 **SP1** **E197** **SP2** **E207** **SP3** **E217** **SP4** **E227** **SP5** **E237** **SP6**		**Setup Checksum Error** The Setup for this Setpoint has become corrupted. Check and correct the setpoint settings and turn the unit off and on again. If the message persists please consult with your supplier.
E188 **SP1** **E198** **SP2** **E208** **SP3** **E218** **SP4** **E228** **SP5** **E238** **SP6**		**SD Card Checksum Error** The SD Card store from which this Setpoint was restored from has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again to the SD card store.

Current Output Errors

E240 E250 E260 E270 E280 E290	A B C D E F	**Current OP Hardware Fault** 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.
E241 E251 E261 E271 E281 E291	A B C D E F	**Sensor IP<Current OP Zero** The sensor input level is below that set for the current output zero.
E242 E252 E262 E272 E282 E292	A B C D E F	**Sensor IP>Current OP Span** The sensor input level is above that set for the current output span.
E243 E253 E263 E273 E283 E293	A B C D E F	**Sensor IP<Current OP Span** The sensor input level is below that set for the current output Span.
E244 E254 E264 E274 E284 E294	A B C D E F	**Sensor IP>Current OP Zero** The sensor input level is above that set for the current output Zero.
 E255 E265 E275 E285 E295	A B C D E F	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 E256 E266 E276 E286 E296	A B C D E F	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

E245 **E255** **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

Digital Input Errors

E301 **E306** **E311** **E316** **E321** **E326** **E331** **E336**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**Store A Checksum Error** The Store A Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E302 **E307** **E312** **E317** **E322** **E327** **E332** **E337**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**Store B Checksum Error** The Store B Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E303 **E308** **E313** **E318** **E323** **E328** **E333** **E338**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**Setup Checksum Error** The Setup for this Digital Input has become corrupted. Check and correct the digital inputs settings and turn the unit off and on again. If the message persists please consult with your supplier.
E304 **E309** **E314** **E319** **E324** **E329** **E334** **E339**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**SD Card Checksum Error** The SD Card store from which this Digital Input was restored from has become corrupted. Check the Digital Input's settings in the digital input menu and then save the settings again to the SD card store.

Communication Errors

E340 **E342** **E344**	**CH1** **CH2** **CH3**	**Comms Failure** The Channel's Input Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E341 **E343** **E345**	**CH1** **CH2** **CH3**	**Comms Error** The Channel's Input Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E346	**UNIT**	**Output Comms Failure** The Basic Internal Outputs are not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E347	**UNIT**	**Output Comms Error** The Basic Internal Outputs are not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E348	**OP**	**Output Option Comms Failure** The Output Option Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option card may require to be returned for repair.
E349	**OP**	**Output Option Comms Error** The Output Option Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option Card may require to be returned for repair.

Calculation Errors

E400 **E411**	**C1** **C2**	**Calculation Over Range** The Calculation reading is greater than the specified upper limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E401 **E411**	**C1** **C2**	**Calculation Under Range** The Calculation reading is less than the specified lower limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E402 **E412**	**C1** **C2**	**Calculation Setup Checksum** The Setup for this Calculation has become corrupted. Check and correct the calculation settings and turn the unit off and on again. If the message persists please consult with your supplier.
E403 **E413**	**C1** **C2**	**Calculation Store A Checksum** The Store A Save for the channel associated with this calculation has become corrupted. Check the calculation’s settings in the calculation menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E404 **E414**	**C1** **C2**	**Calculation Store B Checksum** The Store B Save for the channel associated with this calculation has become corrupted. Check the calculation’s settings in the calculation menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E405 **E415**	**C1** **C2**	**Calculation SD Card Checksum** The SD Card store from which this Calculation was restored from has become corrupted. Check the Calculation's settings in the Calculation menu and then save the settings again to the SD card store.

Modbus Errors

E420	**UNIT**	**Modbus Setup Checksum** The Modbus setup has become corrupted. Check and correct the Modbus settings and turn the unit off and on again. If the message persists please consult with your supplier.
E421	**UNIT**	**Modbus Store A Checksum** The Store A Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store A in the Save/Restore menu.
E422	**UNIT**	**Modbus Store B Checksum** The Store B Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store B in the Save/Restore menu.
E423	**UNIT**	**Modbus SD Card Checksum** The SD Card store from which the Modbus configuration was restored from has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again to the SD card store.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MXD70 Series 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 Appendix D Error Messages gives a list that the MXD70 series 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 instrument,
- The approximate date of purchase.
- Details of the program settings and application
- Electrical environment and supply details
- Circumstances under which the fault occurred.
- The nature of the fault or faults
- Any error messages that are displayed
- The sensor type, cable length and type
- Current output configuration
- Relay connection configuration

It is often worthwhile to check the measurement by an independent method, for example using a handheld meter. (See also Care and Maintenance of Conductivity Sensors, page 7)

Note: low conductivity = high resistivity

The Instrument Appears Dead
Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the MXD70 Series allows the unit to accept from 85 to 250V AC or DC, an alternative option allows operation from 18 to 32V AC or DC, check the connection label for voltage specification. 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 inputs are correctly connected (see Installation and Choice of Conductivity Sensors, page 7) and that the sensor is not faulty or damaged.
- Check that the correct range and Cell Constant has been selected within the Channel Setup menu if in doubt set to Auto Range (see page 16).
- Check the temperature compensation state (see Channel Setup page 18). 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 on the main display is correct.
- Check the sensor using a hand held meter.
- Check that the sensor is “seeing” a representative sample, trapped air will give a low reading.
- Ensure the input is correctly connected and the sensor is not faulty or damaged.
- Check the sensor and its cable for possible short circuits. Consider the fact that the conductivity may be higher than the range of the instrument.

- Check the Pt1000 RTD temperature sensor connections. If an alternative temperature sensor is being used, say Pt100 or 1K Thermistor, check that this has been selected in the Channel Setup Menu (see page 17).
- Check that any in-line junction boxes and extension cables have been fitted and wired up correctly.

The display reads zero

- Check for open circuit sensor (conductivity or TDS modes)
- Check for short circuit sensor (resistivity mode)
- Check for damage to the connecting cable.
- Check that all input connections are secure.
- Check the sensor is wired up correctly.
- Check that the sensor bore is not blocked or completely filled with air.
- Check the sensor is immersed in the correct solution.

Instrument display appears to malfunction

- Switch the instrument power off and on again.
- Check that the display back-light is on, indicating power is reaching the unit.
- See that it displays meaningful text (Issue number etc.) in its start-up sequence, indicating processing activity.

The Sensor Reading Is Incorrect

- Low reading due to incomplete immersion or contamination of the electrodes.
- There may be some trapped matter within the sensor bore.
- High conductivity readings caused by a short circuit or leakage of liquid contamination into the sensor moulding.
- The sensor should be checked, when dry, with an ohmmeter. Disconnect it at the instrument and check the resistance between the E and C terminals. It should be greater than 50 MΩ between E & C. Check the leakage from E & C in turn to the terminated screens (inner and outer). Again, 50 MΩ should be the minimum isolation resistance between them all.
- Low conductivity can be caused by accumulation of trapped air or gas coming out of solution. Check that no "air traps" exist in the sensor installation.
- High conductivity readings caused by leakage of solution into the sensor. This usually indicates that the sensor material has been fractured and the sensor must be replaced.
- First check that the temperature resistance is correct, otherwise the temperature compensation circuit will cause false or erratic readings. Temporarily switching out the temperature compensation can help to show if this is the cause of the problem.
- If another conductivity sensor is available, this can be used to determine whether the fault lies with the instrument or the sensor.
- Check that the sensor cable is not damaged or broken and that the outer screen does not make contact with any other terminals or metal work.
- Check that the inner screen (G) does not contact any other terminals or metalwork at the sensor end. It should not be grounded.
- Check that the sensor cable is sufficiently distant from power cables or electrical noise sources.
- Check that the correct sensor type has been installed.
- Check that the correct range has been selected.
- Check that the correct sensor calibration values have been used.
- Check that the calibration procedure has been followed precisely.
- Check that the temperature compensation has been set up as required.
- Check that the sensor cable does not exceed the maximum specified length (sensor 5m + extension 95m).

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached. (See "Temperature Sensor Connections", page 13).
- Check that the temperature sensor type is correctly selected in the Channel Setup menu (See page 17)
- Where practical check the temperature sensor resistance against the table in Temperature Data, page 35.

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 he current output has been configured properly.

Relays Appear to Malfunction

- Check that the unit is "On-Line" (see page 15)
- Check that the set point configuration is correct (see Setpoints, Current outputs and Digital Input configuration guide)
- If the relays are vibrating or "chattering" as they pass the set point, check the hysteresis setting and increase if necessary.
- Ensure that the relays are connected properly (see MXD73 Installation guide or MXD75 Installation guide) and that the voltage/current levels are not exceeding 5A @ 30V DC or 5A @ 250V AC.
- Check that the instrument input cables are not picking up excessive noise.

GUARANTEE AND SERVICE

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

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

Goods for attention under guarantee (unless otherwise agreed) must be returned to the factory carriage paid and, if accepted for free repair, will be returned to the customer's address free of charge. Arrangements can also be made for repair on site, in which case a charge may be made for the engineer's time and expenses.
If any services other than those covered by the guarantee are required, please contact LTH direct.

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

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*Optional Extra

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MXD70 SERIES

Multi-parameter Monitor

pH / Redox

Setup and Operating

Guide

Preface

Product warranty

The MXD70 Smart pH/Redox Input Card has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2014/30/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2014/35/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2015. Certificate No: FM 13843

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

Contents

pH / Redox Input Card Specification

Measurement Input	Single ended or differential with solution ground. Up to 100 meters cable. **pH** Separate glass and reference electrode pair. Separate Antimony and reference electrode pair. Combination electrode. SensorTalk digital or hybrid electrode. **Redox** Separate glass and reference electrode pair. Separate Antimony and reference electrode pair. Combination electrode. SensorTalk digital or hybrid electrode. Other manufacturer's sensors can be accommodated.
Ranges of Measurement	0.00 to 14.00 pH, 0.000 to 14.000 pH -1999mV to +1999mV.
Accuracy	± 0.05 pH. ± 3mV.
Linearity	± 0.1% of range.
Repeatability	± 0.1% of range.
Operator Adjustment	

	Slope	Offset
pH	60-120%	3 to 11pH
Antimony	60-120%	-4 to +4pH
Redox	NA	-400mV to +400mV

Calibration Methods	Automatic 4pH / 9pH Buffer Calibration. Manual Slope and Offset Adjustment. Automatic loading of stored calibration data from pre-calibrated SensorTalk electrodes. All methods feature post-calibration electrode condition indication.
Custom Buffer	13-point 4pH / 9pH custom buffer entry pre-loaded with standard LTH buffers.
Calibration Timer	Inbuilt calibration count down timer which will trigger an alarm when calibration interval has expired.
Sensor Input filter	Adjustable filter that averages the sensor input over a user selectable time (10sec – 5mins).
Temperature Sensor	Pt100, Pt1000, 3K Balco RTD input. Up to 100 meters of 3 wire cable. Temperature sensor can be mounted in the sensor or separately.
Range of Temperature Measurement	-50 °C to +160 °C (-58 °F to +320 °F) (223.15K to 433.15K) for full specification. Note. When units are set to temperature the reading will be calculated to 2 decimal points between -9.99 and +99.99.
Temperature Accuracy	± 0.2 °C (When using a 3 wire PT1000).

Operator Adjustment (Temperature)	± 50 °C, ± 122 °F or ± 50 K.
Temperature Compensation Type	Automatic or manual -20°C to +160°C.

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 make up, 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 29). Depending on the application it may also need periodic re-calibration, the MXD70 series provides an inbuilt count down timer which will trigger an alarm when calibration interval has expired (see page 36).

SensorTalk Interface

The smart capable version of the MXD70 pH/Redox card is capable of interfacing with the full range of Broadley James All-Digital Smart pH and Hybrid pH sensors. The Plug-and-Play functionality of the of the SensorTalk sensors enables “calibrate here use there”. Sensors can be accurately pre-calibrated away from the operation area with the calibration data stored in the sensor, ready for later use. When the sensor is connected to the MXD70 series the instrument auto-loads and applies the sensor’s calibration values.

For the biotech and pharmaceutical applications, ProCount enabled SensorTalk sensors will count all autoclave/SIP cycles autonomously even if disconnected from the instrument. Once reconnected the total count is accessible from the instrument.

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:

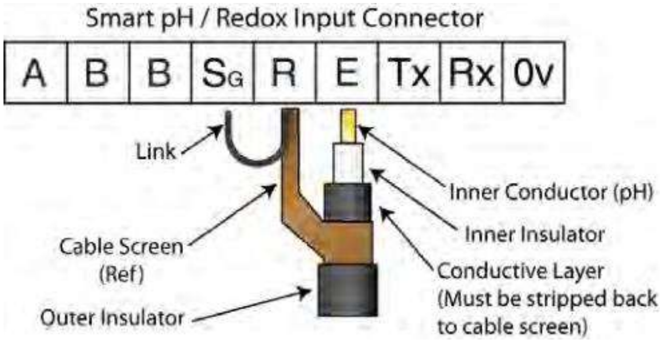
- Remove the black storage boot or transit cover at the end of the electrode
- Re-wet the fibre pack inside the storage boot with 3.8 Molar Potassium Chloride (KCl) saturated solution or if this is not available use a quantity of 4pH buffer solution. Note do not use deionised water.
- Re-seal the storage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

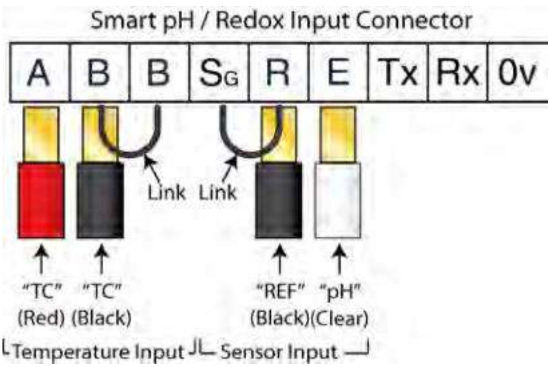
Depending on the issue the following glass body pH electrode maintenance procedures can be carried out:

- 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.

Smart Capable Input Card Termination Information

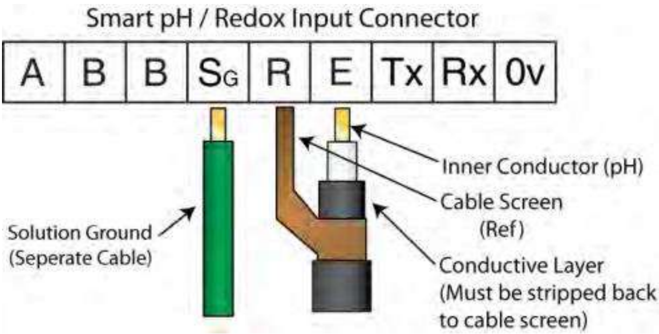


pH / Redox LN10 Coax Cable
(No TC) Connection Details

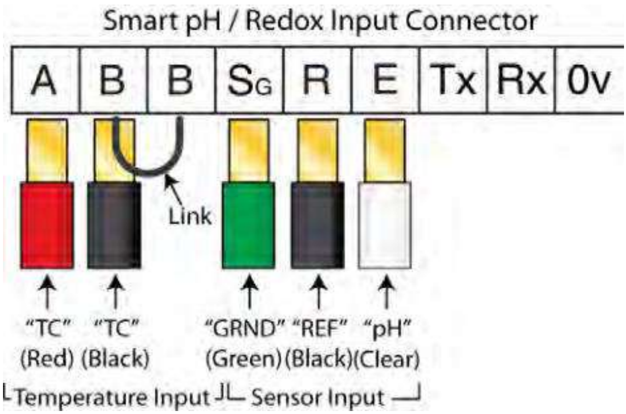


S400 ProcessProbe Cable (Solution Ground Not Fitted)
Connection Details

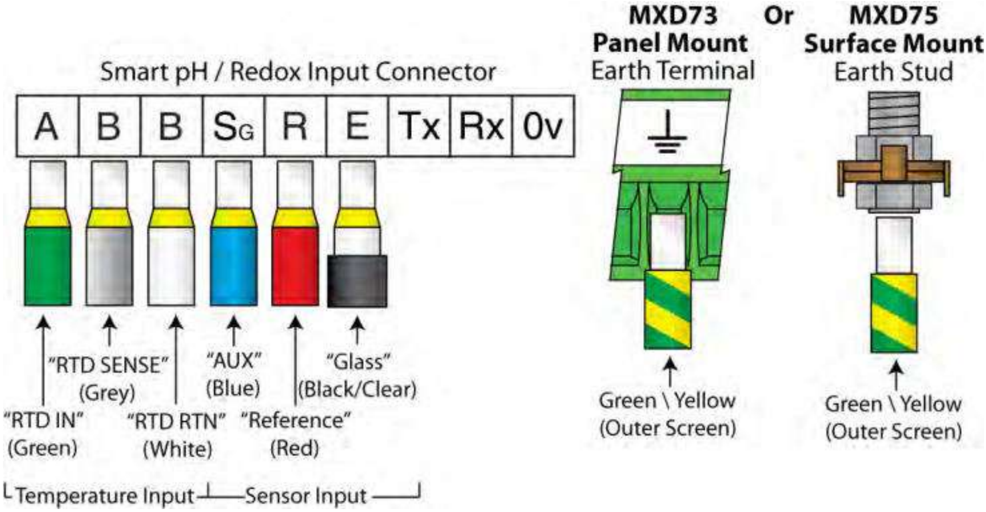
The Smart pH / Redox input card of the MXD70 Series also provides a differential input method of wiring the pH electrode. This provides better electrical noise immunity and allows the sensor to operate in solutions where flowing electrical currents may cause measurement problems.



pH / Redox LN10 Coax Cable with Solution Ground (No TC) Connection Details



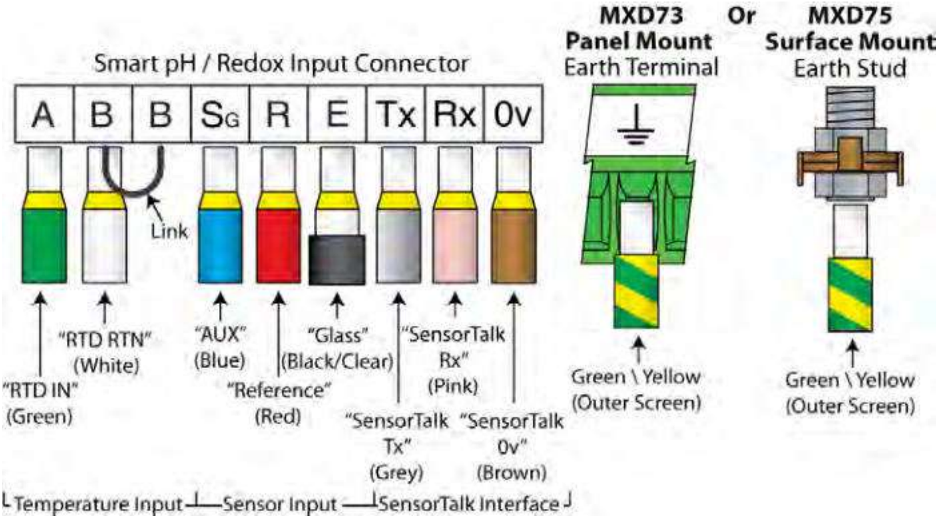
S400 ProcessProbe Cable (Solution Ground Fitted) Connection Details



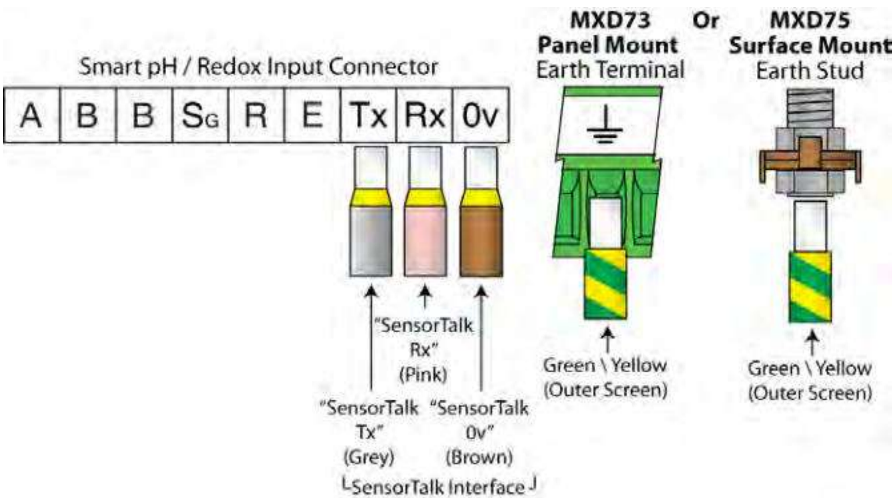
VP6 Detachable Cable Connection Details with "Solution Ground"

SensorTalk Sensors Termination Information

The Smart pH / Redox input card of the MXD70 Series is capable of interfacing with the range of SensorTalk pH / Redox electrodes from Broadley James Corporation. This allows the user to take advantage of the unique calibration functionality these sensors provide. **Please note,** when unplugging an existing SensorTalk sensor from the instrument please wait for the probe is removed message to appear before attaching a different sensor.

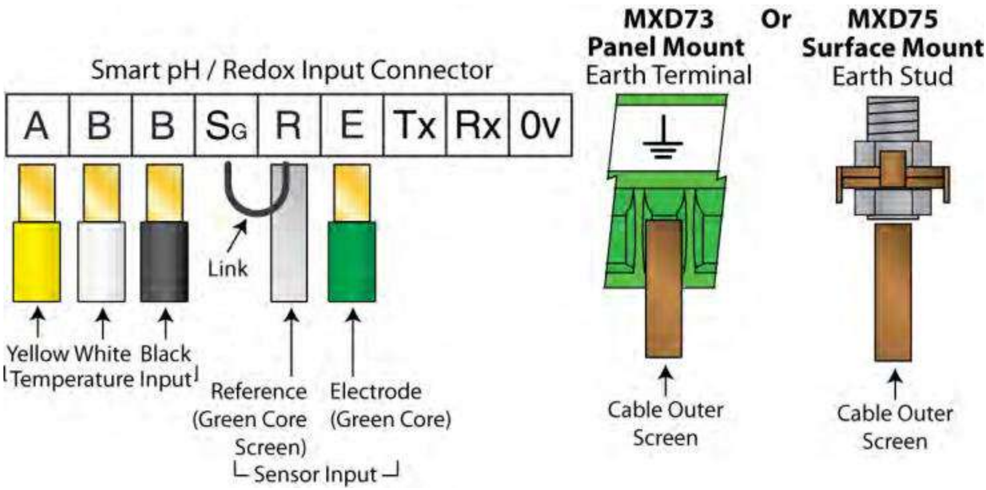


Hybrid SensorTalk Probe Cable Connection Details (Solution Ground Fitted)

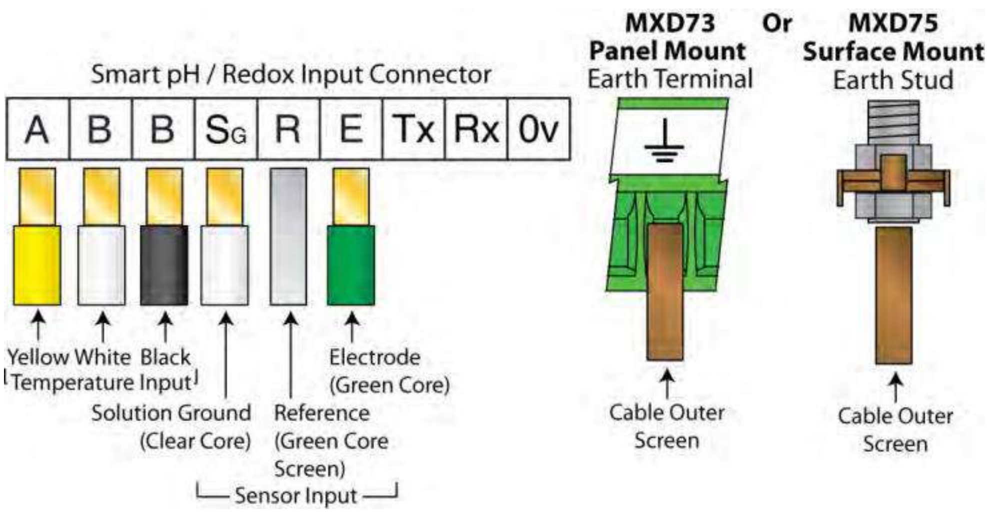


Digital SensorTalk Probe Cable Connection Details

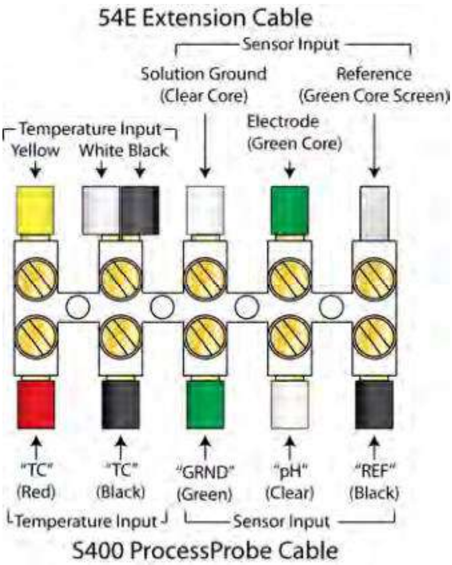
Smart Capable Input Card LTH 54E Extension Cable Connection Information



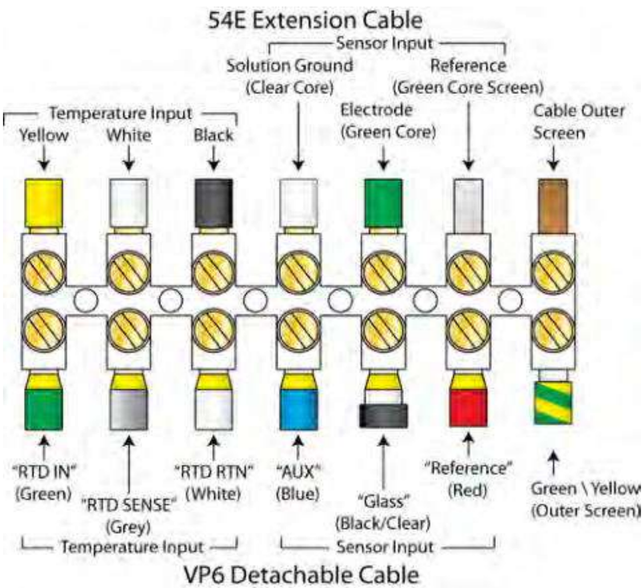
pH 54E Extension Cable Connection Details (Solution Ground Not Fitted)



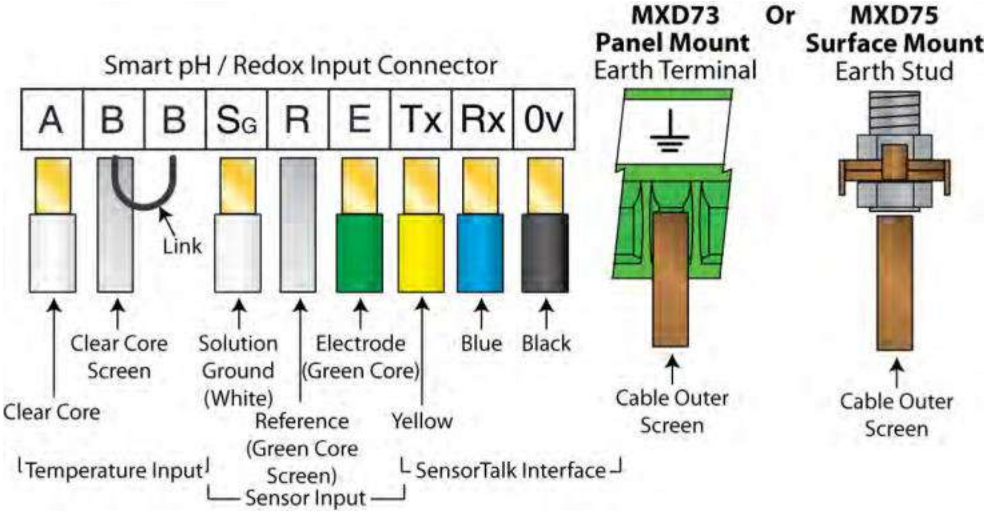
pH 54E Extension Cable Connection Details (Solution Ground Fitted)



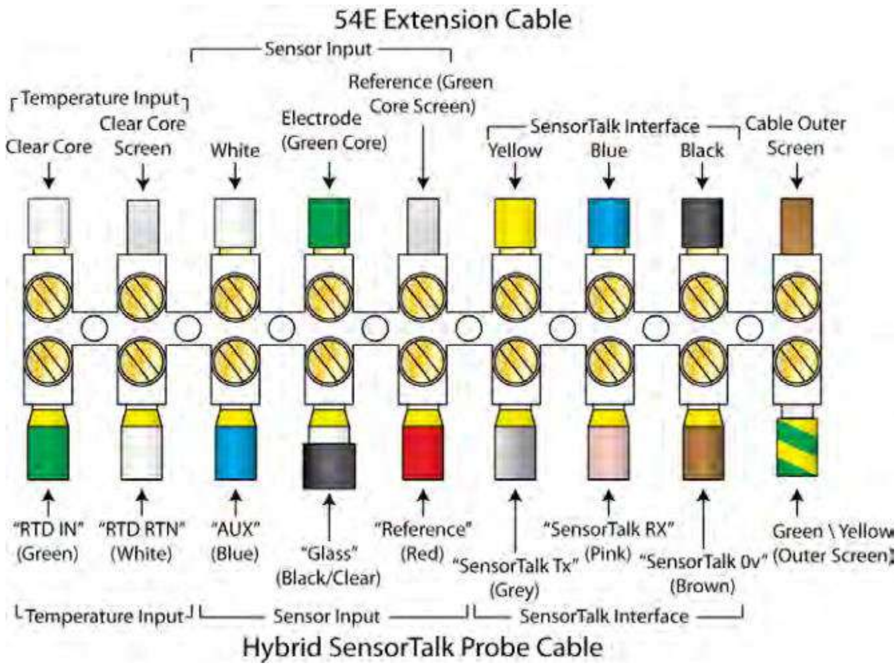
S400 ProcessProbe to 54E Extension Cable Connection Details



VP6 Detachable Cable to 54E Extension Cable Connection Details

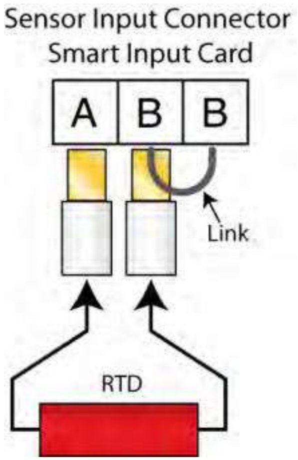


Hybrid SensorTalk 54E Extension Cable Connection Details (Solution Ground Fitted)

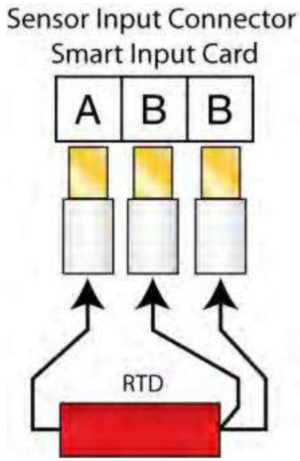


Hybrid SensorTalk Probe Cable To 54E Extension Cable Connection Details

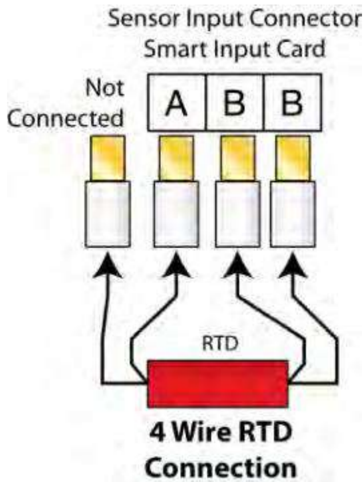
Smart Capable Input Card Temperature Sensor Connections



2 Wire RTD Temperature Connection

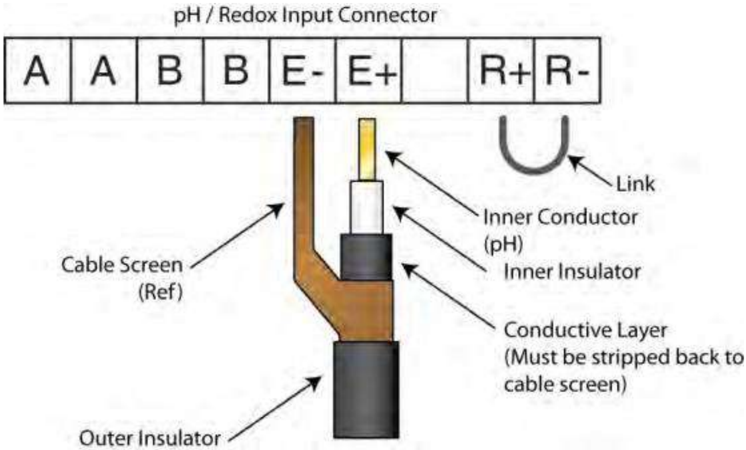


3 Wire RTD Temperature Connection

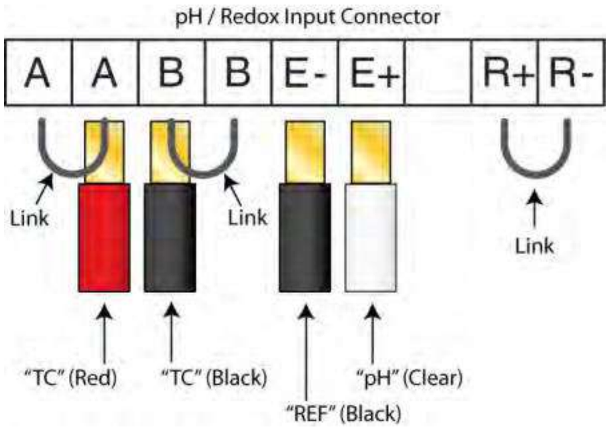


4 Wire RTD Temperature Connection

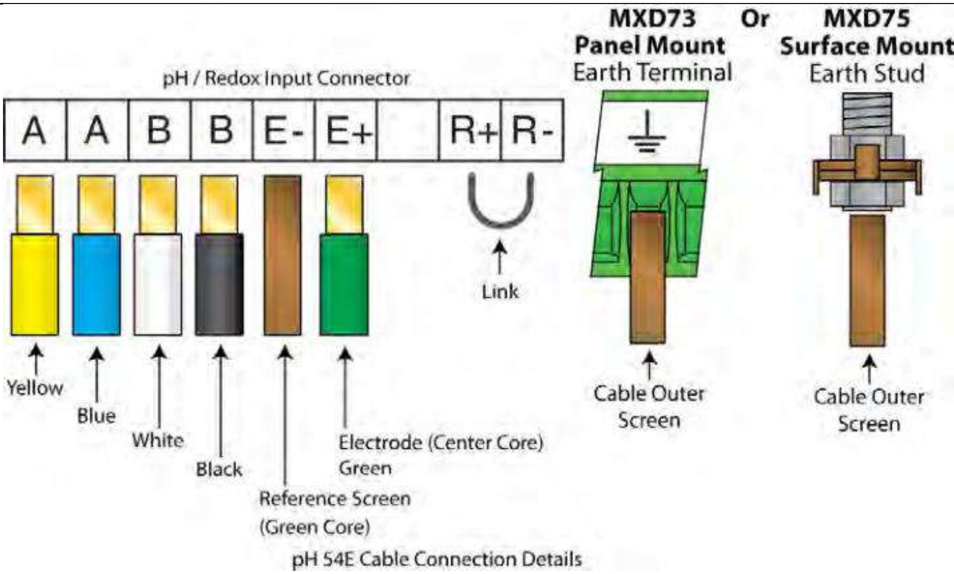
Previous Generation Input Card Termination Information



pH / Redox LN10 Coax Cable Connection Details

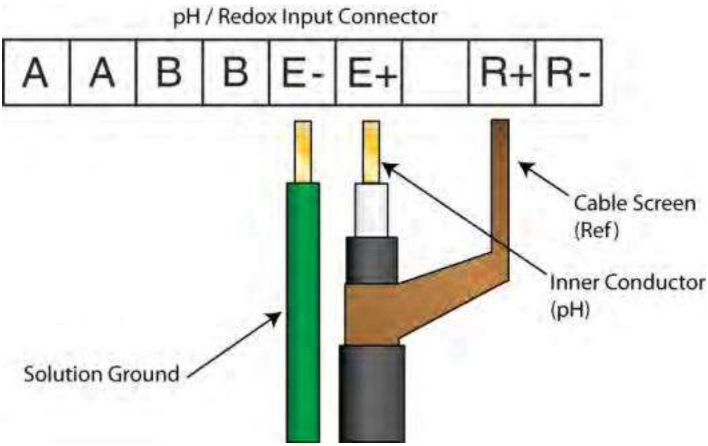


DynaProbe & ProcessProbe Cable Connection Details

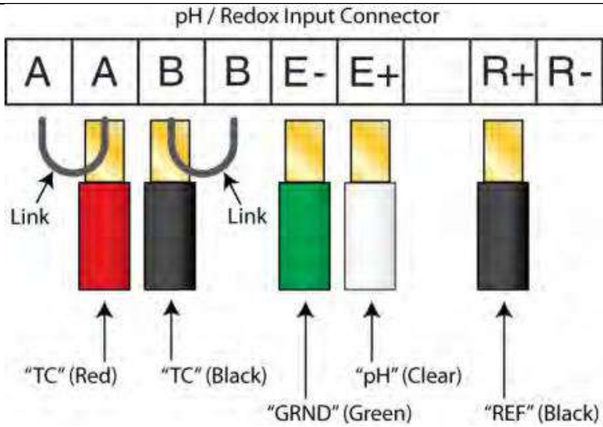


pH / Redox 54E Cable Connection Details

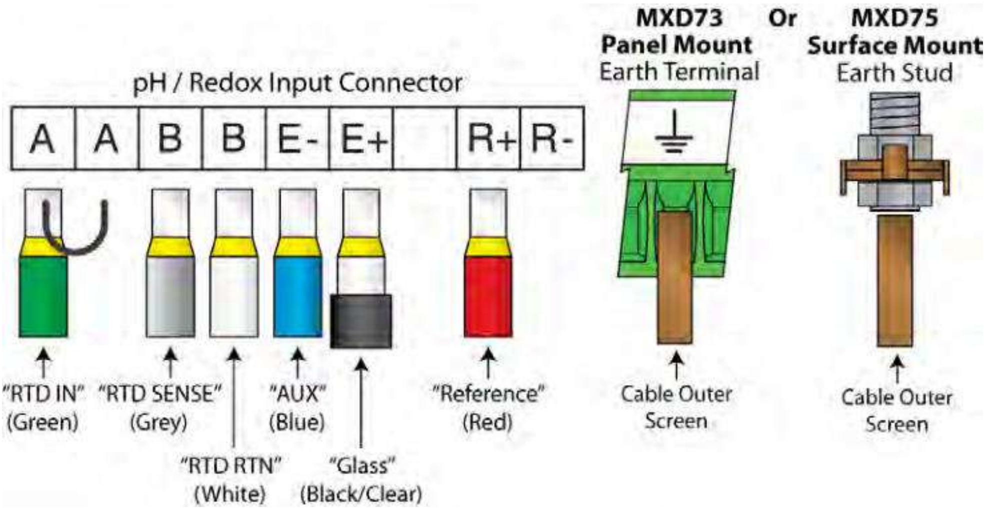
The pH / Redox input card of the MXD70 Series also provides a differential input method of wiring the pH electrode. This provides better electrical noise immunity and allows the sensor to operate in solutions where flowing electrical currents may cause measurement problems.



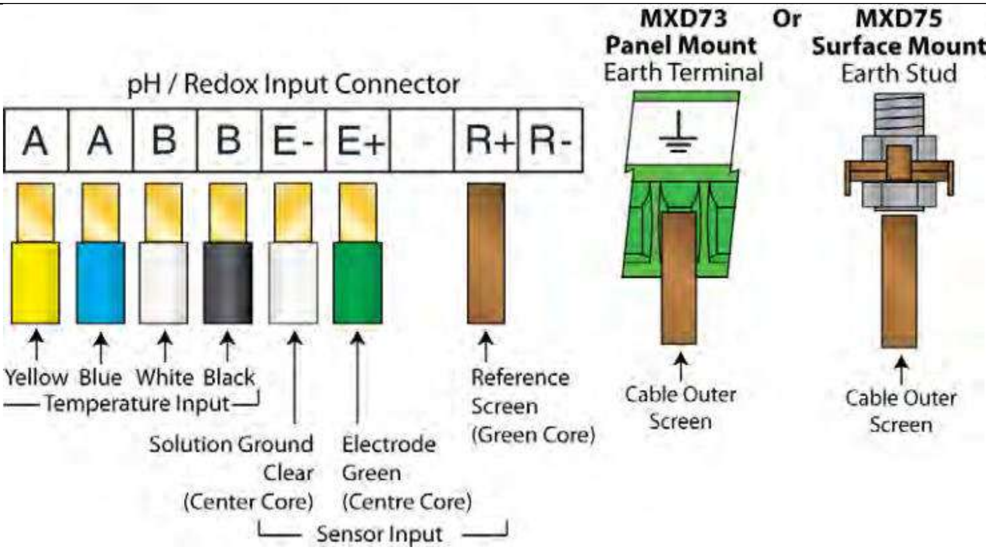
pH / Redox LN10 Coax Cable Connection Details with Separate "Solution Ground" Connection



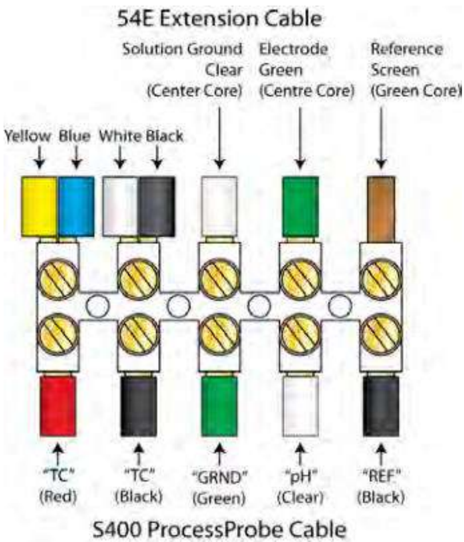
DynaProbe & ProcessProbe Cable Connection Details with "Solution Ground"



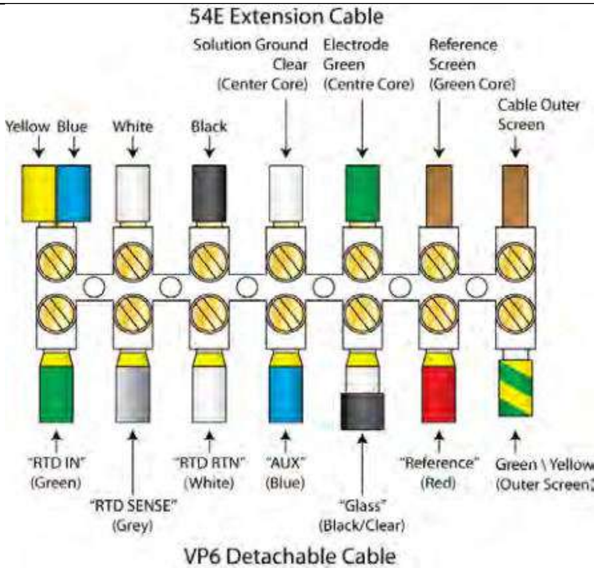
VP6 Detachable Cable Connection Details with "Solution Ground"



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

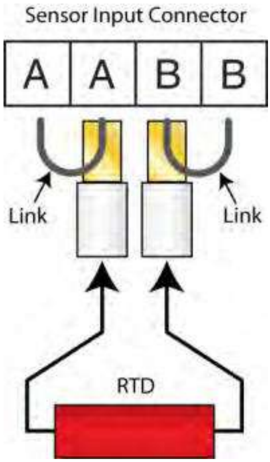


S400 ProcessProbe to 54E Extension Cable Connection Details

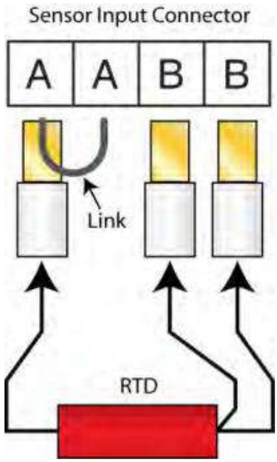


VP6 Detachable Cable to 54E Extension Cable Connection Details

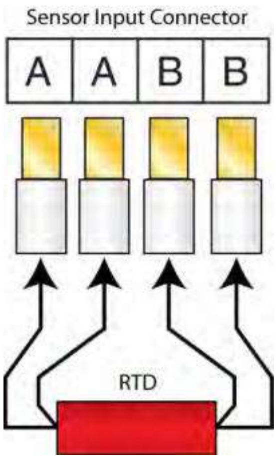
Previous Gen. Input Card Temperature Sensor Connections



2 Wire RTD Temperature Connection



3 Wire RTD Temperature Connection

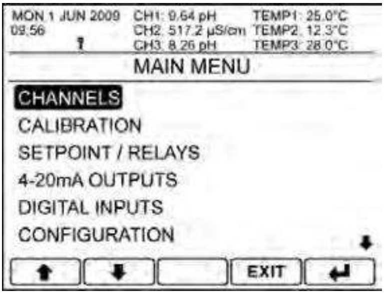


4 Wire RTD Temperature Connection

pH / Redox Input Channel Setup

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

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



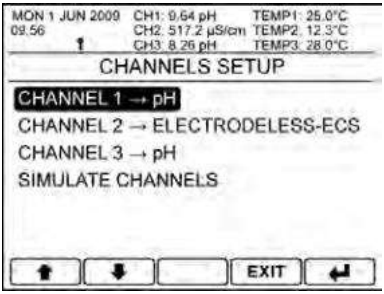
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



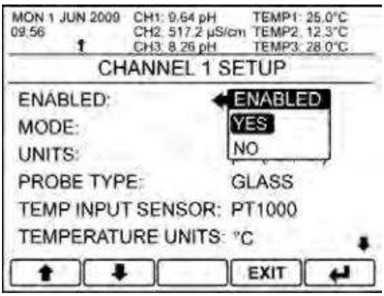
Select Channel

Select the (Smart) pH / Redox input channel you wish to edit.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



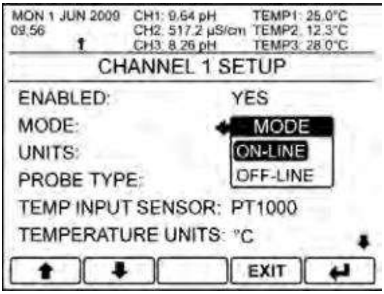
Enabled

Selecting no disables the channel and prevents it from appearing as an option in output and configuration menus, also disables any error messages associated with the channel.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Mode

Selecting off-line causes any control setpoints / Relays associated with this channel to de-energise (any active error relays will remain energised). Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

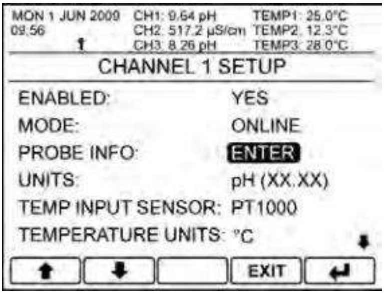
When the unit is placed in an off-line state “off-line” will appear in the channel messages section on the front screen.

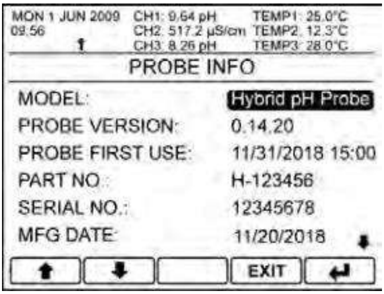
If a “Cannot Edit Digital Input Has Control” message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection





Probe Info

Shows the Model, Probe Version, First Use Date, Part Number, Serial Number, Manufacture Date and Operation Time of the connected SensorTalk probe.

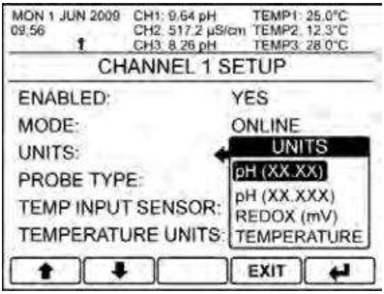
Also allows the entry of customer name and asset number to be saved to the probe.

Only available when a SensorTalk capable probe is connected to the instrument.

⬆/⬇ – Select Option

EXIT – Return to Channel Setup Menu

↵ – Enter Option



Units

The channel can be configured as a pH, Redox or an exclusively temperature input.

When “pH (XX.XX)” is selected the channel will automatically apply the correct temperature compensation and probe type to the electrodes raw mV input to provide a display of pH. Note, the instrument can also display the raw mV as a secondary value on the front screen, see User Interface guide for more details.

When “pH (XX.XXX)” is selected the channel will do as above but will display pH to three decimal places.

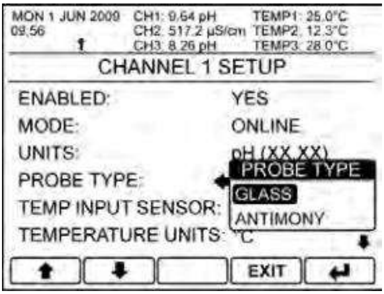
When “Redox (mV)” is selected the instrument displays the unprocessed input voltage to the electrode terminals.

When “Temperature” is selected the channel only shows the temperature input. All other sensor inputs are ignored.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Probe Type

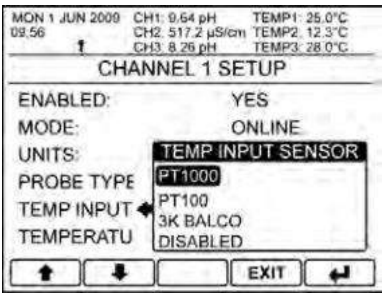
The input channel can scale its readings to operate with either a glass or antimony probe. This sets the isopotential point, for a glass electrode this is 7.00pH, for an antimony electrode it is 0.00pH.

! A sensor calibration must be performed when using a new sensor, see page 29 for details.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Temperature Input Sensor

Select the input channel’s temperature sensor type for use with the sensor measurement’s automatic temperature compensation.

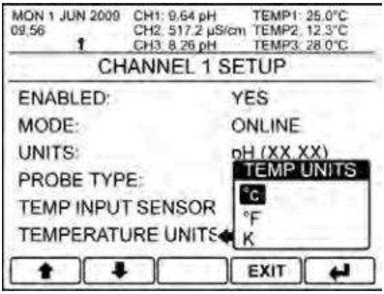
If a temperature sensor is not connected to the input channel then this menu item should be set to disabled, else temperature input error messages will be shown.

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

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

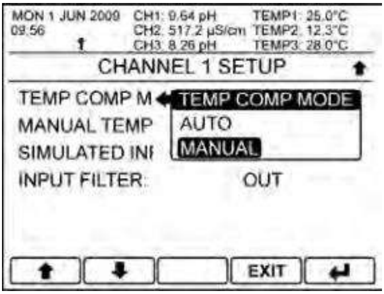


Temperature Units

Sets the temperature units used.

Note. Kelvin is only available when units are set to temperature mode.

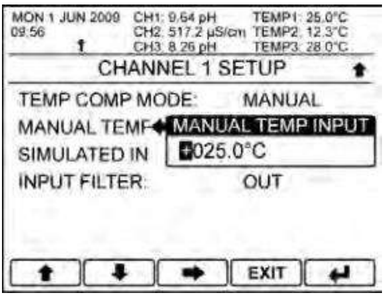
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Temperature 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.

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

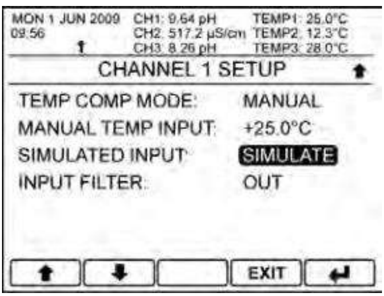


Manual Temperature Input

The fixed temperature value used for manual temperature compensation.

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

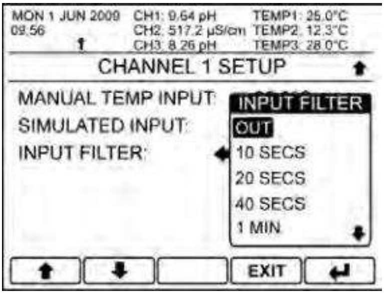
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Simulated Input

See Simulated Channels section of the Setpoints, Current Outputs, Digital Inputs Configuration Guide for more information.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Input Filtering (Averaging)

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

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

Blank

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 input channel can be taken offline, which de-energises the relays and holds the current outputs at their last values. This facility is useful when calibrating the system, however the operator must ensure the relays are 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 MXD70 Series offers two different but simple methods of calibration for pH electrode systems.

Auto
In Auto calibration the instrument requires that the electrode is first placed in a 4pH buffer and then secondly in a 9pH buffer. These are nominal values for which the instrument carries the exact LTH buffer values due to temperature variations (other pH buffer solution values at temperature can also be entered). From these two points the instrument then calculates the Offset and Slope for the electrode. NB. Auto calibration mode is not available when the pH probe type is set to antimony.

In order for the auto calibration to work correctly, the buffer temperature must either be measured by the instrument 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 either the combined *Buffer* and *Slope* menu or individual Buffer menu. It is important to do the calibration at suitable values i.e.

Adjustment of the Buffer (Offset) value at 7.00pH
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. As actual pH buffer values are used no compensation is made for the buffer solution with temperature in the instrument. It is important therefore to note the actual buffer value at the temperature of the solution, see page 33 for a table showing pH variations versus temperature for LTH's standard solutions.

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 an Redox Electrode is a single point adjustment calibration only.

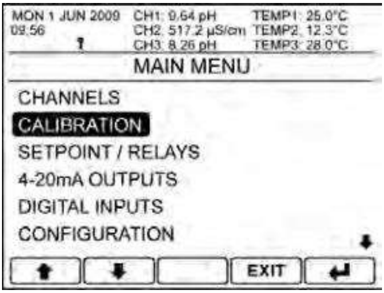
For calibration and test purposes, standard solutions at various potentials can be purchased from LTH Electronics:

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.

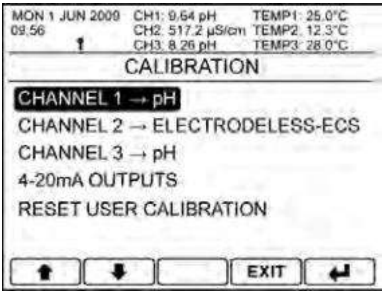
The default security access code is <u>1000</u>



Main Menu

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

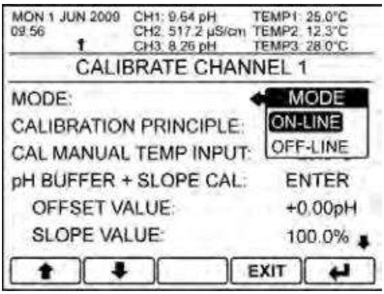
↑/↓	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Select Channel

Select the (Smart) pH / Redox input channel you wish to edit.

↑/↓	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



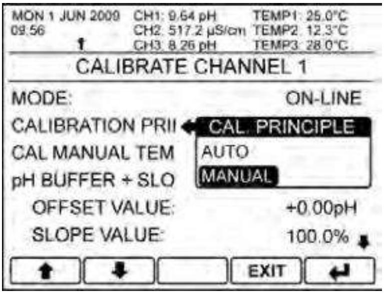
Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

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

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

↑/↓	– Select Option
EXIT	– Cancel
↵	– Save Selection



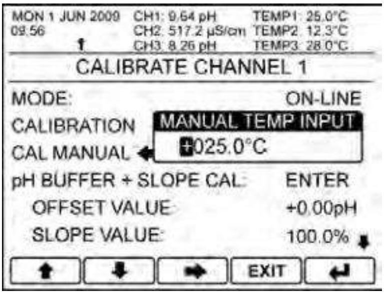
Calibration Principle

This setting defines the operating mode of the pH Electrode calibration. In Auto mode the instrument automatically adjusts the offset and slope. In Manual mode the user manually adjusts the reading to match known values.

Only available when units set to pH in the channel setup menu and if available probe type is set to glass.

See page 29 for more details.

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

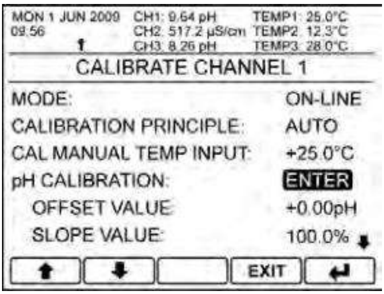


Calibration Manual Temperature Input

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

Only available when the units are set to pH and temperature compensation mode has been set to manual in the channel setup menu.

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



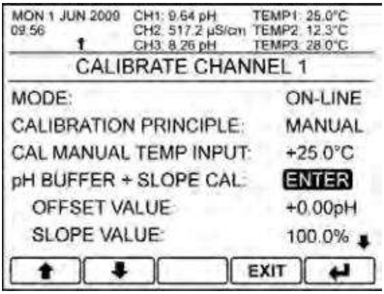
pH Calibration

Enter the pH Auto Calibration routine.

Only available when units set to pH in the channel setup menu and calibration principle is set to auto in this menu.

See page 39 for more details.

⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter pH Auto Calibration



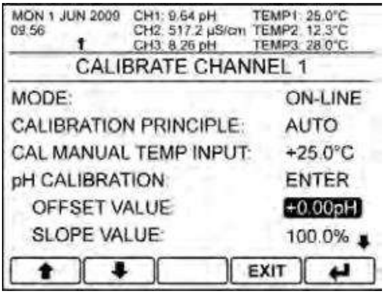
pH Buffer (Offset) + Slope Calibration

Enter the pH Manual Offset and Slope Calibration Routine

Only available when units set to pH in the channel setup menu and calibration principle is set to Manual in this menu.

See page 41 for more details.

⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter pH Manual Offset Calibration

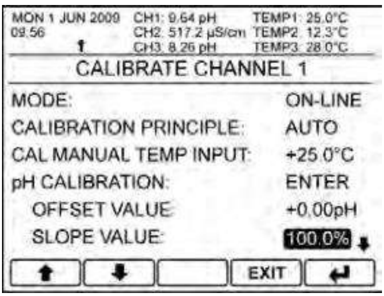


Offset Value

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

Cannot be edited.

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

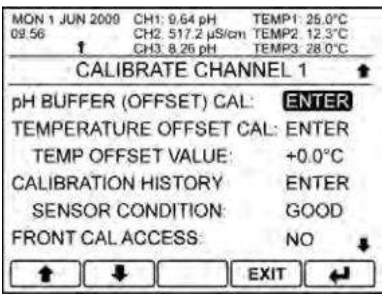


Slope Value

Displays the electrode Slope currently being used by the instrument. 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.



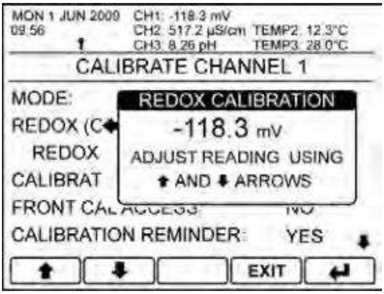
pH Buffer (Offset) Calibration

Enter the pH Manual Offset Calibration Routine

Only available when units set to pH in the channel setup menu and calibration principle is set to Manual in this menu.

See page 41 for more details.

⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter pH Manual Offset Calibration



Redox Offset Calibration

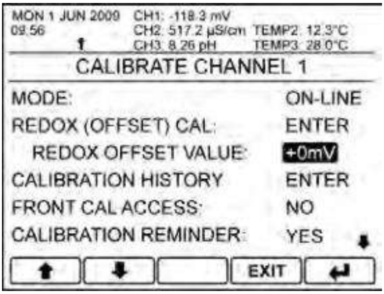
The Redox Offset calibration enables the user to adjust the sensor reading to match a known input.
The current Redox sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration.

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

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

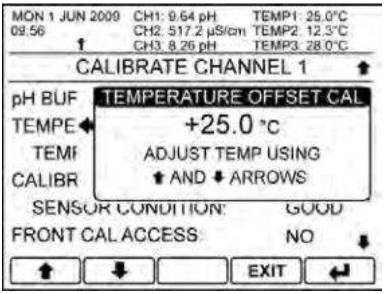
↵ – Save Calibration



Redox 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



Temperature Offset Calibration

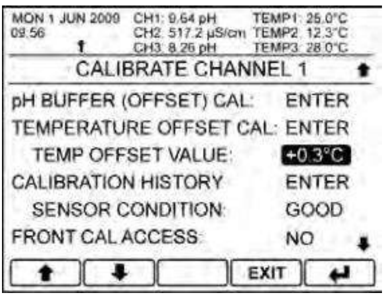
The temperature offset calibration enables the user to adjust the temperature reading to match a known input. Only available when the channel's temperature input is not set to disabled.

The current temperature reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

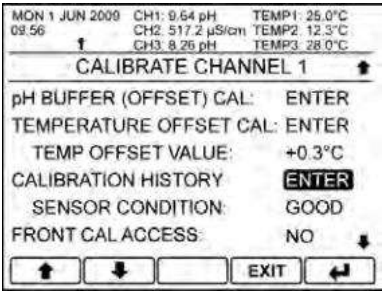
↵ – Save Calibration



Temperature 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

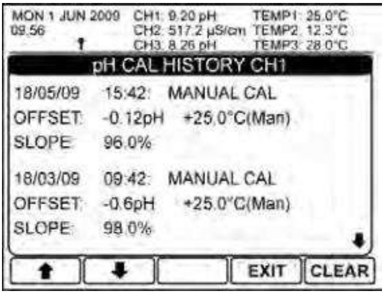


Enter Calibration History

The MXD70 series has a calibration history feature which allows the user to review the record of sensor solution calibrations.

To enter the calibration history menu press enter.

↵ – Enter Calibration History



Calibration History

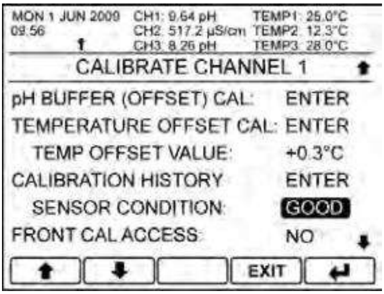
The calibration history page provides a record of all Offset and Slope calibrations carried out.

The data includes the date and time of the calibration, the calculated Offset and Slope, the calibration principle used and the temperature compensation reading at the time.

⬆/⬇ – Move To Next Page Up or Down

EXIT – Return To Calibration Menu

CLEAR – Clear All of the Calibration History

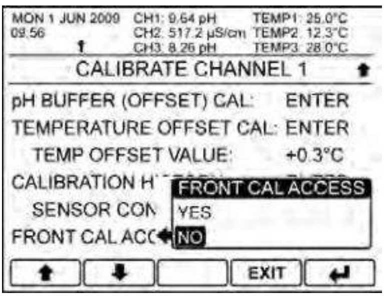


Sensor Condition

The MXD70 Series is capable of analysing the result of the pH electrode offset and slope calibration and indicates 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.



Front Screen Calibration Access Enable

When enabled front calibration access allows direct entry into the calibration menu from the front screen. It also disables the security access system within the calibration menu enabling the calibration functions without having to enter the security access code.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Front Screen Calibration Access

When the calibration access is enabled press the "CAL" button to bring up pop-up to select which channel to calibrate.

CAL – Enter Calibrate Channel Select Menu

⬅/➡ – Scroll Around Menus

Menu – Access Main Menu

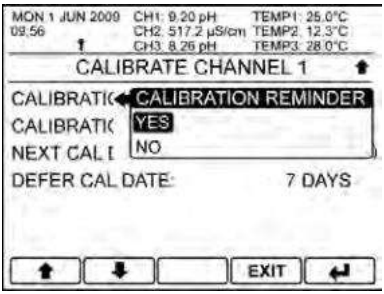
Select Channel to Calibrate

From the pop-up select the channel the user wishes to calibrate. Only channels whose front calibration access has been enabled will appear.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Enter Menu



Calibration Reminder

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

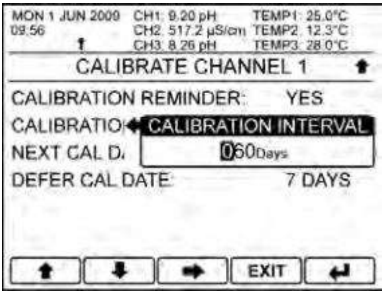
If the interval has expired and the alarm has activated, then on the completion of a successful sensor calibration the next cal date will be automatically incremented by calibration interval.

If the user completes a successful sensor calibration before the calibration interval has expired, then the instrument will ask the user whether they wish to update the next cal due date by the calibration interval.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Interval

Sets the interval time for the calibration alarm.

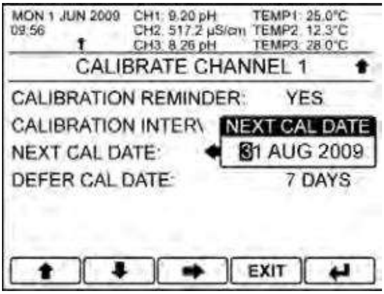
The Next Cal Date will update to show the date of the next calibration alarm.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Next Calibration Date

Sets the exact date of the next calibration alarm.

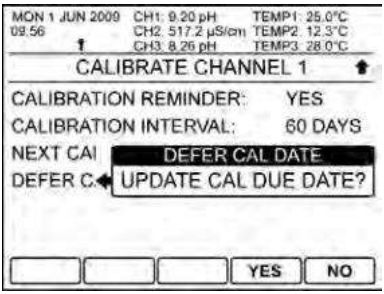
The Calibration Interval will update to show the number of days to the next calibration date.

⬆/⬇ – Increase / Decrease Digit or Text

➡ – Select Next Item

EXIT – Cancel

↵ – Save Entry



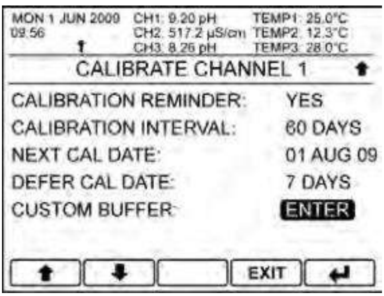
Defer Calibration Date

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

Only appears once the calibration interval has expired.

YES – Increase Interval

NO – Cancel



Custom Buffer Entry

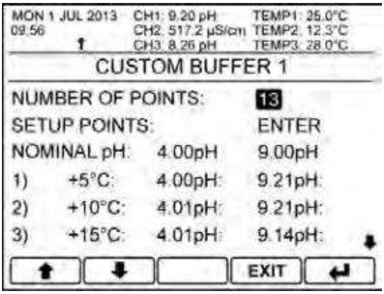
Enters the custom buffer setup menu.

Only available when the pH calibration principle is set to auto.

⬆/⬇ – Select Option

EXIT – Return to Select Calibration Channel

↵ – Enter pH Manual Slope Calibration



Custom Buffer Menu

The custom buffer menu allows the user to enter in custom buffer solution values at fixed temperatures for the nominated pH values chosen, for use with the pH automatic calibration function.

Number of Points – Define the required number of data points to be entered (Maximum 13)

Setup Points – Automatically define the data points one after another. It is recommended that the points are added in ascending order of temperature.

Nominal pH – Define the two pH buffers chosen for Auto calibration

Data Points – Alternatively the user can edit a single temperature point by selecting it in the menu.

Reset Custom Buffer – Reset the points back to the LTH standard buffer defaults.

⬆/⬇	– Select option or Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel or Return to Calibration Menu
↵	– Save Entry

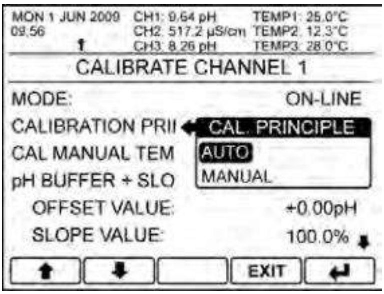
Auto pH Sensor Calibration

The Auto pH sensor calibration is a two point offset and slope calibration, which requires the use of two pH buffer solutions chosen by the user. These are nominal values from which the instrument converts to exact buffer values due to temperature variations. To accomplish this, the instrument requires buffer values at different temperatures relevant to the buffer solutions chosen to be configured, refer to page 37 for the custom buffer instructions.

Alternatively the default configuration uses 4 and 9 pH buffer solutions with the buffer table pre-configured with the following two LTH buffers:

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

In order for the auto calibration to work correctly, the buffer temperature must either be measured by the instrument 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.



Calibration Principle

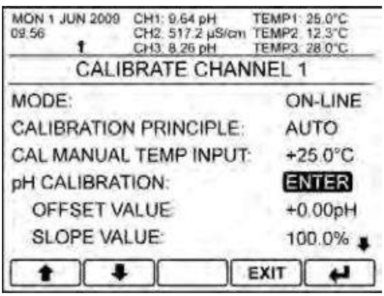
To use Auto calibration first set the calibration principle to Auto.

Note. Calibration Principle is only available when units are set to pH and probe type to glass, both in the channel setup menu.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



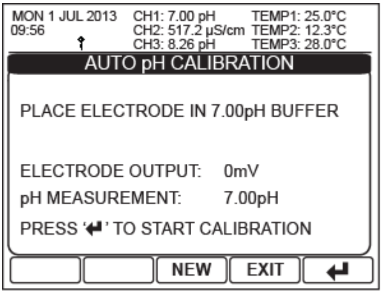
pH Auto Calibration

To start the pH calibration, select the “pH Calibration” item from the desired channel’s calibration menu.

🡅/🡇 – Select Option

EXIT – Return to Select Calibration Channel

↵ – Enter pH Auto Calibration



Place Electrode In Nominal pH Buffer 1

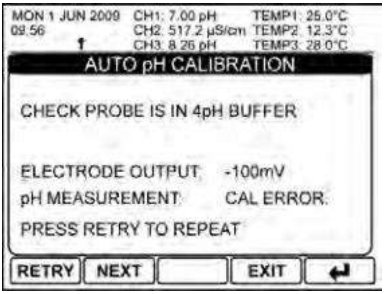
Place the electrode in the first nominated pH buffer and press enter to begin sampling.

Note. If the electrode is new, pressing the "new" button will reset the existing offset and slope and add a "new electrode" entry in the calibration history.

NEW – Register New Electrode

EXIT – Exit Calibration Without Saving

↵ – Initiate Nominated pH Calibration



Calibration Error

If no problem has been detected the instrument will automatically progress to the next calibration point. If it has encountered a problem this screen will appear.

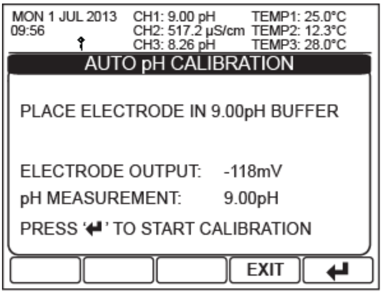
Check that the electrode is connected correctly and that the correct buffer has been used. Then press "Retry" to repeat the calibration.

PREV – Go to Previous Calibration Point

SKIP – Skip to Next Calibration Point

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration



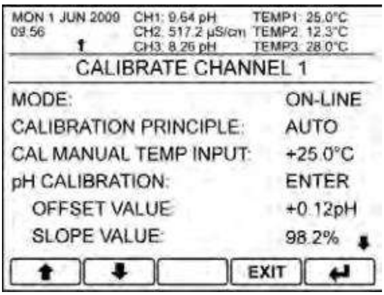
Place Electrode In Nominal pH Buffer 2

Place the electrode in the second nominated pH buffer and press enter to begin sampling.

If the calibration has been completed successfully the instrument will return back to the main calibration menu.

EXIT – Exit Calibration Without Saving

↵ – Initiate Nominated pH Calibration



Offset and Slope

Once back in the main menu the calculated offset and slope values being used by the instrument will be displayed.

Lower down in the calibration menu the instrument will also display the sensor condition calculated from the span and offset values. See page 35 for more information.

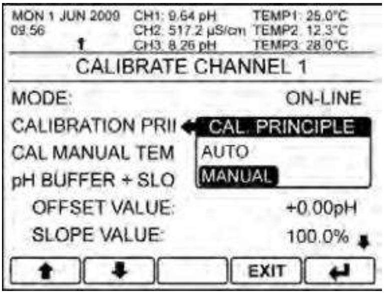
Manual pH Sensor Calibration

When using Manual calibration mode it is possible to do either a single point Buffer (Offset) Cal or a combined two point Buffer and Slope calibration. This is accomplished by using either the *pH Buffer (Offset) Cal* or *pH buffer + Slope Cal* menu items. The combined Buffer and Slope calibration is done in the following 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).

As actual pH buffer values are used no compensation is made for the variation of the buffer solution with temperature in the instrument. 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 44.

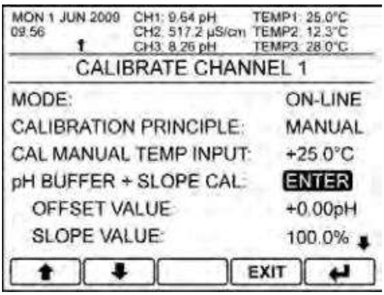
It is also important that the buffer temperature is entered into the Calibration Manual Temperature Input if manual temperature compensation is being employed. Alternatively any automatic temperature compensation element should be placed in the buffer solution with the pH sensor if Auto TC is being used.

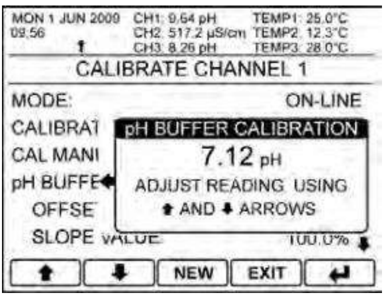


Calibration Principle

The default method of calibration is “Manual” mode, however if the probe is pH and the type is glass then “Auto” mode may have been selected. If this is the case then calibration principle will need to be set to manual.

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





pH Buffer + Slope Calibration – Buffer Calibration

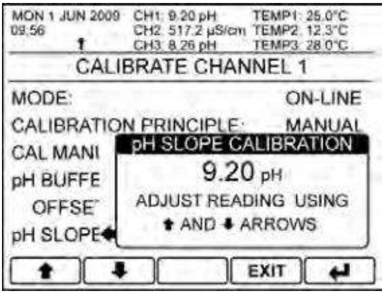
The pH buffer calibration enables the user to adjust the sensor buffer until the displayed reading matches the known input. To activate the function, select “pH Buffer + Slope Cal” and press enter.

The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration and progress to the slope calibration.

It is recommended that the buffer should be adjusted at 7pH (± 2pH) for a glass probe, and 0pH (+2pH) for an antimony probe.

Note. If the electrode is new, pressing the “new” button will reset the existing offset.

⬆/⬇	– Adjust the Reading Up or Down
NEW	– Register New Electrode
EXIT	– Cancel
↵	– Progress to Slope Calibration



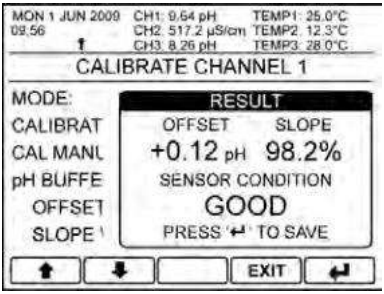
pH Slope Calibration

The pH slope calibration enables the user to adjust the sensor slope until the displayed reading matches the known input. If using the “pH Buffer + Slope Cal” menu, the instrument will automatically progress onto the slope calibration once the Buffer calibration has been done.

The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration.

The slope limits are 80% to 110% for a glass electrode and 75% to 115% for a antimony electrode.

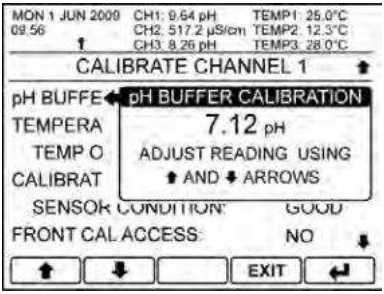
⬆/⬇	– Adjust the Reading Up or Down
EXIT	– Cancel
↵	– Save Calibration



Result

The adjusted offset and slope values, as well as the calculated sensor condition from the calibration routine is displayed here.

If only a single point calibration is required then use the following pH buffer calibration.



pH Buffer (Offset) Calibration

The pH buffer calibration enables the user to adjust the sensor buffer until the displayed reading matches the known input. To activate the function select "pH Buffer (Offset) Cal" and press enter.

The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration.

It is recommended that the buffer should be adjusted at 7pH (± 2pH) for a glass probe, and 0pH (+2pH) for an antimony probe.

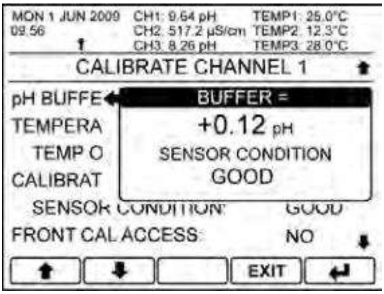
Note. If the electrode is new, pressing the "new" button will reset the existing offset and slope and add a "new electrode" entry in the calibration history.

🡅/🡇 – Adjust the Reading Up or Down

NEW – Register New Electrode

EXIT – Cancel

↵ – Save Calibration



Result

The adjusted offset value, as well as the calculated sensor condition from the calibration routine is displayed here.

Buffer Solutions

The following table gives the LTH buffer solution values. **NB.** Buffer solutions should be prepared and used in accordance with the instructions supplied with them.

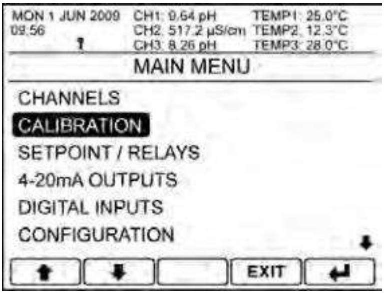
pH variation against temperature			
Temperature (°C)	**LTH 4pH Buffer**	**LTH 7pH Buffer**	**LTH 9pH Buffer**
10	4.00	7.07	9.21
15	4.00	7.04	9.14
20	4.00	7.02	9.06
25	4.00	7.00	9.00
30	4.01	6.99	8.96
35	4.02	6.98	8.92
40	4.03	6.97	8.88
50	4.05	6.96	8.83
60	4.08	6.96	8.81

LTH Buffer Solutions Ordering Information

Type No	Part No	Description
SB-052-1610	138/199	4pH Buffer standard colour coded Red, 500ml.
SB-168-1610	138/200	7pH Buffer standard colour coded Clear, 500ml.
SB-054-1610	138/201	9pH Buffer standard colour coded Blue, 500ml.
SR-009-1610	138/175	124mV Redox solution. 500ml
SR-022-1610	138/176	358mV Redox solution. 500ml

Resetting the User Calibration

If required the user can reset the user calibrations to their default states.



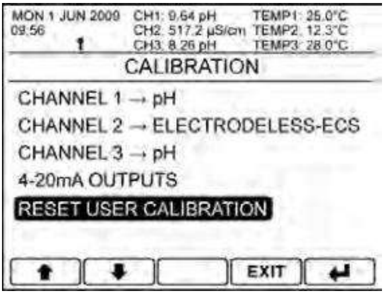
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



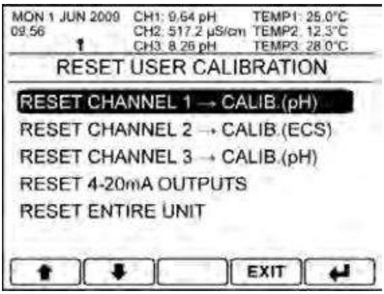
Calibration

Select Reset User Calibration.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



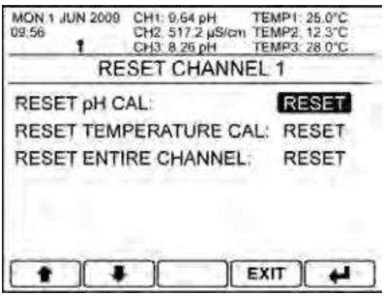
Reset User Calibration

Select the required (smart) pH / Redox input channel.

⬆/⬇ – Select Option

EXIT – Return to Calibration

↵ – Enter Option



Reset Channel User Calibration

Select whether to reset the sensor calibration, the temperature calibration or reset all of the channel's user calibrations.

⬆/⬇ – Select Option

EXIT – Return to Reset User Calibration

↵ – Enter Option

Appendix A - Temperature Data

The table below lists approximate resistance values of temperature sensors that may be used with the MXD70 series. Not all options are available on all input types.

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 B – Instrument Configuration

Instrument Configuration

Instrument Type		Serial Number		Software Version	
Power Supply Type					
Channel 1 Input Card Type		Serial Number			
Channel 2 Input Card Type		Serial Number			
Channel 3 Input Card Type		Serial Number			
Output Expansion Card Type		Serial Number			
Software Expansion		Unlock Code			
Software Expansion		Unlock Code			

Instrument Settings

Security Access Code					
Language					
Front Screen Ch1 Shown		Front Screen Ch1 Secondary Reading i)		Front Screen Ch1 Secondary Reading ii)	
Front Screen Ch2 Shown		Front Screen Ch2 Secondary Reading i)		Front Screen Ch2 Secondary Reading ii)	
Front Screen Ch3 Shown		Front Screen Ch3 Secondary Reading i)		Front Screen Ch3 Secondary Reading ii)	
Front Screen Ch1 Label					
Front Screen Ch2 Label					
Front Screen Ch3 Label					
4-20mA Output Slot 1		4-20mA Output Slot 2			
Menu Header i)		Menu Header ii)		Menu Header iii)	
Menu Header iv)		Menu Header v)		Menu Header vi)	

Channel Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Description			
Units			
Sensor / Probe Type			
Cell Constant			
Range			
Linearisation Source			
TDS Factor			
Membrane Correction Factor			
Bias Voltage			
mA Input: Loop Mode			
mA Input: Input Mode			
Set 0mA Input			
Set 4mA Input			
Set 20mA Input			
Temperature Input Sensor			
Temperature Units			
Temperature Compensation: In/Out			
Temperature Compensation Slope			
Temperature Compensation: Auto / Manual			
Fixed Temperature Input			
Input Salinity			
Pressure Compensation: Auto / Manual			
Pressure Mode: Input / 24V Loop			
Pressure Units			
Pressure 4mA Input			
Pressure 20mA Input			
Fixed Pressure Input			
Cable Compensation			
Input Filter			

Setup

Setup

Curve Setup (available options vary with card type and configuration)

	Channel 1		Channel 2		Channel 3	
Curve A						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						
Curve B						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						

Channel Calibration Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Calibration Principle			
Calibration Manual Temp Input			
Calibration Units			
Calibration Manual Pressure Input			
Span Cal Point			
Enable Auto Span Cal			
Offset Value			
Slope Value			
Temperature Offset			
Sensor Condition			
Front Calibration Access			
Calibration Reminder			
Calibration Interval			

Setpoints Setup (available options vary with card type and configuration)

	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5	Setpoint 6
Channel						
Input Source						
Trigger						
High Value						
Low Value						
USP Pre-Trigger						
Mode						
Cycle Time						
Proportional Band						
Delay						
Hysteresis						
Dose Alarm						
Dose Alarm Time						
Initial Charge						
Charge Time						
Charge Access						
Alarm Mode						
Clean Duration						
Clean Interval						
Clean Mode						
Clean Recovery						
Clean Delay						

Current Output Setup (available options vary with card type and configuration)

	Current Output A	Current Output B	Current Output C	Current Output D	Current Output E	Current Output F
Channel						
Input Source						
Output 0 – 20mA / 4 - 20mA						
Zero						
Span						
On Error						

Digital Inputs (available options vary with card type and configuration)

	Digital Input 1	Digital Input 2	Digital Input 3	Digital Input 4	Digital Input 5	Digital Input 6	Digital Input 7	Digital Input 8
Channel								
Function								
Range Change								
Switch Store								
Cleaning Setpoint								
Polarity								
4-20 Output Level								

Service Alarms

	Channel 1	Channel 2	Channel 3
Service Reminder			
Service Interval			
Next Service Date			

Appendix C - Error Messages

Internal Error Messages

E001	**UNIT**	**Processor RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E002	**UNIT**	**External RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E003	**UNIT**	**Internal Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, Reset Whole unit from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E004	**UNIT**	**Output Card Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E005	**UNIT**	**Internal Outputs Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E006	**UNIT**	**For Future Use**
E007	**UNIT**	**Unit Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the whole unit from the Load Default Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E008	**UNIT**	**Unit Store A Checksum Error** The data in Unit Store A has been corrupted. Save the current setup back to Unit Store A in the Save/Restore menu.
E009	**UNIT**	**Unit Store B Checksum Error** The data in Unit Store B has been corrupted. Save the current setup back to Unit Store B in the Save/Restore menu.
E010 to E013	**UNIT**	**Maths Error** There has been an internal maths calculation failure. As such, it should not appear if the software is functioning properly. The error message should clear after approx. 5 seconds. If the error continues to be displayed consult with your supplier, as this unit may require to be returned for repair.
E014	**UNIT**	**Contrast Chip Error** The Contrast Chip is not operating correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E015	**UNIT**	**Unit SD Card Checksum Error** The SD Card store from which the entire unit was restored from has become corrupted. Check the unit's settings and then save the settings again to the SD card store.
E016	**UNIT**	**SD CARD FULL** The SD card has become full. To continue use, either replace with a blank SD card or remove existing files from SD card

Input Channel Errors

E030 E080 E130	CH1 CH2 CH3	**Input Card Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E031 E081 E131	CH1 CH2 CH3	**Setup Checksum Error** The current channel's configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists reset the current channel from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E032 E082 E132	CH1 CH2 CH3	**Store A Checksum Error** The data in the channel's Store A has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store A in the Save/Restore menu.
E033 E083 E133	CH1 CH2 CH3	**Store B Checksum Error** The data in the channel's Store B has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store B in the Save/Restore menu.
E034 E084 E134	CH1 CH2 CH3	**Factory Cal Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E035 E085 E135	CH1 CH2 CH3	**User Cal Checksum Error** The Channel's User Cal has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the Channel from the Reset User Calibration option in the Calibration menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E036 E086 E136	CH1 CH2 CH3	**Sensor Cal Out Of Spec** The last Sensor Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E037 E087 E137	CH1 CH2 CH3	**Sensor Zero Cal Out Of Spec** The last Sensor Zero Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E038 E088 E138	CH1 CH2 CH3	**Sensor Span Cal Out Of Spec** The last Sensor Span Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E039 E089 E139	CH1 CH2 CH3	**No Signal** No Sensor connected or there is 'zero' detector current. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E040 E090 E140	CH1 CH2 CH3	**Signal Overload** The gain step is equal to 0 and the A/D output is over 255. This cannot happen in a liquid but could happen if the sensor is in full sunlight. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.

E041 **E091** **E141**	**CH1** **CH2** **CH3**	**Partial Depletion** Large difference between the detectors, i.e. one very dirty. This alarm will come up if there is a difference of 3:1 between the detectors. Remove sensor and clean sensor fingers. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E042 **E092** **E142**	**CH1** **CH2** **CH3**	**Full Depletion** Attenuation too high or the real probe signal goes above 14000. The probe sensor units (PSU) will be set to 16000. If this message persists, please consult with your supplier.
E043 **E093** **E143**	**CH1** **CH2** **CH3**	**Sensor User Offset At Limit** The last Sensor Offset Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E044 **E094** **E144**	**CH1** **CH2** **CH3**	**Sensor User Slope At Limit** The last Sensor Slope Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E045 **E095** **E145**	**CH1** **CH2** **CH3**	**Sensor User Slope < Spec** The last Sensor Slope Calibration was less than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E046 **E096** **E146**	**CH1** **CH2** **CH3**	**Sensor User Slope > Spec** The last Sensor Slope Calibration was greater than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E047 **E097** **E147**	**CH1** **CH2** **CH3**	**Sensor Open Circuit** The sensor input is at open circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E048 **E098** **E148**	**CH1** **CH2** **CH3**	**Sensor Short Circuit** The sensor input is at short circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E049 **E099** **E149**	**CH1** **CH2** **CH3**	**Sensor Positive Saturation** The sensor input is greater than the maximum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E050 **E100** **E150**	**CH1** **CH2** **CH3**	**Sensor Negative Saturation** The sensor input is less than the minimum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E051 **E101** **E151**	**CH1** **CH2** **CH3**	**Sensor Input Over Range** The sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E052 **E102** **E152**	**CH1** **CH2** **CH3**	**Sensor Input Under Range** The sensor reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.

E053 **E103** **E153**	**CH1** **CH2** **CH3**	**Temp Sensor Fault** The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check that the temperature sensor is set to the correct type in the channel setup menu. Under this condition, the unit will default to the fixed temperature setting for compensation purposes. If the message persists please consult with your supplier.
E054 **E104** **E154**	**CH1** **CH2** **CH3**	**Temp Input Over Range** The temperature sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E055 **E105** **E155**	**CH1** **CH2** **CH3**	**Temp Input Under Range** The temperature reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E056 **E106** **E156**	**CH1** **CH2** **CH3**	**Temp Comp Outside Limits** The temperature reading is less than 0.0C or greater than 150.0C, leading to an error in compensation.
E057 **E107** **E157**	**CH1** **CH2** **CH3**	**Polar Zero Cal At Limit** The last Polargraphic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E058 **E108** **E158**	**CH1** **CH2** **CH3**	**Polar Span Cal At Limit** The last Polargraphic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E059 **E109** **E159**	**CH1** **CH2** **CH3**	**Galvanic Zero Cal At Limit** The last Galvanic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E060 **E110** **E160**	**CH1** **CH2** **CH3**	**Galvanic Span Cal At Limit** The last Galvanic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E061 **E111** **E161**	**CH1** **CH2** **CH3**	**Pressure Sensor Over Range** The pressure sensor reading is greater than the specified limit for the probe.
E062 **E112** **E162**	**CH1** **CH2** **CH3**	**Pressure Sensor Under Range** The pressure sensor reading is less than the specified limit for the probe.
E063 **E113** **E163**	**CH1** **CH2** **CH3**	**Pressure Above 20mA** The pressure sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E064 **E114** **E164**	**CH1** **CH2** **CH3**	**Pressure Below 4mA** The pressure sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E065 **E115** **E165**	**CH1** **CH2** **CH3**	**AUX mA Input Above 20mA** The sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.

E066 **E116** **E166**	**CH1** **CH2** **CH3**	**AUX mA Input Below 4mA** The sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E067 **E117** **E167**	**CH1** **CH2** **CH3**	**Sensor 0mV Cal Out of Spec** The pH 0mV calibration for this channel is outside recommended specifications.
E068 **E118** **E168**	**CH1** **CH2** **CH3**	**Calibration Due** The time since the last calibration was performed on this channel has exceeded the time set in the calibration menu.
E069 **E119** **E169**	**CH1** **CH2** **CH3**	**Planned Service Due** The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
E070 **E120** **E170**	**CH1** **CH2** **CH3**	**SD Card Checksum Error** The SD Card store from which this channel was restored from has become corrupted. Check the channel's settings and then save the settings again to the SD card store.
E071 **E121** **E171**	**CH1** **CH2** **CH3**	**Gain Error** The sensor gain has been exceeded. If this message persists, please consult with your supplier.
E072 **E122** **E172**	**CH1** **CH2** **CH3**	**Invalid Linearisation Curve** A minimum of 2 linearisation points are required. Please check linearisation curve settings in the channel setup menu for this channel.
E073 **E123** **E173**	**CH1** **CH2** **CH3**	**Linearisation Over-Range** The linearisation result is greater than 9999 (or 100.0% when using %).
E074 **E124** **E174**	**CH1** **CH2** **CH3**	**Linearisation Under-Range** The linearisation result is less than 0.
E075 **E125** **E175**	**CH1** **CH2** **CH3**	**Curve Low Limit** The incoming probe signal is less than the lowest point in the linearisation curve.
E076 **E126** **E176**	**CH1** **CH2** **CH3**	**Curve High Limit** The incoming probe signal is greater than the highest point in the linearization curve.
E077 **E127** **E177**	**CH1** **CH2** **CH3**	**Custom Error** Contact your supplier for details.

Setpoint Errors

E180 **SP1** **E190** **SP2** **E200** **SP3** **E210** **SP4** **E220** **SP5** **E230** **SP6**		**Dose Alarm Error** The Setpoint has been dosing for longer than the Dose Alarm time as defined in the setpoint menu.
E181 to E184 **E191 to E194** **E201 to E204** **E211 to E214** **E221 to E224** **E231 to E234**	**SP1** **SP2** **SP3** **SP4** **SP5** **SP6**	**For Future Use**
E185 **SP1** **E195** **SP2** **E205** **SP3** **E215** **SP4** **E225** **SP5** **E235** **SP6**		**Store A Checksum Error** The Store A Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E186 **SP1** **E196** **SP2** **E206** **SP3** **E216** **SP4** **E226** **SP5** **E236** **SP6**		**Store B Checksum Error** The Store B Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E187 **SP1** **E197** **SP2** **E207** **SP3** **E217** **SP4** **E227** **SP5** **E237** **SP6**		**Setup Checksum Error** The Setup for this Setpoint has become corrupted. Check and correct the setpoint settings and turn the unit off and on again. If the message persists please consult with your supplier.
E188 **SP1** **E198** **SP2** **E208** **SP3** **E218** **SP4** **E228** **SP5** **E238** **SP6**		**SD Card Checksum Error** The SD Card store from which this Setpoint was restored from has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again to the SD card store.

Current Output Errors

E240	**A**	**Current OP Hardware Fault**
E250	**B**	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.
E260	**C**	
E270	**D**	
E280	**E**	
E290	**F**	
E241	**A**	**Sensor IP<Current OP Zero**
E251	**B**	The sensor input level is below that set for the current output zero.
E261	**C**	
E271	**D**	
E281	**E**	
E291	**F**	
E242	**A**	**Sensor IP>Current OP Span**
E252	**B**	The sensor input level is above that set for the current output span.
E262	**C**	
E272	**D**	
E282	**E**	
E292	**F**	
E243	**A**	**Sensor IP<Current OP Span**
E253	**B**	The sensor input level is below that set for the current output Span.
E263	**C**	
E273	**D**	
E283	**E**	
E293	**F**	
E244	**A**	**Sensor IP>Current OP Zero**
E254	**B**	The sensor input level is above that set for the current output Zero.
E264	**C**	
E274	**D**	
E284	**E**	
E294	**F**	
	A	**Store A Checksum Error**
E255	**B**	The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E265	**C**	
E275	**D**	
E285	**E**	
E295	**F**	
E246	**A**	**Store B Checksum Error**
E256	**B**	The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E266	**C**	
E276	**D**	
E286	**E**	
E296	**F**	

E245 **E255** **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

Digital Input Errors

E301 E306 E311 E316 E321 E326 E331 E336	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store A Checksum Error** The Store A Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E302 E307 E312 E317 E322 E327 E332 E337	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store B Checksum Error** The Store B Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E303 E308 E313 E318 E323 E328 E333 E338	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Setup Checksum Error** The Setup for this Digital Input has become corrupted. Check and correct the digital inputs settings and turn the unit off and on again. If the message persists please consult with your supplier.
E304 E309 E314 E319 E324 E329 E334 E339	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**SD Card Checksum Error** The SD Card store from which this Digital Input was restored from has become corrupted. Check the Digital Input's settings in the digital input menu and then save the settings again to the SD card store.

Communication Errors

E340 **E342** **E344**	**CH1** **CH2** **CH3**	**Comms Failure** The Channel's Input Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E341 **E343** **E345**	**CH1** **CH2** **CH3**	**Comms Error** The Channel's Input Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E346	**UNIT**	**Output Comms Failure** The Basic Internal Outputs are not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E347	**UNIT**	**Output Comms Error** The Basic Internal Outputs are not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E348	**OP**	**Output Option Comms Failure** The Output Option Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option card may require to be returned for repair.
E349	**OP**	**Output Option Comms Error** The Output Option Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option Card may require to be returned for repair.

Calculation Errors

E400 **E411**	**C1** **C2**	**Calculation Over Range** The Calculation reading is greater than the specified upper limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E401 **E411**	**C1** **C2**	**Calculation Under Range** The Calculation reading is less than the specified lower limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E402 **E412**	**C1** **C2**	**Calculation Setup Checksum** The Setup for this Calculation has become corrupted. Check and correct the calculation settings and turn the unit off and on again. If the message persists please consult with your supplier.
E403 **E413**	**C1** **C2**	**Calculation Store A Checksum** The Store A Save for the channel associated with this calculation has become corrupted. Check the calculation's settings in the calculation menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E404 **E414**	**C1** **C2**	**Calculation Store B Checksum** The Store B Save for the channel associated with this calculation has become corrupted. Check the calculation's settings in the calculation menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E405 **E415**	**C1** **C2**	**Calculation SD Card Checksum** The SD Card store from which this Calculation was restored from has become corrupted. Check the Calculation's settings in the Calculation menu and then save the settings again to the SD card store.

Modbus Errors

E420	**UNIT**	**Modbus Setup Checksum** The Modbus setup has become corrupted. Check and correct the Modbus settings and turn the unit off and on again. If the message persists please consult with your supplier.
E421	**UNIT**	**Modbus Store A Checksum** The Store A Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store A in the Save/Restore menu.
E422	**UNIT**	**Modbus Store B Checksum** The Store B Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store B in the Save/Restore menu.
E423	**UNIT**	**Modbus SD Card Checksum** The SD Card store from which the Modbus configuration was restored from has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again to the SD card store.

SensorTalk Errors

E450 **E480** **E510**	**CH1** **CH2** **CH3**	**LED Off Temperature Exceeded** The probe's photoluminescence system is turned off as a result of the probe's temperature exceeding the defined threshold setting.
E451 **E481** **E511**	**CH1** **CH2** **CH3**	**CIP Temperature Exceeded** A Clean-In-Place cycle is occurring, the probe's photoluminescence system is turned off and an CIP event is recorded to the probe's log. This is a result of the probe's temperature exceeding the defined threshold setting.
E452 **E482** **E512**	**CH1** **CH2** **CH3**	**SIP Temperature Exceeded** A Steam-In-Place cycle is occurring, the probe's photoluminescence system is turned off and an SIP event is recorded to the probe's log. This is a result of the probe's temperature exceeding the defined threshold setting.
E453 **E483** **E513**	**CH1** **CH2** **CH3**	**Smart Sensor Error** An error has occurred with operation of the smart sensor. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card or sensor may require to be returned for repair.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MXD70 Series 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 previously in this section gives a list of errors that the MXD70 series generates, along with their probable causes. If after these checks the fault has not been cleared contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable quick diagnosis and correction of the problem.

- Serial number of the instrument, input and output cards.
- The approximate date of purchase.
- The software version of the instrument.
- 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.
- Relay connection configuration.

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

The Instrument Appears Dead
Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the MXD70 Series allows the unit to accept from 85 to 250V AC or DC, an alternative option allows operation from 18 to 32V AC or DC, check the connection label for voltage specification. 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 Section) and that the sensor is not faulty or damaged.
- Check that the correct probe type has been selected within the Channel Setup menu (see page 25).
- If the units are set to pH, check the temperature compensation state (see Channel Setup Section page 25). 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 on the main display is correct.

The Sensor Reading Is Incorrect

- If reading pH, check that the correct probe type has been selected (see pH / Redox Input Channel Setup, page 23).
- Check that no error messages are being displayed. Check that the sensor cable has been correctly connected (see Installation Section, Page 7).
- Check that the Temperature reading is correct.
- Check the instrument calibration using a pH simulator, Adjust the channel calibration if necessary (see Calibration Section).
- 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 instrument.

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached. (Installation Section, page 16).
- Check that the temperature sensor type is correctly selected in the Channel Setup menu (See page 23)
- Where practical check the temperature sensor resistance against the table on page 46.

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 he current output has been configured properly.

Relays Appear to Malfunction

- Check that the unit is “On-Line” (see page 23)
- Check that the set point configuration is correct (see Setpoints, Current Outputs and Digital Input Configuration Guide)
- If the relays are vibrating or “chattering” as they pass the set point, check the hysteresis setting and increase if necessary.
- Ensure that the relays are connected properly (see MXD73 Installation guide or MXD75 Installation guide) and that the voltage/current levels are not exceeding 5A @ 30V DC or 5A @ 250V AC.
- Check that the instrument input cables are not picking up excessive noise.

Problems with Cables and Connectors

The cable connecting the pH probe to the instrument 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 instrument. 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 instrument 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.

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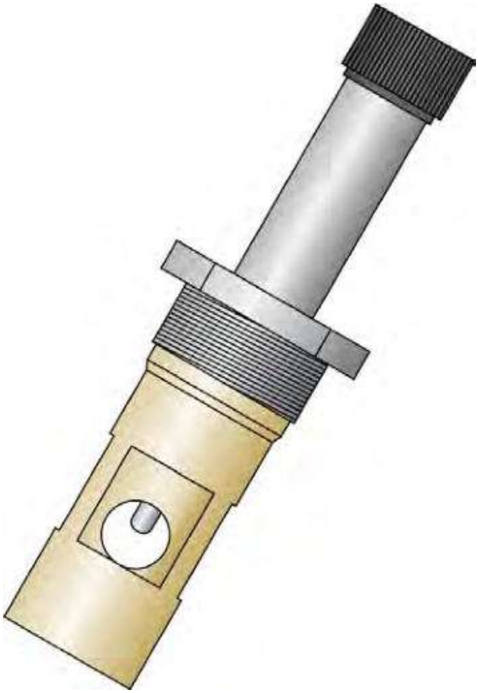
MXD70 SERIES

Multi-parameter Monitor



Electrodeless Conductivity Setup and Operating Guide

Preface

Product warranty

The MXD70 Electrodeless Conductivity Input Card has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

Copyright and trademarks

Fourth edition: June 2022

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. 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.

Contents

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Electrodeless Conductivity Input Card Specification

Measurement Input	ECS20 or ECS40 Series electrodeless conductivity sensor.
Connection Cable	Up to 100 meters LTH 54E.
Ranges of Measurement	0-999.9µS/cm, 0-9.999mS/cm, 0-99.99ms/cm, 0-999.9mS/cm, 0-1999mS/cm (Note, 0-1999mS/cm range not available when using ECS20 sensors) 0-999.9 ppm, 0-9999 ppm, 0-99.99 ppt (parts per thousand). 0 to 16.00% NaOH – Sodium Hydroxide 0 to 30.00% NaCl – Sodium Chloride 0 to 15.00% HCl – Hydrochloric Acid 0 to 25.00% H_2SO_4 – Sulphuric Acid 0 to 25.00% H_3PO_4 – Phosphoric Acid 0 to 25.00% HNO_3 – Nitric Acid 0 to 41.00 ppt Salinity Custom Range - Defined by a user entered 2 to 9 point curve. (Two independent curves per channel). User defined scale: 0 to 999.9, 0 to 99.99, 0 to 999.9, and 0 to 9999. User defined units up to 5 characters.
Range Selection	Internal single or auto range, or external range selection via digital inputs.
Cell Constant Adjustment	Fully adjustable from 00.00 to 10.00
Conductivity Accuracy	± 1% of range.
Linearity	± 0.1% of range.
Repeatability	± 0.1% of range.
Operator Adjustment (Conductivity)	Conductivity ± 10% slope. Solution ±20% offset.
Temperature Sensor	Pt1000 RTD input. Up to 100 meters of cable. Temperature sensor can be mounted in the sensor or separately.
Range of Temperature Measurement	-50 °C to +160 °C (-58 °F to +320 °F) for full specification.
Temperature Accuracy	0.2 °C (When using a 4 wire PT1000)
Operator Adjustment (Temperature)	± 50 °C or ± 122 °F
Range of Temperature Compensation	-10 °C to +150 °C (+14 °F to +302 °F) for full specification.
Temperature Compensation Type	Variable slope 0 - 3.9 %/°C over -10 to +150 °C. Selectable In or Out.
Temperature Compensation Base	Selectable at 20 °C or 25 °C.

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Installation and Choice of Electrodeless Conductivity Sensors

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

The following criteria are of great importance during selection:

- The choice of the best method of measurement
- Use of the correct materials for temperature and corrosion resistance
- Position of sensor for robustness and service access
- Ensuring a representative, uncontaminated solution sample

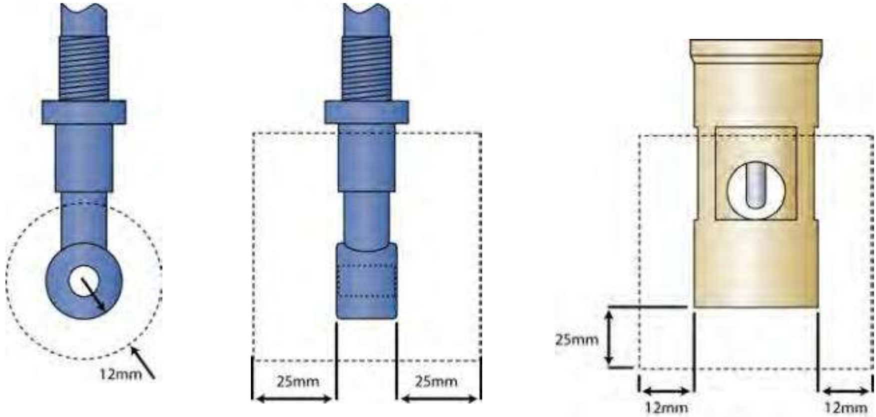
The electrodeless method of measuring conductivity has many advantages over conventional methods in particular the sensors will operate with virtually zero maintenance and provide reliable measurements over extended periods of time.

LTH provides a selection of electrodeless sensors in a variety of materials including PEEK™ a food grade material with excellent chemical resistance and high temperature performance. Contact LTH Electronics or your local distributer for more information.

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

- The solution around the sensor is representative of the solution as a whole.
- For best performance line up the cross hole with direction of flow.
- A moderate flow is maintained to provide an “up to date” sample. Excessive flow rates, however, can cause cavitations and turbulence within the sensor, which will result in inaccurate readings.
- The sensor is mounted so that air bubbles do not lodge within it - displacing solutions and affecting the sample volume (air is not conductive).
- Similarly it must be in a position so that sludge and particulate matter does not collect within the sensor.

The electrodeless sensor will need a minimum clearance around it when installed or making measurements in a sample. Do not rest it on the bottom of a tank or vessel. See the following figures for details.

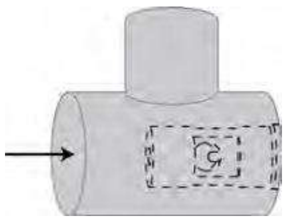


ECS20 SERIES SENSORS **ECS40 SERIES SENSORS**

Sensor Installation Clearance

Care should also be taken to ensure to position of the sensor within the flow is correct.

Incorrect

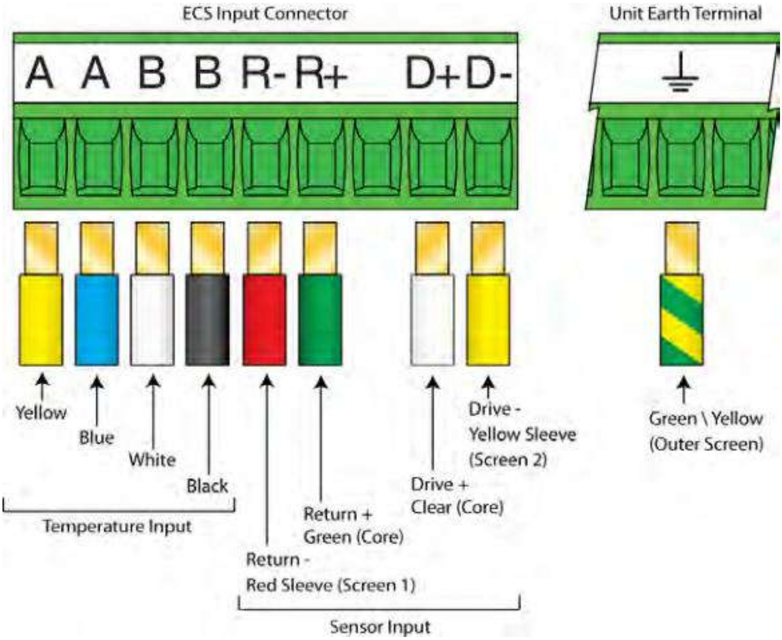


Best Solution

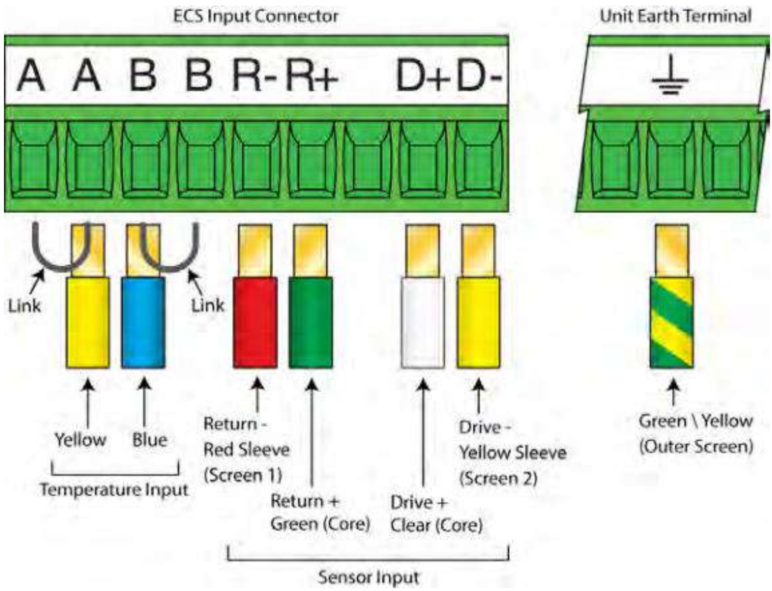
Acceptable

Acceptable

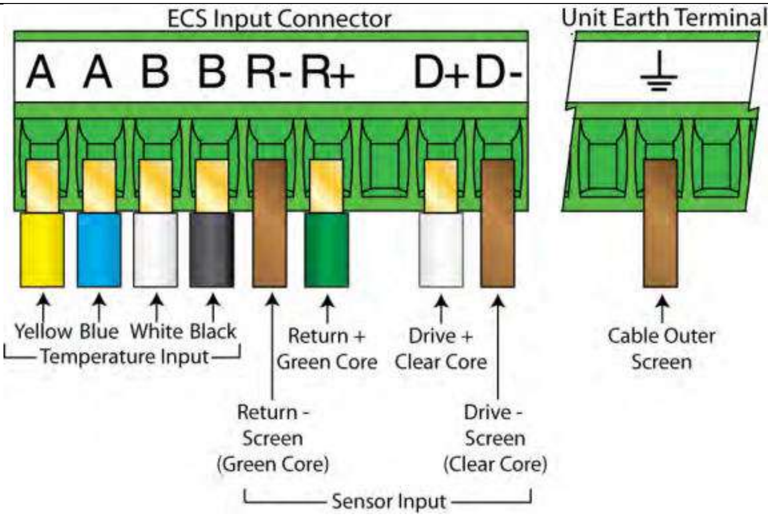
MXD73 – Panel Mount Termination Information



Electrodeless Conductivity 54E Cable Connection Details

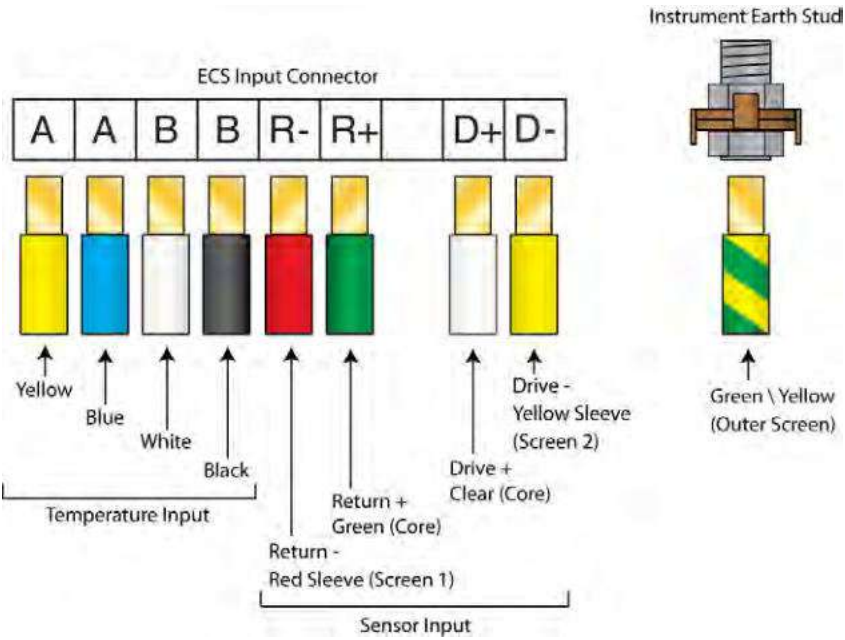


Electrodeless Conductivity 54H Cable Connection Details

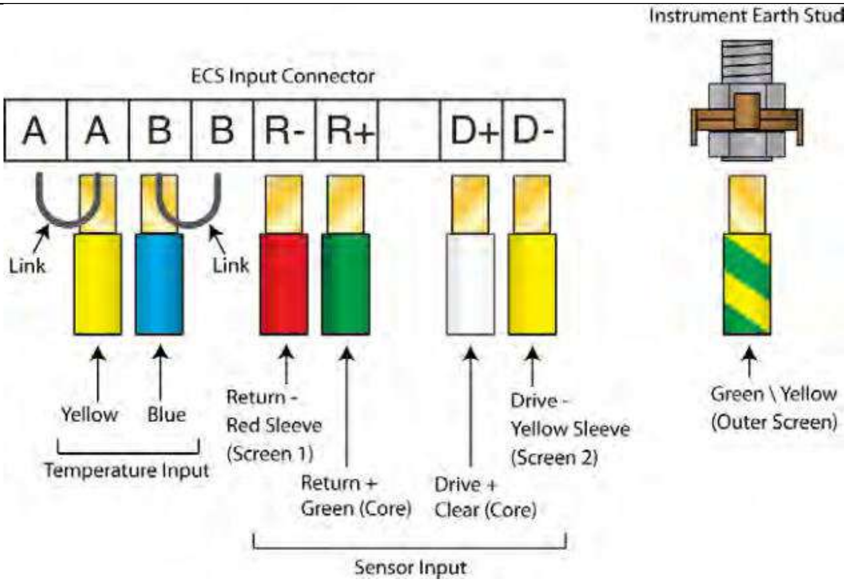


Electrodeless Conductivity 54E Extension Cable Connection Details

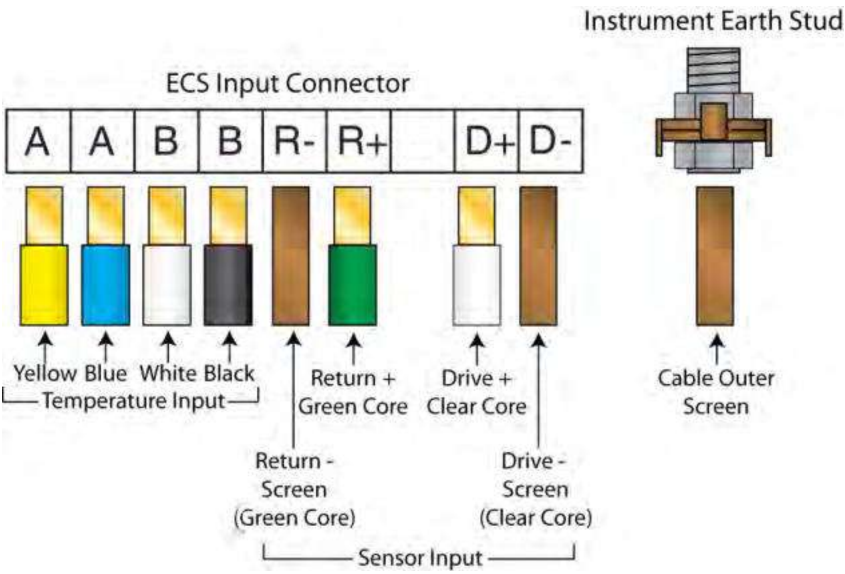
MXD75 – Surface Mount Termination Information



Electrodeless Conductivity 54E Cable Connection Details



Electrodeless Conductivity 54H Cable Connection Details

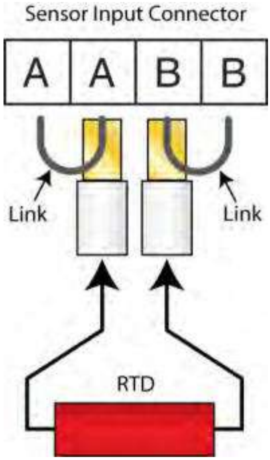


Electrodeless Conductivity 54E Extension Cable Connection Details

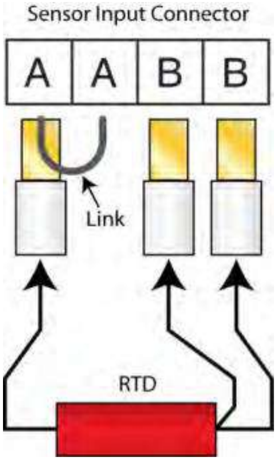
Installation

Installation

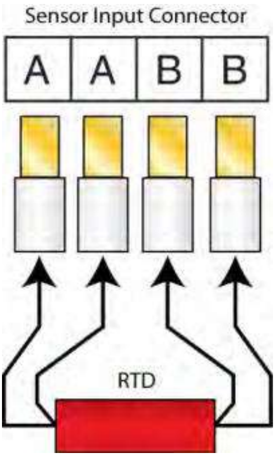
Temperature Sensor Connections



2 Wire RTD Temperature Connection



3 Wire RTD Temperature Connection



4 Wire RTD Temperature Connection

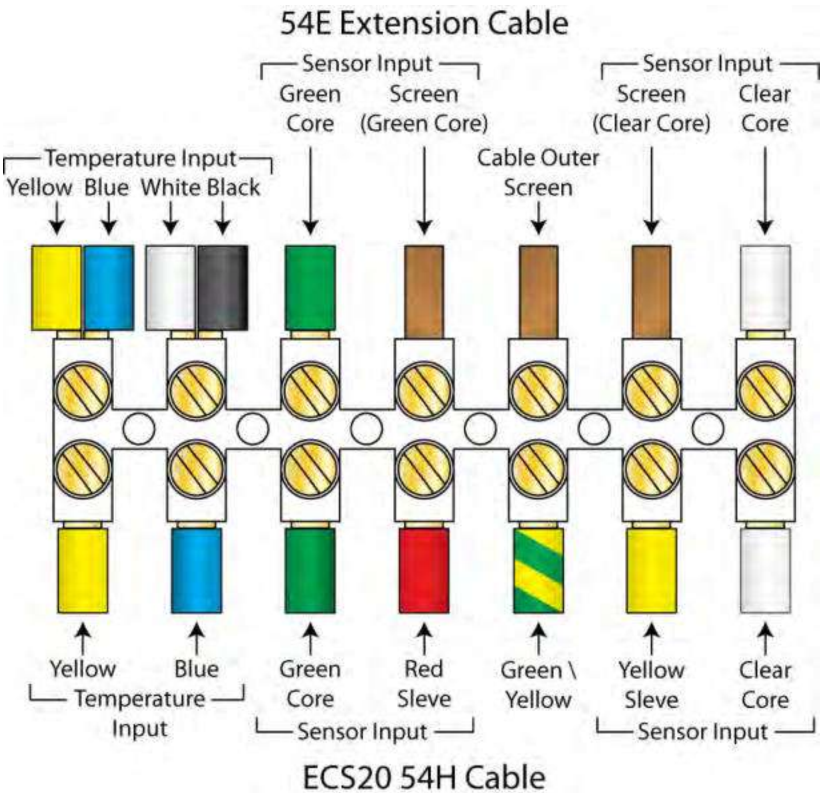
Extension Cable Arrangement

It is strongly recommended that only LTH 54E is used to extend the sensor / instrument distance. When extending the cable a terminal block can be used to connect two lengths of cable. The user should be careful to avoid wiring the positive drive and return signals into adjacent locations on the terminal block. The preferred arrangement would be to have the positive signals as far apart from each other as the terminal block will allow with the negatives between them and the earth between the negative signals as shown in the following diagram.

Drive +	Drive -	Earth	Return -	Return +

Recommended Extension Terminal Block Arrangement

The following diagram details the connections required to extend a 54H cable as found on the ECS20 sensors with 54E cable.

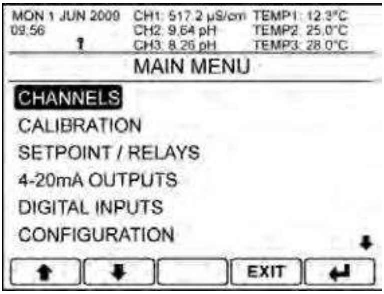


ECS20 54H Cable To 54E Extension Cable Connection Details

Electrodeless Conductivity Input Channel Setup

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

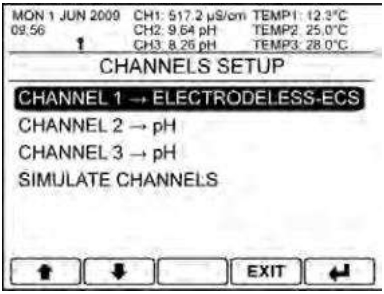
The default security access code is 1000



Main Menu

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

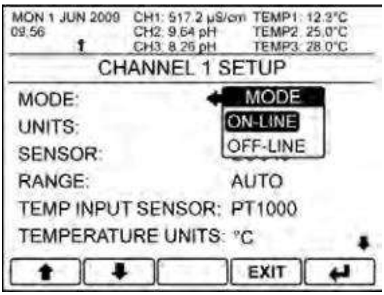
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Select Channel

Select the electrodeless conductivity input channel you wish to edit.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



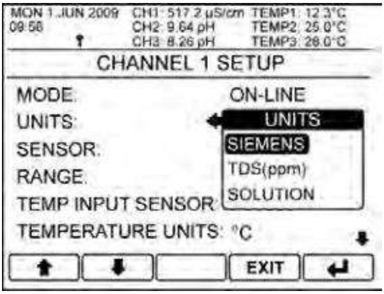
Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

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

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

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



Units

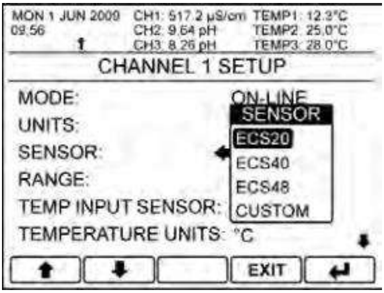
The channel can be setup to display conductivity in Siemens/cm, TDS (Total Dissolved Solids) in ppm, or Solution.

When solution is selected the channel will automatically apply the correct conversion and temperature conversion and display the concentration as "%" with an indication of the solution type selected (see range selection).

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Sensor Type

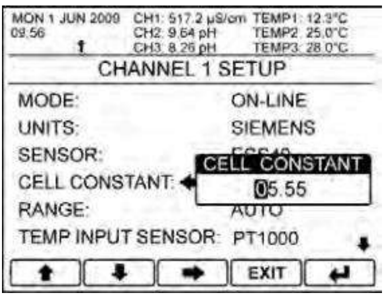
The electrodeless conductivity input can use either the ECS20, or all of the ECS40 series sensors. Selecting the appropriate sensor will configure the instrument with the correct nominal cell constant. If the sensor type is not shown selecting custom will allow a manual cell constant to be entered.

! A Sensor loop calibration must be performed when a new sensor is attached to the instrument or the sensor cable is changed; see page 27 for details.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Cell Constant

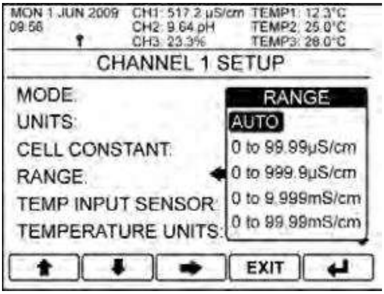
Allows manual entry of the sensor cell constant if custom is selected in the sensor type menu.

🡅/🡇 – Increase / Decrease Digit

🡆 – Select Next Digit

EXIT – Cancel

↵ – Save Value



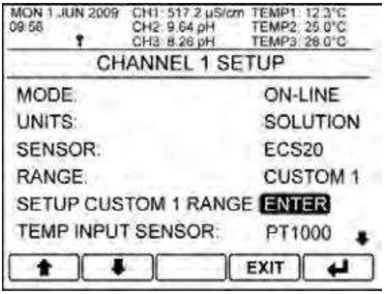
Range

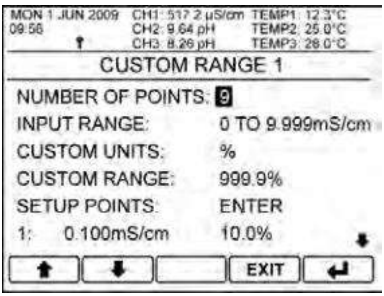
Select the desired operating range for the input or select auto to let the instrument select the appropriate operating range.

If units have been set to solution then the user can select what concentration to display or alternatively if one of the two custom ranges is selected then the user can then use a custom range as defined in the custom range menu (see setup custom range menu in this section for more information).

If a “Cannot Edit Digital Input Has Control” message appears, then an associated digital input is currently defining the operating range.

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





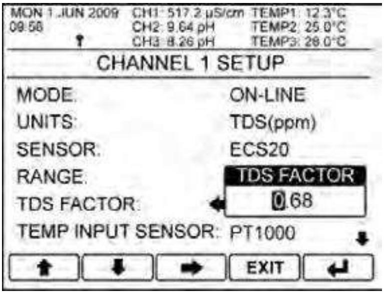
Setup Custom Solution Range

The electrodeless conductivity input provides the user with the facility to enter two different customised conversions from conductivity to a user defined concentration, for solutions not specifically defined in the standard ranges.

To use this first set the units to “Solution”, then the range to one of the two custom ranges. The “Setup Custom X Range” menu will appear, select this and press enter.

The new screen provides the following options.

- Number of points – Define the number of data entry points which make up the custom curve (not including the zero point as the unit will always assume that the concentration zero is equal to the conductivity zero).
- Input Range – The conductivity range over which the custom curve will operate.
- Custom Units –Enter the units the conversion will use (5 Characters maximum).
- Custom Range –Enter the range over which the converted reading will operate.
- Setup Points – Automatically define the data points one after another. It is recommended that the points are added in ascending order of conductivity.
- Data Points – Alternatively the user can edit a single point by selecting it in the menu.



TDS Factor

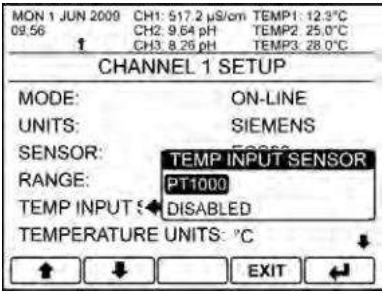
When TDS is selected as the operating units the instrument will display the conductivity as “ppm” using a factor which can be adjusted between 0.50 and 0.90.

↑/↓ – Increase / Decrease Digit

→ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Temperature Input Sensor

Select the input channel’s temperature sensor type for use with the sensor measurement’s automatic temperature compensation.

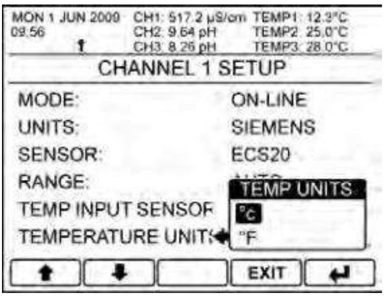
If a temperature sensor is not connected to the input channel then this menu item should be set to disabled, else temperature input error messages will be shown.

Note. Even when disabled is set a manual temperature compensation can be used.

↑/↓ – Select Option

EXIT – Cancel

↵ – Save Selection



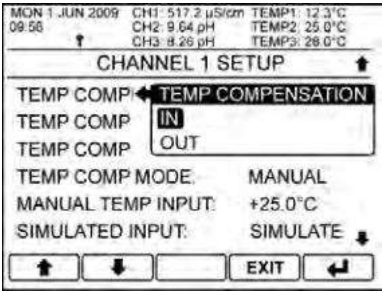
Temperature Units

Sets the temperature units used.

↑/↓ – Select Option

EXIT – Cancel

↵ – Save Selection



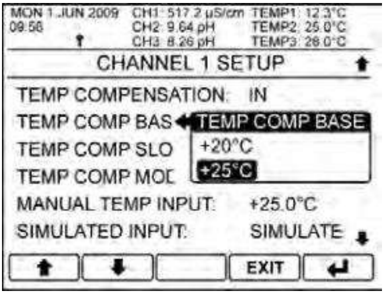
Temperature Compensation

Temperature compensation is enabled by setting this to “In”.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



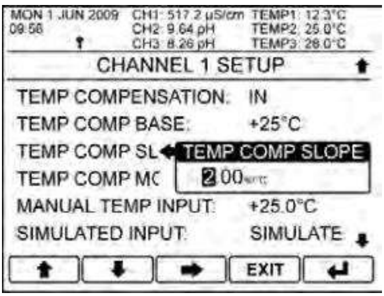
Temperature Compensation Base

Sets the temperature compensation base. See Appendix B - Temperature Coefficient for more information. Only Available if Temperature Compensation is set to in.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Temperature Compensation Slope

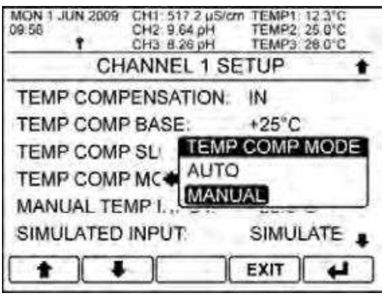
Sets the temperature compensation slope. See Appendix B - Temperature Coefficient for more information. Only Available if Temperature Compensation is set to in.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



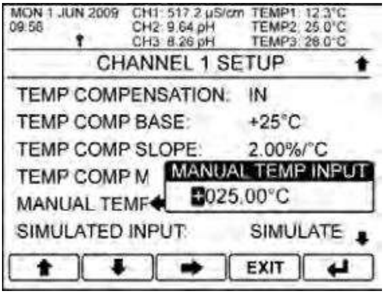
Temperature Compensation Mode

To use temperature compensation from a measured input select “Auto”, else select “Manual” to enable a fixed value entry. Only Available if Temperature Compensation is set to in.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Manual Temperature Input

The fixed temperature value used for manual temperature compensation.

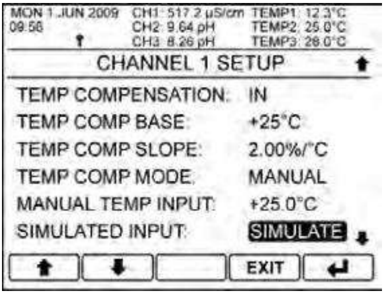
Only available when temperature compensation mode is set to “manual”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



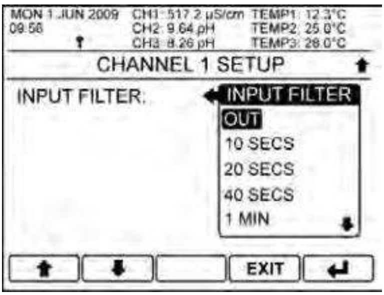
Simulated Input

See Simulated Channels section of the Setpoints, Current Outputs, Digital Inputs Configuration Guide for more information.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Input Filtering (Averaging)

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

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Calibration

Normal good practices should be observed when calibrating an electrodeless conductivity system.

Four Calibration procedures are provided with the electrodeless conductivity input:

- An initial installation loop calibration that matches the sensor, cable and instrument using loop resistors. This only needs to be performed when the system is commissioned and when a sensor or cable is changed.
- A solution calibration, that will allow the user to fine tune the calibration. Note: The amount of adjustment is quite small because the factory calibration is accurate and with modern electronics, drift is very low. If it is found that during a calibration there is insufficient adjustment then it is probable that there is a problem with either the calibration procedure, or a fault with the instrument, sensor or cabling.
- Temperature measurement adjustment, will allow to fine tune the temperature input in relation to a known input.
- Current output adjustment.

For best results always clean the sensor before making any adjustments.

Calibration of Conductivity Readings
Conductivity measurements are very temperature dependent so it is essential that an understanding of the complex relationship between conductivity and temperature is understood when calibrations are made. It is possible to make several different types of calibration.

Calibration with Standard Solutions
This calibration must be carried out under strictly controlled conditions due to the temperature effect on conductivity measurements and the possibility of contamination of the standard solution. The advantage of this calibration method is that the sensor and cable are an integral part of the calibration. LTH strongly recommends a lower limit of 500µS/cm for this type of calibration. Conductivity is a very sensitive measurement and even trace contamination of the standard solution will be detected, for example exposing the solution to air will add 1µS/cm to the standard solution due to absorption of CO_2.

Most standards are made up from a solution of KCl dissolved in high purity water. BS EN 60746-3 provides details of the concentrations of KCl necessary to produce industry standard conductivity solutions. Ready made solutions are available from LTH with traceable certification if required.

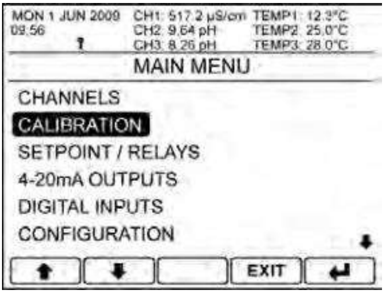
Standard solutions will be supplied with a conductivity value quoted at a reference temperature. This temperature is the base temperature and the calibration should be performed at that temperature, with the temperature compensation switched out. Alternatively, the temperature compensation should be switched on and a temperature slope and base temperature equal to that of the calibration solution can be used to configure the instrument. For example this would be 1.76%/°C for a KCl solution between 1000 to 10,000µS/cm. For more details on calculating the slope of a different solution, refer to Appendix B - Temperature Coefficient (page 31)

Calibration by Comparison with Another Instrument
This can provide the easiest method for in-situ calibrations but has the disadvantage of only being able to check a single measurement point. As measurements are made by comparison of the readings taken in the same solution, temperature effects are less critical. However, it is essential that settings for temperature compensation are the same on both instruments.

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 <u>1000</u>



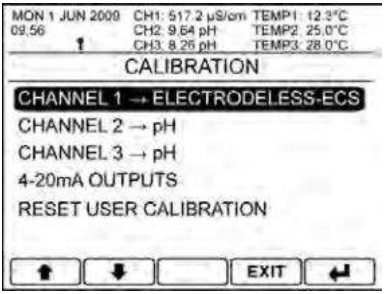
Main Menu

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

↑/↓ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



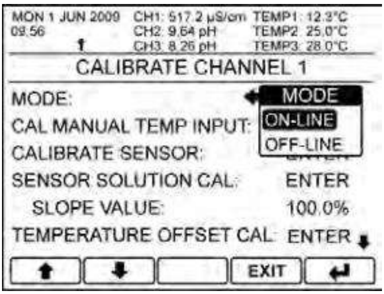
Select Channel

Select the electrodeless conductivity input channel you wish to edit.

↑/↓ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

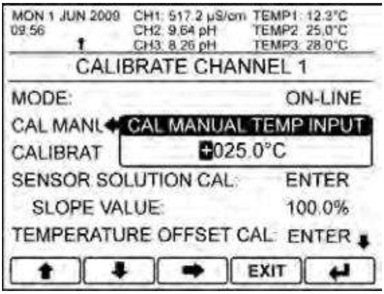
When the unit is placed in an off-line state "off-line" will appear in the channel messages section on the front screen.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

↑/↓ – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Manual Temperature Input

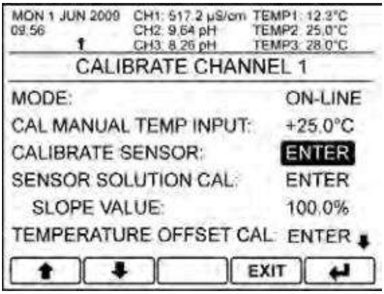
This setting allows a different fixed temperature value to be used when calibrating. Makes it easier to calibrate a standard solution at a different temperature to the process. Only available when the temperature compensation mode has been set to manual in the channel setup menu.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



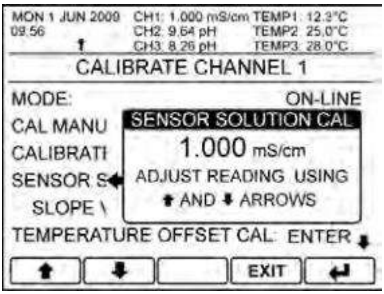
Calibrate Sensor

Sensor loop calibration. Must be carried out when a sensor or sensor cable is changed. See page 27 for more details.

⬆/⬇ – Select Option

EXIT – Return to Select Calibration Channel

↵ – Enter Sensor Calibration



Sensor Solution Calibration

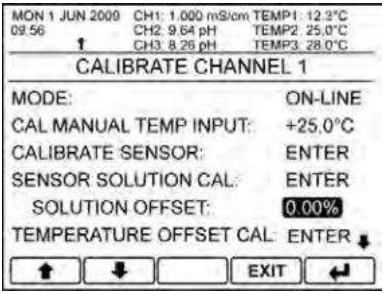
The sensor solution calibration enables the user to adjust the sensor reading to match a known input.

The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration. The calculated slope or offset, depending on the channel's units, are shown in the next menu entry.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

↵ – Save Calibration



Sensor Slope or Offset Value

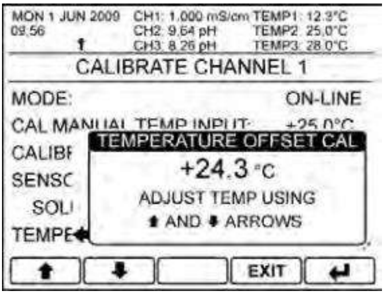
Depending on the channel's units, the sensor slope or offset value currently being used. The value will change depending on the result of the sensor solution calibration.

Cannot be edited

A slope value of 100% indicates that no adjustment has been made to the sensor calibration.

A slope value of greater than 100% indicates that the sensor reading has had to be increased to match the known input.

A slope value of less than 100% indicates that the sensor reading has had to be decreased to match the known input.



Temperature Offset Calibration

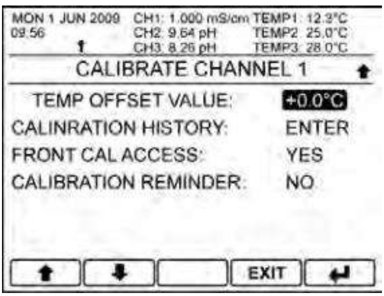
The temperature offset calibration enables the user to adjust the temperature reading to match a known input.

The current temperature reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration. The calculated offset is shown in the next menu entry.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

↵ – Save Calibration

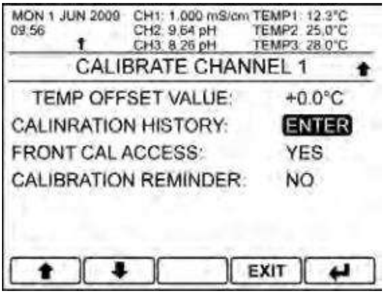


Temperature Offset Value

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

Cannot be edited

Channel Calibration

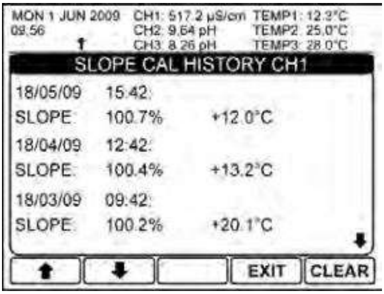


Enter Calibration History

The MXD70 series has a calibration history feature which allows the user to review the record of sensor solution calibrations.

To enter the calibration history menu press enter.

↵ – Enter Calibration History



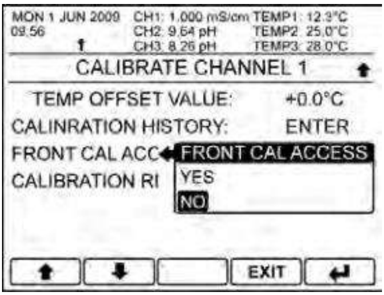
Calibration History

The calibration history page provides a record of all sensor solution calibrations carried out. The data includes the date and time of the calibration, the calculated sensor slope and the temperature compensation reading at the time.

↑/↓ – Move To Next Page Up or Down

EXIT – Return To Calibration Menu

CLEAR – Clear All of the Calibration History



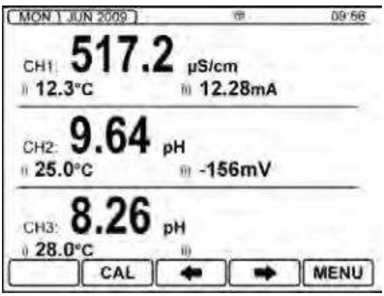
Front Screen Calibration Access Enable

When enabled front calibration access allows direct entry into the calibration menu from the front screen. It also disables the security access system within the calibration menu enabling the calibration functions without having to enter the security access code.

↑/↓ – Select Option

EXIT – Cancel

↵ – Save Selection



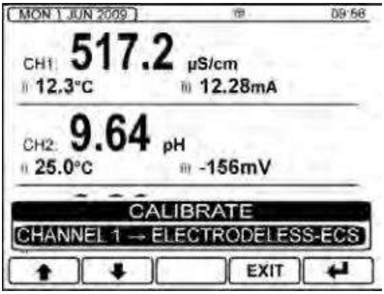
Front Screen Calibration Access

When the calibration access is enabled press the “CAL” button to bring up pop-up to select which channel to calibrate.

CAL – Enter Calibrate Channel Select Menu

←/→ – Scroll Around Menus

Menu – Access Main Menu



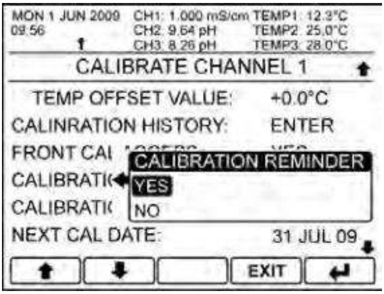
Select Channel to Calibrate

From the pop-up select the channel the user wishes to calibrate. Only channels whose front calibration access has been enabled will appear.

↑/↓ – Select Option

EXIT – Cancel

↵ – Enter Menu



Calibration Reminder

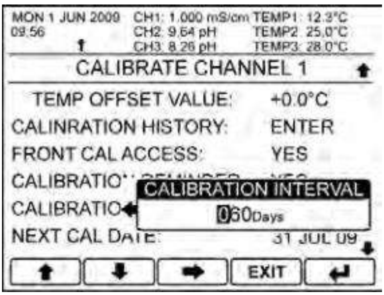
By enabling the calibration reminder the user can configure a calibration interval, which when expired will activate an alarm and channel message on the front screen.

At the end a sensor solution calibration, if calibration reminder is enabled, the user will be prompted to update the cal due date by the calibration interval and so clearing an alarm if active.

↑/↓ – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Interval

Sets the interval time for the calibration alarm.

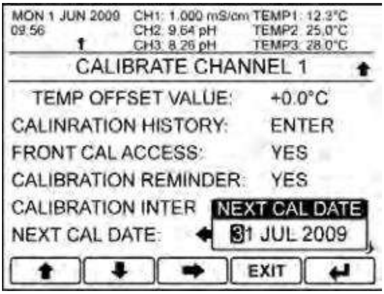
The Next Cal Date will update to show the date of the next calibration alarm.

↑/↓ – Increase / Decrease Digit

→ – Select Next Digit

EXIT – Cancel

↵ – Save Value

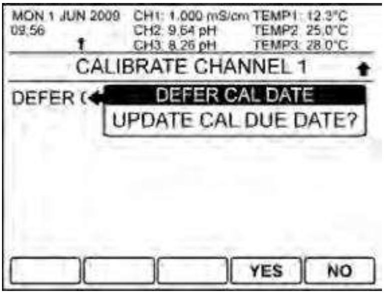


Next Calibration Date

Sets the exact date of the next calibration alarm.

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

⬆/⬇	– Increase / Decrease Digit or Text
➡	– Select Next Item
EXIT	– Cancel
↵	– Save Entry



Defer Calibration Date

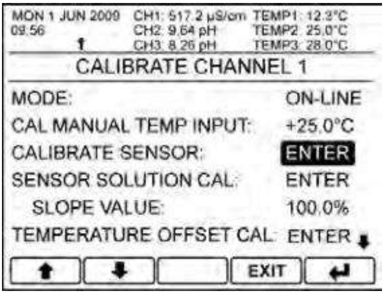
Turns off the alarm and increases the calibration interval by an extra 7 days.

Only appears once the calibration interval has expired.

YES	– Increase Interval
NO	– Cancel

Sensor Loop Calibration

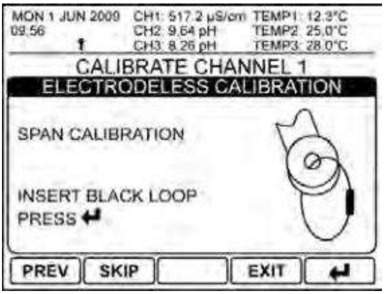
The sensor calibration is a one off configuration calibration, to allow for losses due to cable length and sensor output variations. It must be completed when either a sensor or sensor cable is changed. To complete the calibration the four loop resistors (Black, Glue, Green, Pink) supplied with the input card must be used, once completed do not discard the resistors as they will be required for future calibration and checks. The resistors must be removed prior to installing the sensor into a pipe or tank.

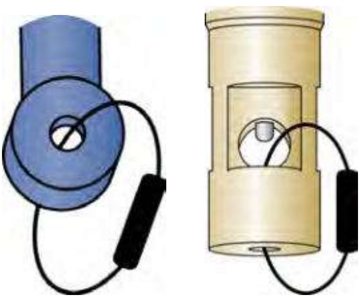


Calibrate Sensor

To start the sensor loop calibration select the “Calibrate Sensor” item from the desired channel’s calibration menu.

⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter Sensor Calibration





ECS20 Series Sensor **ECS40 Series Sensor**

Loop Resistor Path

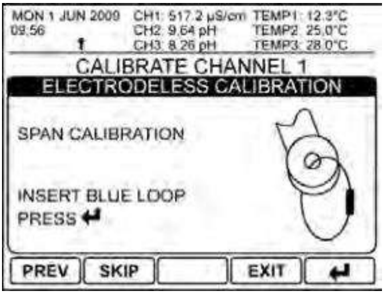
Insert Black Loop

Attach the Black (5000Ω) loop resistor to the sensor as shown, then press the enter button. The screen will then indicate that the unit is sampling the sensor.

If the calibration has been completed successfully then the instrument will automatically prompt for the next loop resistor.

If the fail message appears then there has been a calibration problem check the loop resistor, the sensor and the cable. If all appears correct press the “prev” button then the enter button to restart the calibration.

PREV	– Exit Calibration Without Saving
SKIP	– Skip to Next Calibration Point
EXIT	– Exit Calibration Without Saving
↵	– Initiate Calibration



Insert Blue Loop

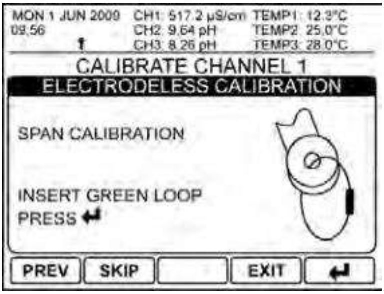
Remove the previous loop resistor and attach the Blue (500Ω) loop resistor to the sensor as shown previously, then press the enter button.

PREV – Go to Previous Calibration Point

SKIP – Skip to Next Calibration Point

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration



Insert Green Loop

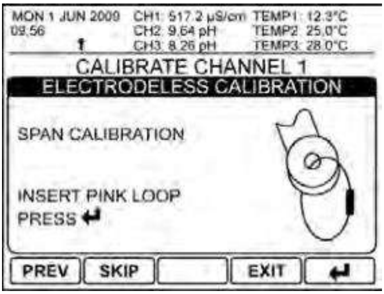
Remove the previous loop resistor and attach the Green (50Ω) loop resistor to the sensor as shown previously, then press the enter button.

PREV – Go to Previous Calibration Point

SKIP – Skip to Next Calibration Point

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration



Insert Pink Loop

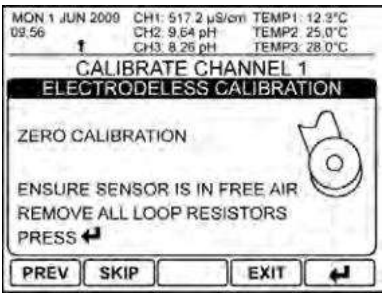
Remove the previous loop resistor and attach the Pink (5Ω) loop resistor to the sensor as shown previously, then press the enter button.

PREV – Go to Previous Calibration Point

SKIP – Skip to Next Calibration Point

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration



Zero Calibration

Remove the previous loop resistor, and ensure that the sensor head is located in free air, then press the enter button. Note this calibration can take a few minutes.

When the calibration has completed successfully press the enter button to save the calibration and return to the channel's main calibration menu.

PREV – Go to Previous Calibration Point

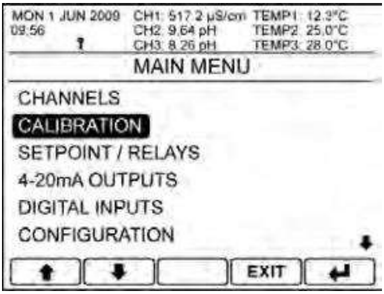
SKIP – Exit Calibration Without Saving

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration

Resetting the User Calibration

If required the user can reset the user calibrations to their default states.



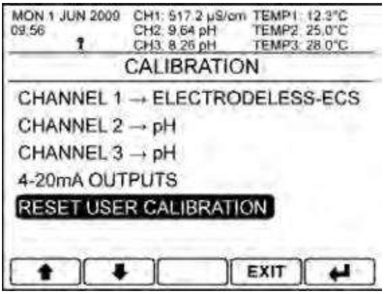
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



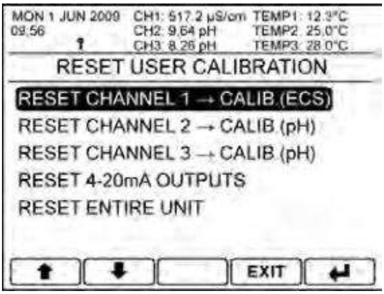
Calibration

Select Reset User Calibration.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



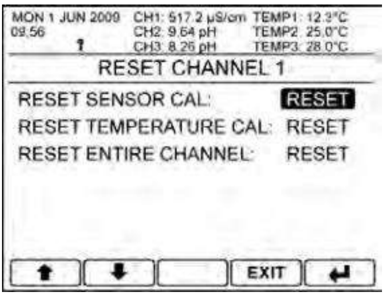
Reset User Calibration

Select the required conductivity input channel.

⬆/⬇ – Select Option

EXIT – Return to Calibration

↵ – Enter Option



Reset Channel User Calibration

Select whether to reset the sensor calibration, the temperature calibration or reset the all of the channel's user calibrations.

⬆/⬇ – Select Option

EXIT – Return to Reset User Calibration

↵ – Enter Option

Appendix A - Solution Conversion

The following table provides some of the data points which have been used in the instrument to make the conversion between conductivity and solution concentration.

Temperature Compensated Conductivity (mS/cm @ 25°C)							
% wt / vol	**NaOH**	**NaCl**	**HCl**	**H_2SO_4**	**H_3PO_4**	**HNO_3**	**Salinity**
1	53.2	17.6	103.0	48.5	11.25	60.0	20.0
5	223.0	78.3	432.0	237.0	32.9	275.0	90.0
10	358.0	140.0	709.0	427.0	61.1	498.0	170.0
20	414.0	226.0	--------	709.0	117.0	763.0	320.0

Note: Salinity range is displayed by the instrument in parts per thousand concentration (p.p.t.), which is the concentration in % shown above, multiplied by 100.

Temperature Compensation Slope (% / ° C)							
% / °C	**NaOH**	**NaCl**	**HCl**	**H_2SO_4**	**H_3PO_4**	**HNO_3**	**Salinity**
----------	1.79	1.90	1.27	1.03	0.86	1.19	1.92

Appendix B - Temperature Coefficient

Calculating the temperature coefficient of a solution

If the temperature coefficient of the solution being monitored is not known, the instrument can be used to determine that coefficient. You should set the channel to a suitable range and the temperature coefficient to 0.0% or temperature compensation to “Out”.
The following measurements should be made as near to the normal operating point as practical, between 5°C and 70°C for the highest accuracy. Immerse the measuring cell in at least 500 ml of the solution to be evaluated, allow sufficient time to stabilise, approximately one or two minutes, and then record both the temperature and conductivity readings. Raise the solution temperature by at least 10°C and again record the temperature and conductivity readings. Using the following equation, the temperature compensation slope can be calculated in percentage terms:

$$\alpha = \frac{(Gx-Gy) \times 100\%}{Gy(Tx-25) - Gx(Ty-25)} \quad \text{(base temperature 25°C)}$$

Note: If the base temperature is set to 20°C, then replace 25 with 20 in the above equation.

Term	Description
Gx	Conductivity in µS/cm at temperature Tx
Gy	Conductivity in µS/cm at temperature Ty

Note: One of these measurements can be made at ambient temperature.

Set the temperature compensation slope to the calculated value. The temperature compensation is now set up for normal operation.
If it is difficult or impossible to evaluate the temperature compensation slope using this method, a 2.0 % / °C setting will generally give a good first approximation until the true value can be determined by independent means.

Temperature Data

The table below lists approximate resistance values of temperature sensors that may be used with the MXD70 series. Not all options are available on all models.

Temperature (°C)	PT1000 RTD	PT100 RTD	1K Therm-istor	3K Balco
0	1000.0Ω	100.00Ω	2691Ω	2663Ω
10	1039.0Ω	103.90Ω	1779Ω	2798Ω
20	1077.9Ω	107.79Ω	1204Ω	2933Ω
25	1097.3Ω	109.73Ω	1000Ω	3000Ω
30	1116.7Ω	111.67Ω	833.7Ω	3068Ω
40	1155.4Ω	115.54Ω	589.0Ω	3203Ω
50	1194.0Ω	119.40Ω	423.9Ω	3338Ω
60	1232.4Ω	123.24Ω	310.5Ω	3473Ω
70	1270.7Ω	127.07Ω	231.0Ω	3608Ω
80	1308.9Ω	130.89Ω	174.5Ω	3743Ω
90	1347.0Ω	134.70Ω	133.6Ω	3878Ω
100	1385.0Ω	138.50Ω	103.6Ω	4013Ω

Appendix C - Instrument Configuration

Instrument Configuration

Instrument Type		Serial Number		Software Version	
Power Supply Type					
Channel 1 Input Card Type		Serial Number			
Channel 2 Input Card Type		Serial Number			
Channel 3 Input Card Type		Serial Number			
Output Expansion Card Type		Serial Number			
Software Expansion		Unlock Code			
Software Expansion		Unlock Code			

Instrument Settings

Security Access Code					
Language					
Front Screen Ch1 Shown		Front Screen Ch1 Secondary Reading i)		Front Screen Ch1 Secondary Reading ii)	
Front Screen Ch2 Shown		Front Screen Ch2 Secondary Reading i)		Front Screen Ch2 Secondary Reading ii)	
Front Screen Ch3 Shown		Front Screen Ch3 Secondary Reading i)		Front Screen Ch3 Secondary Reading ii)	
Front Screen Ch1 Label					
Front Screen Ch2 Label					
Front Screen Ch3 Label					
4-20mA Output Slot 1		4-20mA Output Slot 2			
Menu Header i)		Menu Header ii)		Menu Header iii)	
Menu Header iv)		Menu Header v)		Menu Header vi)	

Setup

Channel Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Description			
Units			
Sensor / Probe Type			
Cell Constant			
Range			
Linearisation Source			
TDS Factor			
Membrane Correction Factor			
Bias Voltage			
mA Input: Loop Mode			
mA Input: Input Mode			
Set 0mA Input			
Set 4mA Input			
Set 20mA Input			
Temperature Input Sensor			
Temperature Units			
Temperature Compensation: In/Out			
Temperature Compensation Slope			
Temperature Compensation: Auto / Manual			
Fixed Temperature Input			
Input Salinity			
Pressure Compensation: Auto / Manual			
Pressure Mode: Input / 24V Loop			
Pressure Units			
Pressure 4mA Input			
Pressure 20mA Input			
Fixed Pressure Input			
Cable Compensation			
Input Filter			

Curve Setup (available options vary with card type and configuration)

	Channel 1		Channel 2		Channel 3	
Curve A						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						
Curve B						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						

Channel Calibration Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Calibration Principle			
Calibration Manual Temp Input			
Calibration Units			
Calibration Manual Pressure Input			
Span Cal Point			
Enable Auto Span Cal			
Offset Value			
Slope Value			
Temperature Offset			
Sensor Condition			
Front Calibration Access			
Calibration Reminder			
Calibration Interval			

Setpoints Setup (available options vary with card type and configuration)

	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5	Setpoint 6
Channel						
Input Source						
Trigger						
High Value						
Low Value						
USP Pre-Trigger						
Mode						
Cycle Time						
Proportional Band						
Delay						
Hysteresis						
Dose Alarm						
Dose Alarm Time						
Initial Charge						
Charge Time						
Charge Access						
Alarm Mode						
Clean Duration						
Clean Interval						
Clean Mode						
Clean Recovery						
Clean Delay						

Current Output Setup (available options vary with card type and configuration)

	Current Output A	Current Output B	Current Output C	Current Output D	Current Output E	Current Output F
Channel						
Input Source						
Output 0 – 20mA / 4 - 20mA						
Zero						
Span						
On Error						

Digital Inputs (available options vary with card type and configuration)

	Digital Input 1	Digital Input 2	Digital Input 3	Digital Input 4	Digital Input 5	Digital Input 6	Digital Input 7	Digital Input 8
Channel								
Function								
Range Change								
Switch Store								
Cleaning Setpoint								
Polarity								
4-20 Output Level								

Service Alarms

	Channel 1	Channel 2	Channel 3
Service Reminder			
Service Interval			
Next Service Date			

Appendix D - Error Messages

Internal Error Messages

E001	**UNIT**	**Processor RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E002	**UNIT**	**External RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E003	**UNIT**	**Internal Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, Reset Whole unit from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E004	**UNIT**	**Output Card Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E005	**UNIT**	**Internal Outputs Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E006	**UNIT**	**For Future Use**
E007	**UNIT**	**Unit Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the whole unit from the Load Default Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E008	**UNIT**	**Unit Store A Checksum Error** The data in Unit Store A has been corrupted. Save the current setup back to Unit Store A in the Save/Restore menu.
E009	**UNIT**	**Unit Store B Checksum Error** The data in Unit Store B has been corrupted. Save the current setup back to Unit Store B in the Save/Restore menu.
E010 to E013	**UNIT**	**Maths Error** There has been an internal maths calculation failure. As such, it should not appear if the software is functioning properly. The error message should clear after approx. 5 seconds. If the error continues to be displayed consult with your supplier, as this unit may require to be returned for repair.
E014	**UNIT**	**Contrast Chip Error** The Contrast Chip is not operating correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E015	**UNIT**	**Unit SD Card Checksum Error** The SD Card store from which the entire unit was restored from has become corrupted. Check the unit's settings and then save the settings again to the SD card store.
E016	**UNIT**	**SD CARD FULL** The SD card has become full. To continue use, either replace with a blank SD card or remove existing files from SD card

Input Channel Errors

E030 **E080** **E130**	**CH1** **CH2** **CH3**	**Input Card Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E031 **E081** **E131**	**CH1** **CH2** **CH3**	**Setup Checksum Error** The current channel's configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists reset the current channel from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E032 **E082** **E132**	**CH1** **CH2** **CH3**	**Store A Checksum Error** The data in the channel's Store A has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store A in the Save/Restore menu.
E033 **E083** **E133**	**CH1** **CH2** **CH3**	**Store B Checksum Error** The data in the channel's Store B has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store B in the Save/Restore menu.
E034 **E084** **E134**	**CH1** **CH2** **CH3**	**Factory Cal Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E035 **E085** **E135**	**CH1** **CH2** **CH3**	**User Cal Checksum Error** The Channel's User Cal has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the Channel from the Reset User Calibration option in the Calibration menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E036 **E086** **E136**	**CH1** **CH2** **CH3**	**Sensor Cal Out Of Spec** The last Sensor Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E037 **E087** **E137**	**CH1** **CH2** **CH3**	**Sensor Zero Cal Out Of Spec** The last Sensor Zero Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E038 **E088** **E138**	**CH1** **CH2** **CH3**	**Sensor Span Cal Out Of Spec** The last Sensor Span Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E039 **E089** **E139**	**CH1** **CH2** **CH3**	**No Signal** No Sensor connected or there is 'zero' detector current. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E040 **E090** **E140**	**CH1** **CH2** **CH3**	**Signal Overload** The gain step is equal to 0 and the A/D output is over 255. This cannot happen in a liquid but could happen if the sensor is in full sunlight. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.

E041 E091 E141	CH1 CH2 CH3	**Partial Depletion** Large difference between the detectors, i.e. one very dirty. This alarm will come up if there is a difference of 3:1 between the detectors. Remove sensor and clean sensor fingers. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E042 E092 E142	CH1 CH2 CH3	**Full Depletion** Attenuation too high or the real probe signal goes above 14000. The probe sensor units (PSU) will be set to 16000. If this message persists, please consult with your supplier.
E043 E093 E143	CH1 CH2 CH3	**Sensor User Offset At Limit** The last Sensor Offset Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E044 E094 E144	CH1 CH2 CH3	**Sensor User Slope At Limit** The last Sensor Slope Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E045 E095 E145	CH1 CH2 CH3	**Sensor User Slope < Spec** The last Sensor Slope Calibration was less than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E046 E096 E146	CH1 CH2 CH3	**Sensor User Slope > Spec** The last Sensor Slope Calibration was greater than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E047 E097 E147	CH1 CH2 CH3	**Sensor Open Circuit** The sensor input is at open circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E048 E098 E148	CH1 CH2 CH3	**Sensor Short Circuit** The sensor input is at short circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E049 E099 E149	CH1 CH2 CH3	**Sensor Positive Saturation** The sensor input is greater than the maximum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E050 E100 E150	CH1 CH2 CH3	**Sensor Negative Saturation** The sensor input is less than the minimum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E051 E101 E151	CH1 CH2 CH3	**Sensor Input Over Range** The sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E052 E102 E152	CH1 CH2 CH3	**Sensor Input Under Range** The sensor reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.

E053 **E103** **E153**	**CH1** **CH2** **CH3**	**Temp Sensor Fault** The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check that the temperature sensor is set to the correct type in the channel setup menu. Under this condition, the unit will default to the fixed temperature setting for compensation purposes. If the message persists please consult with your supplier.
E054 **E104** **E154**	**CH1** **CH2** **CH3**	**Temp Input Over Range** The temperature sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E055 **E105** **E155**	**CH1** **CH2** **CH3**	**Temp Input Under Range** The temperature reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E056 **E106** **E156**	**CH1** **CH2** **CH3**	**Temp Comp Outside Limits** The temperature reading is less than 0.0C or greater than 150.0C, leading to an error in compensation.
E057 **E107** **E157**	**CH1** **CH2** **CH3**	**Polar Zero Cal At Limit** The last Polargraphic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E058 **E108** **E158**	**CH1** **CH2** **CH3**	**Polar Span Cal At Limit** The last Polargraphic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E059 **E109** **E159**	**CH1** **CH2** **CH3**	**Galvanic Zero Cal At Limit** The last Galvanic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E060 **E110** **E160**	**CH1** **CH2** **CH3**	**Galvanic Span Cal At Limit** The last Galvanic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E061 **E111** **E161**	**CH1** **CH2** **CH3**	**Pressure Sensor Over Range** The pressure sensor reading is greater than the specified limit for the probe.
E062 **E112** **E162**	**CH1** **CH2** **CH3**	**Pressure Sensor Under Range** The pressure sensor reading is less than the specified limit for the probe.
E063 **E113** **E163**	**CH1** **CH2** **CH3**	**Pressure Above 20mA** The pressure sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E064 **E114** **E164**	**CH1** **CH2** **CH3**	**Pressure Below 4mA** The pressure sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E065 **E115** **E165**	**CH1** **CH2** **CH3**	**AUX mA Input Above 20mA** The sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.

E066 **E116** **E166**	**CH1** **CH2** **CH3**	**AUX mA Input Below 4mA** The sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E067 **E117** **E167**	**CH1** **CH2** **CH3**	**Sensor 0mV Cal Out of Spec** The pH 0mV calibration for this channel is outside recommended specifications.
E068 **E118** **E168**	**CH1** **CH2** **CH3**	**Calibration Due** The time since the last calibration was performed on this channel has exceeded the time set in the calibration menu.
E069 **E119** **E169**	**CH1** **CH2** **CH3**	**Planned Service Due** The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
E070 **E120** **E170**	**CH1** **CH2** **CH3**	**SD Card Checksum Error** The SD Card store from which this channel was restored from has become corrupted. Check the channel's settings and then save the settings again to the SD card store.
E071 **E121** **E171**	**CH1** **CH2** **CH3**	**Gain Error** The sensor gain has been exceeded. If this message persists, please consult with your supplier.
E072 **E122** **E172**	**CH1** **CH2** **CH3**	**Invalid Linearisation Curve** A minimum of 2 linearisation points are required. Please check linearisation curve settings in the channel setup menu for this channel.
E073 **E123** **E173**	**CH1** **CH2** **CH3**	**Linearisation Over-Range** The linearisation result is greater than 9999 (or 100.0% when using %).
E074 **E124** **E174**	**CH1** **CH2** **CH3**	**Linearisation Under-Range** The linearisation result is less than 0.
E075 **E125** **E175**	**CH1** **CH2** **CH3**	**Curve Low Limit** The incoming probe signal is less than the lowest point in the linearisation curve.
E076 **E126** **E176**	**CH1** **CH2** **CH3**	**Curve High Limit** The incoming probe signal is greater than the highest point in the linearization curve.
E077 **E127** **E177**	**CH1** **CH2** **CH3**	**Custom Error** Contact your supplier for details.

Setpoint Errors

E180 SP1 E190 SP2 E200 SP3 E210 SP4 E220 SP5 E230 SP6		**Dose Alarm Error** The Setpoint has been dosing for longer than the Dose Alarm time as defined in the setpoint menu.
E181 to E184 SP1 E191 to E194 SP2 E201 to E204 SP3 E211 to E214 SP4 E221 to E224 SP5 E231 to E234 SP6		**For Future Use**
E185 SP1 E195 SP2 E205 SP3 E215 SP4 E225 SP5 E235 SP6		**Store A Checksum Error** The Store A Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E186 SP1 E196 SP2 E206 SP3 E216 SP4 E226 SP5 E236 SP6		**Store B Checksum Error** The Store B Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E187 SP1 E197 SP2 E207 SP3 E217 SP4 E227 SP5 E237 SP6		**Setup Checksum Error** The Setup for this Setpoint has become corrupted. Check and correct the setpoint settings and turn the unit off and on again. If the message persists please consult with your supplier.
E188 SP1 E198 SP2 E208 SP3 E218 SP4 E228 SP5 E238 SP6		**SD Card Checksum Error** The SD Card store from which this Setpoint was restored from has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again to the SD card store.

Current Output Errors

E240 **E250** **E260** **E270** **E280** **E290**	**A** **B** **C** **D** **E** **F**	**Current OP Hardware Fault** 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.
E241 **E251** **E261** **E271** **E281** **E291**	**A** **B** **C** **D** **E** **F**	**Sensor IP<Current OP Zero** The sensor input level is below that set for the current output zero.
E242 **E252** **E262** **E272** **E282** **E292**	**A** **B** **C** **D** **E** **F**	**Sensor IP>Current OP Span** The sensor input level is above that set for the current output span.
E243 **E253** **E263** **E273** **E283** **E293**	**A** **B** **C** **D** **E** **F**	**Sensor IP<Current OP Span** The sensor input level is below that set for the current output Span.
E244 **E254** **E264** **E274** **E284** **E294**	**A** **B** **C** **D** **E** **F**	**Sensor IP>Current OP Zero** The sensor input level is above that set for the current output Zero.
 E255 **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

E245 **E255** **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

Digital Input Errors

E301 E306 E311 E316 E321 E326 E331 E336	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store A Checksum Error** The Store A Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E302 E307 E312 E317 E322 E327 E332 E337	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store B Checksum Error** The Store B Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E303 E308 E313 E318 E323 E328 E333 E338	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Setup Checksum Error** The Setup for this Digital Input has become corrupted. Check and correct the digital inputs settings and turn the unit off and on again. If the message persists please consult with your supplier.
E304 E309 E314 E319 E324 E329 E334 E339	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**SD Card Checksum Error** The SD Card store from which this Digital Input was restored from has become corrupted. Check the Digital Input's settings in the digital input menu and then save the settings again to the SD card store.

Communication Errors

E340 **E342** **E344**	**CH1** **CH2** **CH3**	**Comms Failure** The Channel's Input Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E341 **E343** **E345**	**CH1** **CH2** **CH3**	**Comms Error** The Channel's Input Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E346	**UNIT**	**Output Comms Failure** The Basic Internal Outputs are not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E347	**UNIT**	**Output Comms Error** The Basic Internal Outputs are not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E348	**OP**	**Output Option Comms Failure** The Output Option Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option card may require to be returned for repair.
E349	**OP**	**Output Option Comms Error** The Output Option Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option Card may require to be returned for repair.

Calculation Errors

E400 **E411**	**C1** **C2**	**Calculation Over Range** The Calculation reading is greater than the specified upper limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E401 **E411**	**C1** **C2**	**Calculation Under Range** The Calculation reading is less than the specified lower limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E402 **E412**	**C1** **C2**	**Calculation Setup Checksum** The Setup for this Calculation has become corrupted. Check and correct the calculation settings and turn the unit off and on again. If the message persists please consult with your supplier.
E403 **E413**	**C1** **C2**	**Calculation Store A Checksum** The Store A Save for the channel associated with this calculation has become corrupted. Check the calculation’s settings in the calculation menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E404 **E414**	**C1** **C2**	**Calculation Store B Checksum** The Store B Save for the channel associated with this calculation has become corrupted. Check the calculation’s settings in the calculation menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E405 **E415**	**C1** **C2**	**Calculation SD Card Checksum** The SD Card store from which this Calculation was restored from has become corrupted. Check the Calculation's settings in the Calculation menu and then save the settings again to the SD card store.

Modbus Errors

E420	**UNIT**	**Modbus Setup Checksum** The Modbus setup has become corrupted. Check and correct the Modbus settings and turn the unit off and on again. If the message persists please consult with your supplier.
E421	**UNIT**	**Modbus Store A Checksum** The Store A Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store A in the Save/Restore menu.
E422	**UNIT**	**Modbus Store B Checksum** The Store B Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store B in the Save/Restore menu.
E423	**UNIT**	**Modbus SD Card Checksum** The SD Card store from which the Modbus configuration was restored from has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again to the SD card store.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MXD70 Series 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 previously in this section gives a list that the MXD70 series 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 instrument, input and output cards.
- 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.
- Relay connection configuration.

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

The Instrument Appears Dead

Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the MXD70 Series allows the unit to accept from 85 to 250V AC or DC, an alternative option allows operation from 18 to 32V AC or DC, check the connection label for voltage specification. 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 inputs are correctly connected (see Installation and Choice of Electrodeless Conductivity Sensors, page 7) and that the sensor is not faulty or damaged.
- Check that the correct range, sensor type or cell constant has been entered within the Channel Setup menu if in doubt set to Auto Range (see page 16).
- Check the temperature compensation state (see Channel Setup page 18) 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 on the main display is correct.
- Check that the sensor is “seeing” a representative sample, trapped air will give a low reading.
- Ensure the input is correctly connected and the sensor is not faulty or damaged.
- Check the sensor and its cable for possible short circuits. Consider the fact that the conductivity may be higher than the range of the instrument.
- Check the Pt1000 RTD temperature sensor connections.
- Check that any in-line junction boxes and extension cables have been fitted and wired up correctly.

The display reads zero

- Check for open circuit sensor (conductivity or TDS modes)
- Check for damage to the connecting cable.
- Check that all input connections are secure.
- Check the sensor is wired up correctly.
- Check the sensor is immersed in the correct solution.

Instrument display appears to malfunction

- Switch the instrument power off and on again.
- Check that the display back-light is on, indicating power is reaching the unit.
- See that it displays meaningful text (Issue number etc.) in its start-up sequence, indicating processing activity.

The Sensor Reading Is Incorrect

- Low reading due to incomplete immersion.
- There may be some trapped matter within the sensor bore.
- High conductivity readings caused by a short circuit or leakage of liquid contamination into the sensor moulding.
- Low conductivity can be caused by accumulation of trapped air or gas coming out of solution. Check that no "air traps" exist in the sensor installation.
- High conductivity readings caused by leakage of solution into the sensor. This usually indicates that the sensor material has been fractured and the sensor must be replaced.
- First check that the temperature resistance is correct, otherwise the temperature compensation circuit will cause false or erratic readings. Temporarily switching out the temperature compensation can help to show if this is the cause of the problem.
- If another electrodeless sensor is available, this can be used to determine whether the fault lies with the instrument or the sensor.
- Check that the sensor cable is not damaged or broken and that the outer screen does not make contact with any other terminals or metal work.
- Check that the sensor cable is sufficiently distant from power cables or electrical noise sources.
- Check that the correct sensor type has been installed.
- Check that the correct range has been selected.
- Check that the correct sensor loop resistor calibration values have been used.
- Check that the calibration procedure has been followed precisely.
- Check that the temperature compensation has been set up as required.
- Check that the sensor cable does not exceed the maximum specified length (sensor 5m + extension 95m).

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached. (See Temperature Sensor Connections, page 12)
- Check that the temperature sensor type is correctly selected in the Channel Setup menu (See Page 17)
- Where practical check the temperature sensor resistance against the table in Temperature Data, page 31.

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 he current output has been configured properly.

Relays Appear to Malfunction

- Check that the unit is "On-Line" (Page 14)
- Check that the set point configuration is correct (see Setpoints, Current Outputs and Digital Input configuration guide)
- If the relays are vibrating or "chattering" as they pass the set point, check the hysteresis setting and increase if necessary.
- Ensure that the relays are connected properly (see MXD73 Installation guide or MXD75 Installation guide) and that the voltage/current levels are not exceeding 5A @ 30V DC or 5A @ 250V AC.
- Check that the instrument input cables are not picking up excessive noise.

Guarantee and Service

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

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

Goods for attention under guarantee (unless otherwise agreed) must be returned to the factory carriage paid and, if accepted for free repair, will be returned to the customer's address free of charge. Arrangements can also be made for repair on site, in which case a charge may be made for the engineer's time and expenses.
If any services other than those covered by the guarantee are required, please contact LTH direct.

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

Index

Main Display ↔ Current Output Bargraphs ↔ Live Trends 1, 2 & 3* ↔ Channels Setup ↔ Setpoint / Relays Setup ↔ 4-20mA Outputs Setup ↔ Digital Inputs Setup ↔ Error Messages

*Optional Extra

Electrodeless Conductivity Channel Setup - Electrodeless Conductivity Calibration

Menu

Main Menu
- **Channels**
- Calibration
- Setpoint / Relays
- 4-20mA Outputs
- Digital Inputs
- **Configuration**
- Access Code Managment
- Save / Restore
- Errors

Channels Setup
- Channel 1
- Channel 2
- Channel 3
- Simulate Channels

Channel Setup (Conductivity)
- Mode
- Units
- Sensor
- Cell Constant
- Range
- Temp Input Sensor
- Temperature Units
- Temp Compensation
- Temp Comp Base
- Temp Comp Slope
- Temp Comp Mode
- Manual Temp Input
- Simulated Input
- Input Filter

Channel Setup (TDS)
- Mode
- Units
- Sensor
- Cell Constant
- Range
- TDS Factor
- Temp Input Sensor
- Temperature Units
- Temp Compensation
- Temp Comp Base
- Temp Comp Slope
- Temp Comp Mode
- Manual Temp Input
- Simulated Input
- Input Filter

Channel Setup (Solution)
- Mode
- Units
- Sensor
- Cell Constant
- Range
- Setup Custom Range 1
- Setup Custom Range 2
- Temp Input Sensor
- Temperature Units
- Temp Compensation
- Temp Comp Base
- Temp Comp Slope
- Temp Comp Mode
- Manual Temp Input
- Simulated Input
- Input Filter

Menu

Main Menu
- Channels
- **Calibration**
- Setpoint / Relays
- 4-20mA Outputs
- Digital Inputs
- **Configuration**
- Access Code Managment
- Save / Restore
- Errors

Calibration
- Channel 1
- Channel 2
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- 4-20mA Outputs
- Reset User Calibration

Calibrate Channel (Conductivity or Solution or TDS)
- Mode
- Cal Manual Temp Input
- Calibrate Sensor
- Sensor Solution Cal
- Slope Value
- **Temperature Offset Cal**
- **Temp Offset Value**
- Calibration History
- Front Cal Access
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Calibrate 4-20mA Outputs
- 4-20mA Output A
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Reset User Calibration
- Reset Channel 1
- Reset Channel 2
- Reset Channel 3
- Reset 4-20mA Outputs
- Reset Entire Unit

Reset Channel
- Reset Sensor Cal
- Reset Temp Cal
- Reset Entire Channel

4-20mA Outputs Reset
- 4-20mA Output A
- 4-20mA Output B
- 4-20mA Output C
- 4-20mA Output D
- 4-20mA Output E
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- All 4-20mA Outputs

MXD70 SERIES

Multi-parameter Monitor

Dissolved Oxygen
Setup and Operating
Guide

Preface

Product warranty

The MXD70 Dissolved Oxygen Input Card has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

Copyright and trademarks

MXD70 is a trademark of LTH Electronics Ltd

Fourth edition: March 2019

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2015. Certificate No: FM 13843

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

Contents

Dissolved Oxygen Input Card Specification

Measurement Input	Polargraphic (Clark) – 0 to 500.0nA
Sensor Bias Voltage	User defined -1.000V to +1.000V, ±1mV Resolution, ±3mV Output Accuracy.
Membrane Correction Factor	User defined 0 to 9999
Sensor Connection Cable	Up to 100 meters
Ranges of Measurement	0 – 199.9 % Saturation 0 – 30.00 ppm Concentration 0 – 9999 mBar pO^2 (Partial Pressure of Oxygen)(Calibration specific) 0 – 999.9 mmHg (Millimetres of Mercury)(Calibration specific) 0 - 30.00 mg/l Milligrams per Litre Sensor Current (nA)
Accuracy	±1.0nA (Polargraphic Mode)
Linearity	±0.1% of Range
Repeatability	±0.1% of Range
Calibration	Automatic Zero (offset) and Span (slope) calibration with user entered span calibration point and post-calibration sensor condition indication.
Calibration Timer	Inbuilt calibration count down timer which will trigger an alarm when calibration interval has expired.
Sensor Input Filter	Adjustable filter that averages the sensor input over a user selectable time (10sec – 5mins).
Temperature Sensor	Pt100, Pt1000, LTH 1k and BJ 22k input. Up to 100 meters of 4 wire cable. Temperature sensor can be mounted in the sensor or separately.
Range of Temperature Measurement	-50 °C to +160 °C (-58 °F to +320 °F) for full specification.
Temperature accuracy	± 0.2 °C (When using a 4 wire PT1000).
Operator Temperature Adjustment	± 50 °C or ± 122 °F.
Temperature Compensation	Automatic or manual -20°C to +160°C.
Pressure Compensation	Automatically from external 4-20mA pressure transducer input (Direct or 24V loop powered from the instrument) with user scaling and selectable pressure damping, or manually via user entered value.
Salinity Compensation	User Programmable from 0 – 40.0 ppt.

Blank

Installation and Choice of Dissolved Oxygen Sensors

The Dissolved Oxygen input of the MXD70 Series has been designed to accept a wide variety of Polarographic Dissolved Oxygen sensors. Parameters such as membrane correction, bias voltage and temperature sensor type can be easily programmed into the instrument.

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

The following criteria are of great importance during selection:

- The trade-off between a thin membrane giving quick response times and depending on the sample the reduced life time of the membrane.
- The use of the correct materials for corrosion resistance.
- The chemical make up, temperature of the sample.
- Position of the sensor for robustness and service access.
- Ensuring a representative, uncontaminated solution sample.

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

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

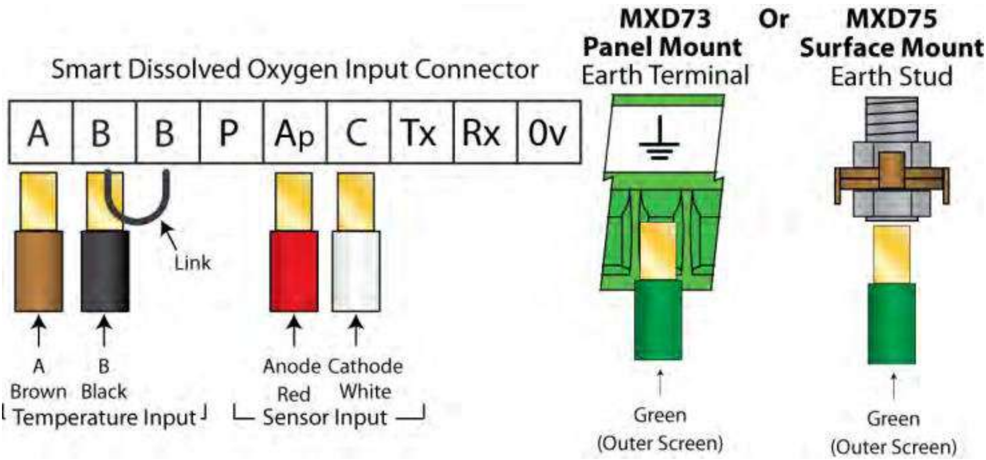
When a new dissolved oxygen sensor is first fitted or changed it must be calibrated (see page 27). Due to the nature of polarographic dissolved oxygen sensors it will also need periodic re-calibration, the MXD70 series provides an inbuilt count down timer which will trigger an alarm when the calibration interval has expired (see page 37).

SensorTalk Interface

The smart capable version of the MXD70 Dissolved Oxygen card is capable of interfacing with the full range of Broadley James All-Digital Smart and Hybrid Dissolved Oxygen sensors. The Plug-and-Play functionality of the of the SensorTalk sensors enables “calibrate here use there”. Sensors can be accurately pre-calibrated away from the operation area with the calibration data stored in the sensor, ready for later use. When the sensor is connected to the MXD70 series the instrument auto-loads and applies the sensor’s calibration values.

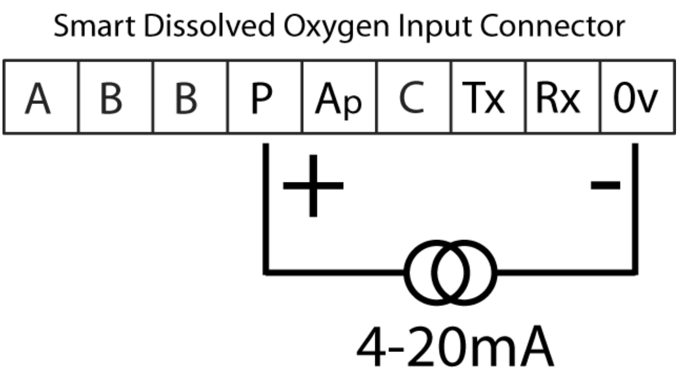
The SensorTalk interface also allows for the connection of OptaProbe Dissolved Oxygen sensors which use optical (fluorescence) technology to provide long term stability and accuracy without the usual maintenance regime associated with traditional polarographic sensors.

Smart Capable Input Card Termination Information



Broadley James ProcessProbe™ Polarographic Dissolved Oxygen Sensor Cable Connection Details

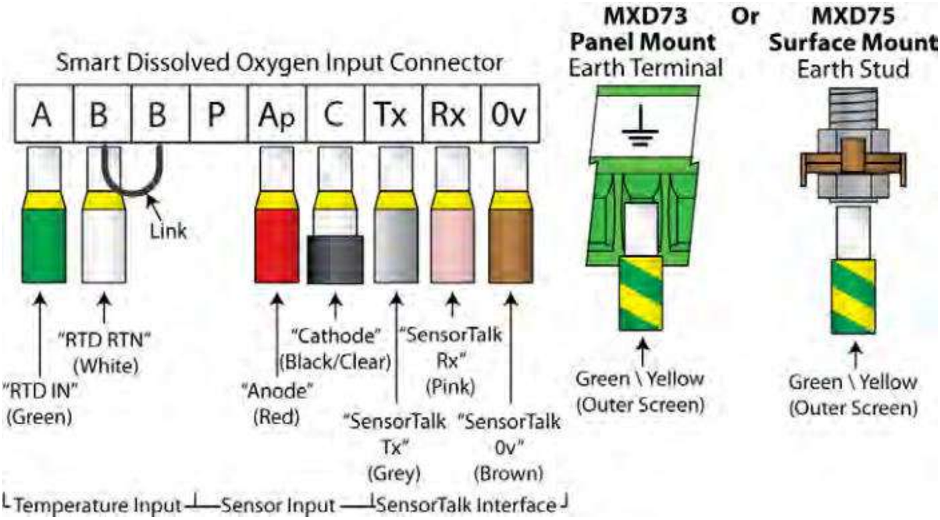
The Dissolved Oxygen input card of the MXD70 Series can also accept a 4-20mA input signal from a pressure transmitter. This can be scaled using the instrument's user menu and permits active pressure compensation of the dissolved oxygen measurement. The signal can either be 24V loop powered, from the MXD70 instrument or externally powered from the transmitter. The mode of operation is selected in the software setup.



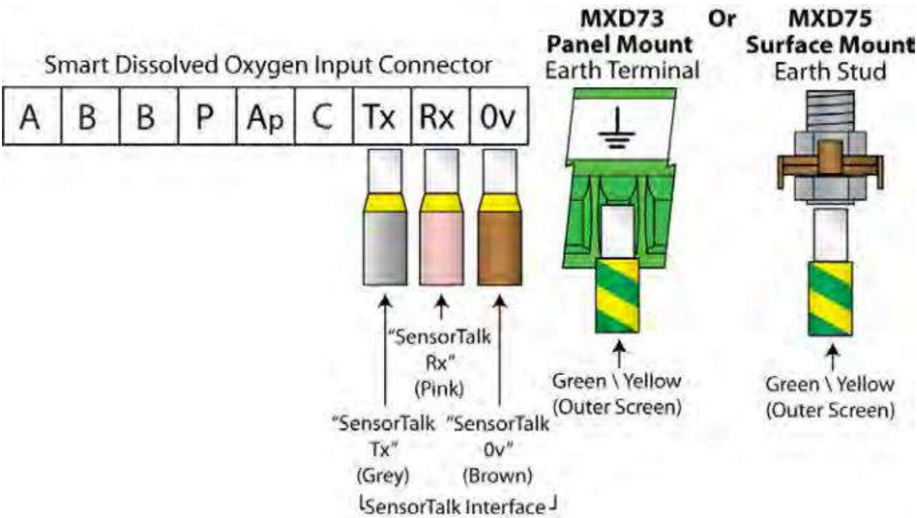
Pressure Transmitter Connections

SensorTalk Sensors Termination Information

The Smart Dissolved Oxygen input card of the MXD70 Series is capable of interfacing with the range of SensorTalk Dissolved Oxygen sensors from Broadley James Corporation. This allows the user to take advantage of the unique calibration functionality these sensors provide. **Please note,** when unplugging an existing SensorTalk sensor from the instrument please wait for the probe is removed message to appear before attaching a different sensor.

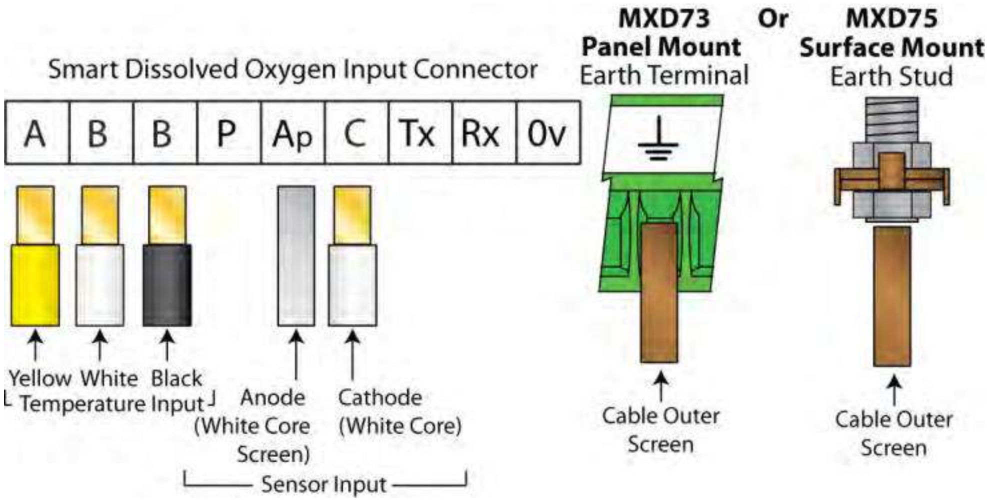


Hybrid™ SensorTalk™ Probe Cable Connection Details

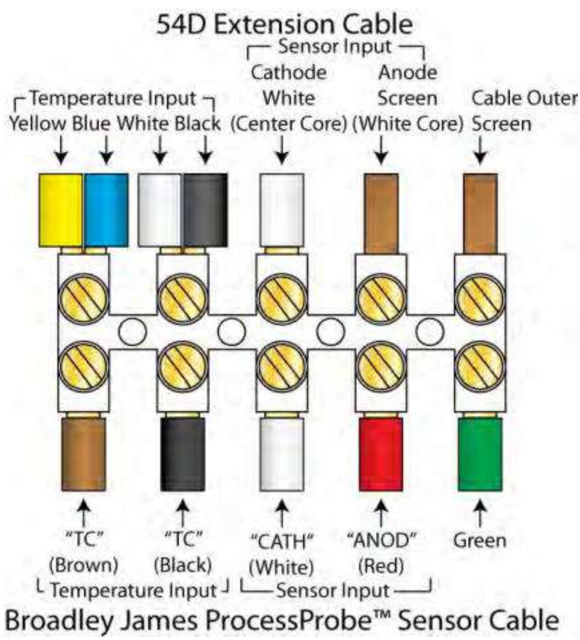


OptaProbe™ or Digital SensorTalk™ Probe Cable Connection Details

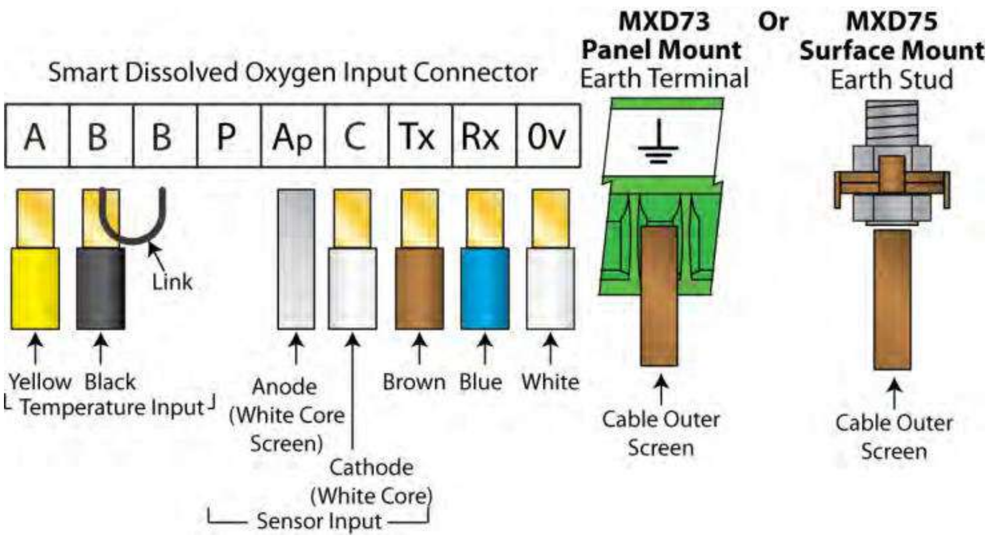
Smart Capable Input Card LTH 54D Extension Cable Connection Information



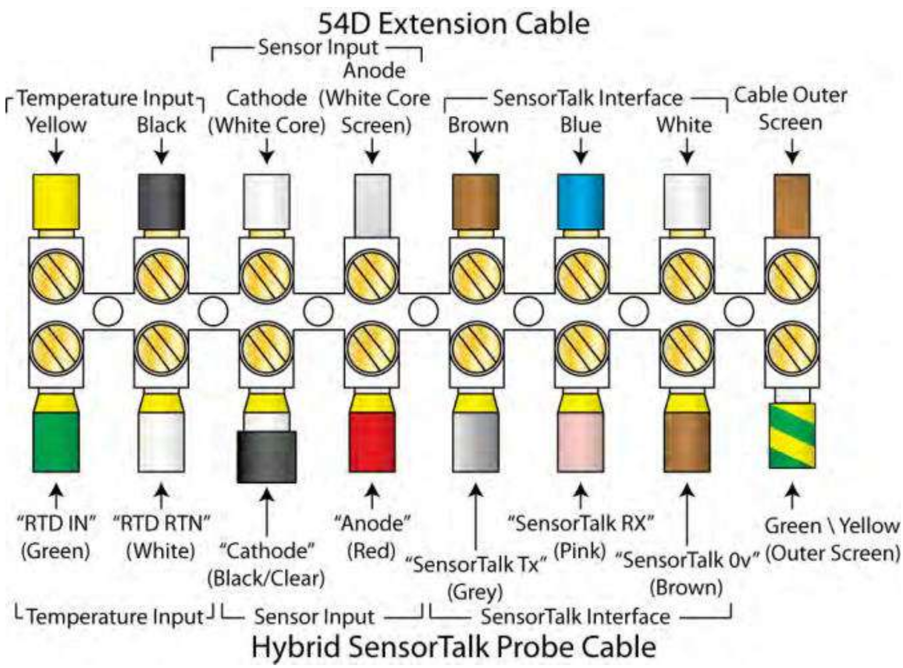
Broadley James ProcessProbe™ 54D Extension Cable Connection Details



Broadley James ProcessProbe™ Cable To 54D Extension Cable Connection Details

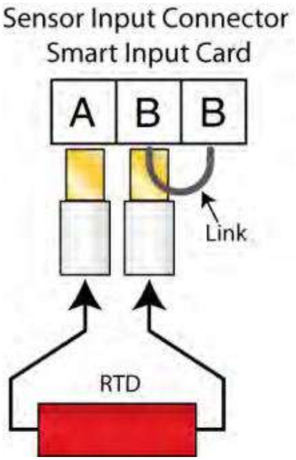


Hybrid™ SensorTalk™ 54D Extension Cable Connection Details

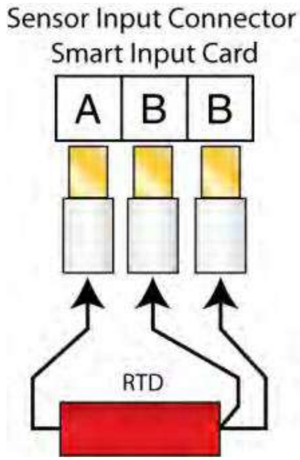


Hybrid™ SensorTalk™ Probe Cable To 54D Extension Cable Connection Details

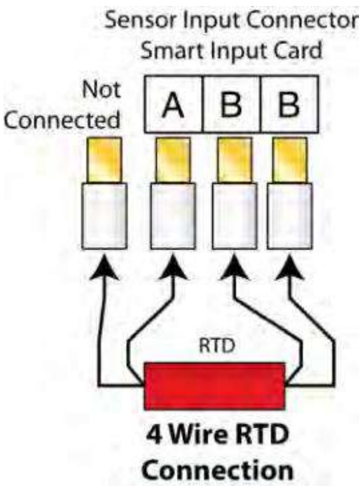
Smart Capable Input Card Temperature Sensor Connections



2 Wire RTD Temperature Connection

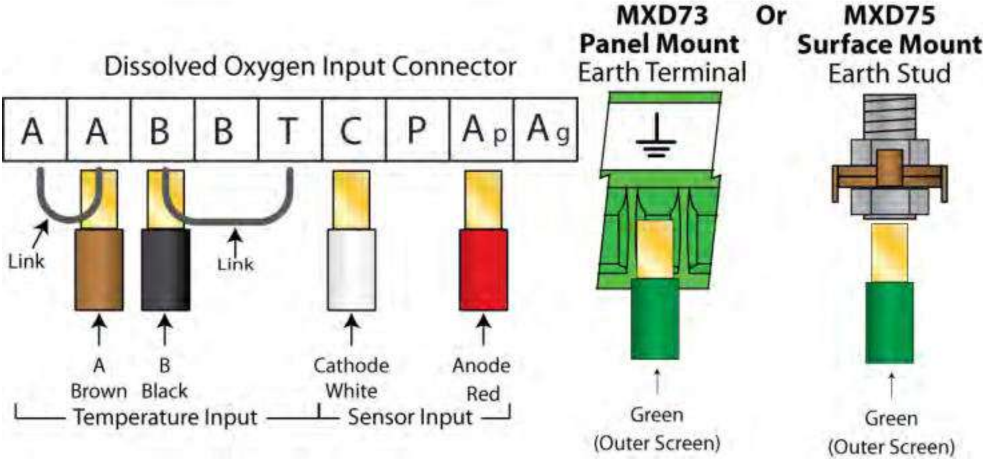


3 Wire RTD Temperature Connection



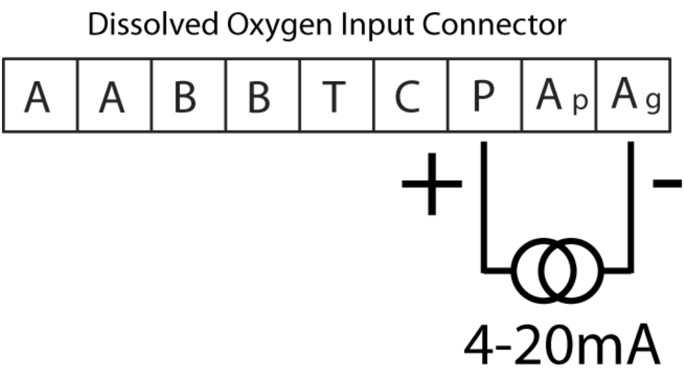
4 Wire RTD Temperature Connection

Previous Generation Input Card Termination Information

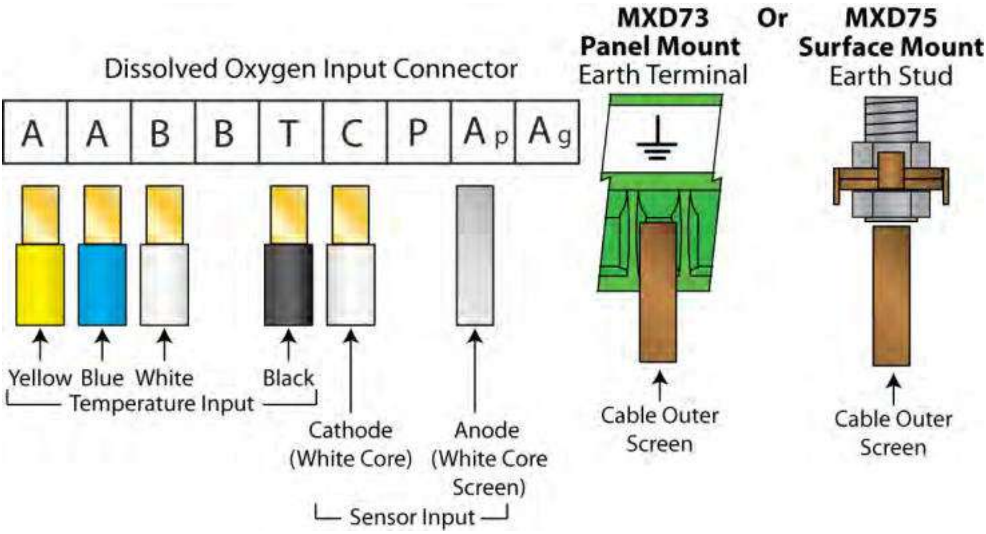


Broadley James ProcessProbe™ Polarographic Dissolved Oxygen Sensor Cable Connection Details

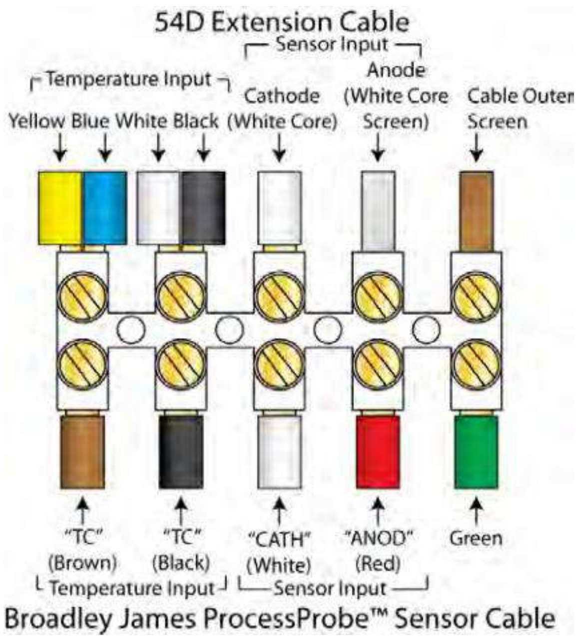
The Dissolved Oxygen input card of the MXD70 Series can also accept a 4-20mA input signal from a pressure transmitter. This can be scaled using the instrument's user menu and permits active pressure compensation of the dissolved oxygen measurement. The signal can either be 24V loop powered, from the MXD70 instrument or externally powered from the transmitter. The mode of operation is selected in the software setup.



Pressure Transmitter Connection Details

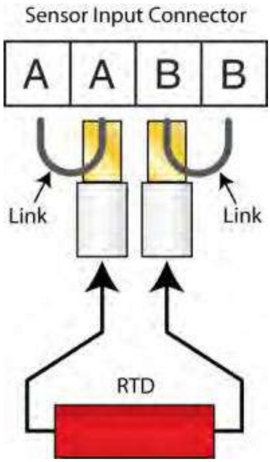


54D Extension Cable Connection Details

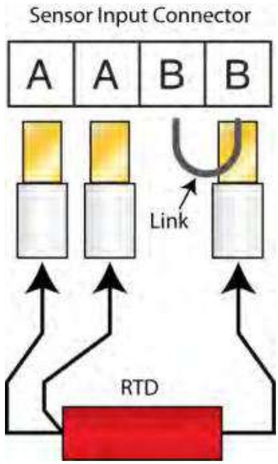


Broadley James ProcessProbe™ Cable To 54D Extension Cable Connection Details

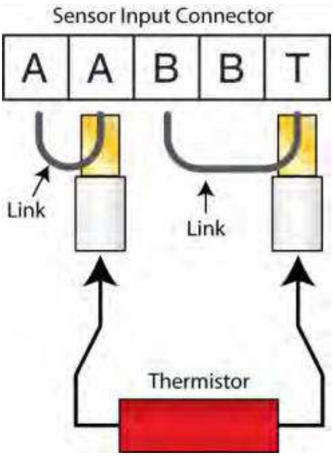
Previous Gen. Input Card Temperature Sensor Connections



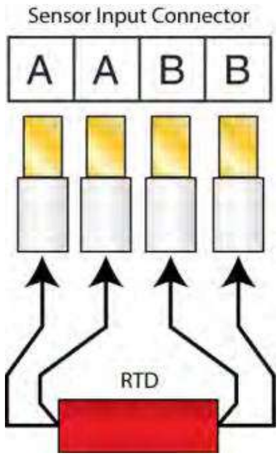
2 Wire RTD Temperature Connection



3 Wire RTD Temperature Connection



ProcessProbe 22K Thermistor Connection

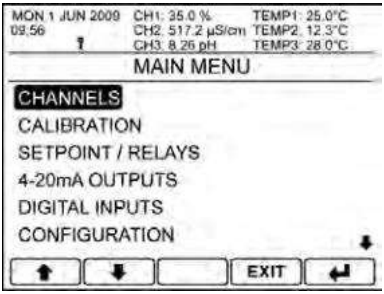


4 Wire RTD Temperature Connection

Dissolved Oxygen Input Channel Setup

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

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



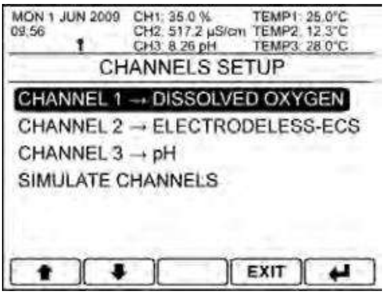
Main Menu

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

🡅/🡇 – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



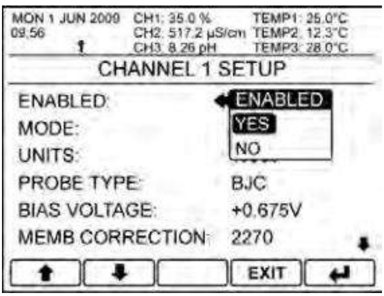
Select Channel

Select the Dissolved Oxygen input channel you wish to edit.

🡅/🡇 – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



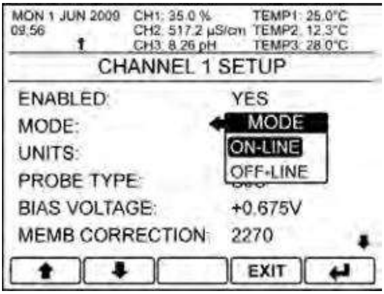
Enabled

Selecting no disables the channel and prevents it from appearing as an option in output and configuration menus, also disables any error messages associated with the channel.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

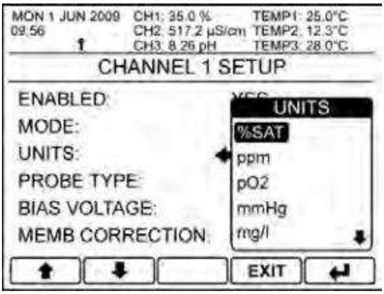
When the unit is placed in an off-line state "off-line" will appear in the channel messages section on the front screen.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Units

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

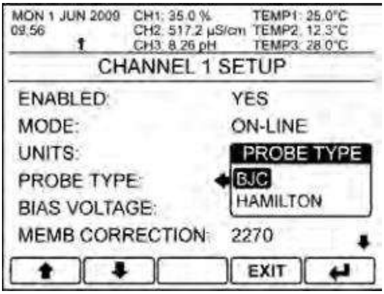
- % (saturation)
- ppm (concentration)
- pO2 (partial pressure of Oxygen)
- mmHg (millimetres of Mercury)
- mg/l (milligrams per litre)
- sensor's output current.

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

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection

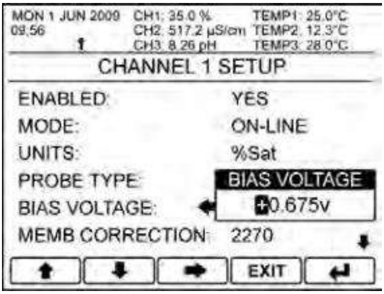


Probe Type

By selecting the sensor type from the available options: BJC (Broadley James ProcessProbe™) or Hamilton, the instrument will configure itself with the appropriate sensor type, membrane correction factor and bias voltage.

! A sensor calibration must be performed when a new sensor is attached to the instrument, see page 27 for details.

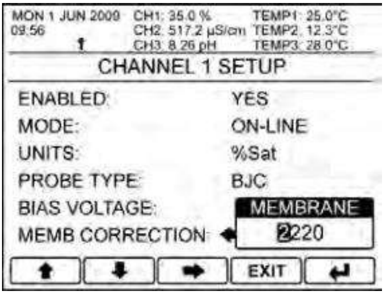
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Bias Voltage

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

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

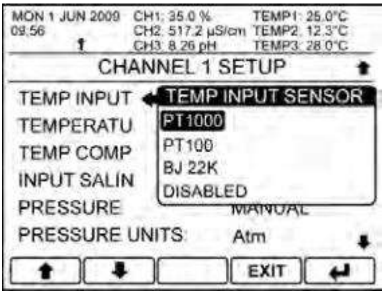


Membrane Correction Factor

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

The Correction Factor can be set at using this menu.

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



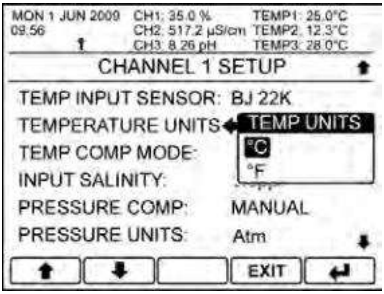
Temperature Input Sensor

Select the input channel's temperature sensor type for use with the sensor measurement's automatic temperature compensation.

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

Note. Even when disabled a manual temperature compensation can be used.

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



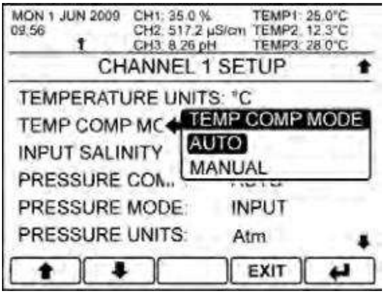
Temperature Units

Sets the temperature units used.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



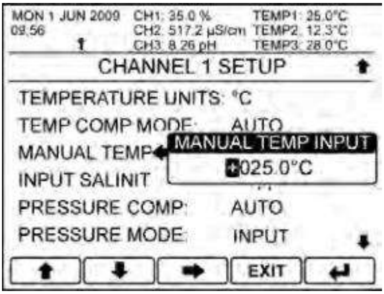
Temperature Compensation Mode

To use temperature compensation from a measured input select “Auto”, else select “Manual” to enable a fixed value entry.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Manual Temperature Input

The fixed temperature value used for manual temperature compensation.

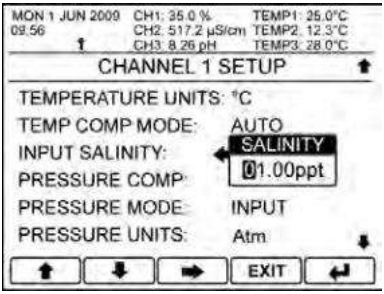
Only available when temperature compensation mode is set to “manual”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Input Salinity

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

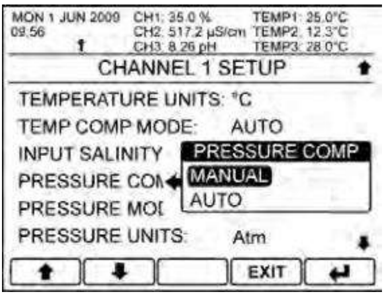
Using this menu the user can compensate for this by setting the input salinity parameter to the correct level. (Entered in ppt, parts per thousand).

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Pressure Compensation

To compensate for the effect pressure has on the solubility oxygen has in water the user can enter in a manual pressure value, or if available connect a pressure transmitter to the dissolved oxygen input channel (see page 7).

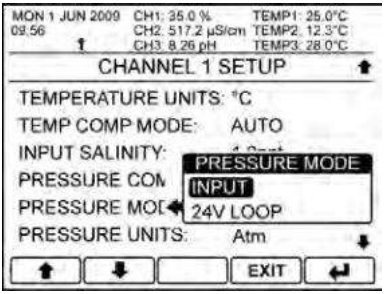
Auto - external pressure input used.

Manual - fixed pressure value used.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Pressure Mode

The input channel has the ability to support both direct 4-20mA and 24V looped powered systems by setting this parameter.

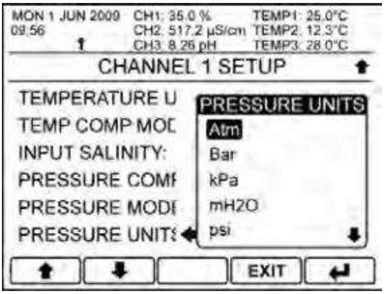
NB. When using 24V loop mode a user calibration is recommended (see page 27). Also for direct input configuration the input resistance is 100Ω.

Menu only available when Pressure Compensation is set to “Auto”.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Pressure Units

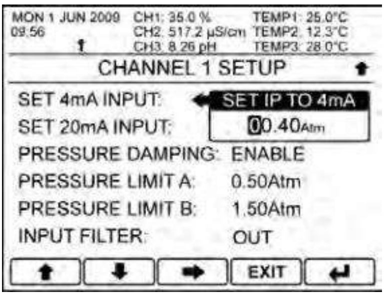
The pressure can be displayed in one of the following units:

- Atm
- Bar
- kPa
- mH_2o
- psi
- mmHg

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Set 4mA Input

Set the pressure level at 4mA input

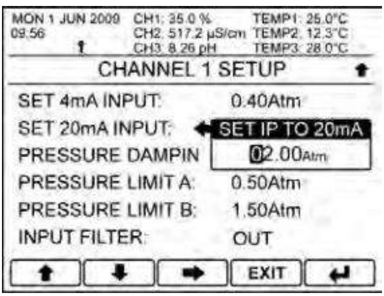
Menu only available when Pressure Compensation is set to “Auto”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Set 20mA Input

Set the pressure level at 20mA input

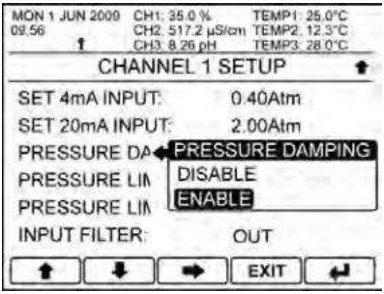
Menu only available when Pressure Compensation is set to “Auto”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Pressure Damping

The facility has been provided to allow the user to dampen the effect of rapid changes in pressure, which might lead to the setpoint relays activating before the sensor has had a chance to react to the change in pressure (which would give a false reading). When activated the unit will hold the sensor readings and flash a “pressure damping” message on the front display for 20 seconds.

After the 20 seconds have expired the unit will update the sensor readings, compensated to what ever level the pressure has settled to having allowed the sensor to “catch up”.

If the pressure returns to the level it was at prior to damping being applied then the damping will be cancelled, whether the twenty seconds has expired or not.

The user may also cancel the pressure damping by pressing the “ACK” button whilst on the front screen.

To use this facility set this menu item to “Enable”. This then enables two limit items. Limit A “From” and Limit B “To”. These operate as shown in the following examples:

If Limit A “From” is set to 1.00Atm and Limit B “To” is set to 2.5Atm, then when the input pressure rises from an input below 1.00Atm to one greater than 2.5Atm, them pressure damping will be applied.

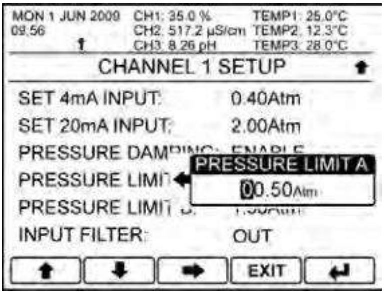
Alternatively if Limit A “From” is set to 2.3Atm and Limit B “To” is set to 1.2Atm, then when the input pressure falls from an input above 2.3Atm to one less than 1.2Atm, pressure damping will be applied.

Menu only available when Pressure Compensation is set to “Auto”.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Pressure Limit A

Defines the Pressure Damping Limit A “From” value.

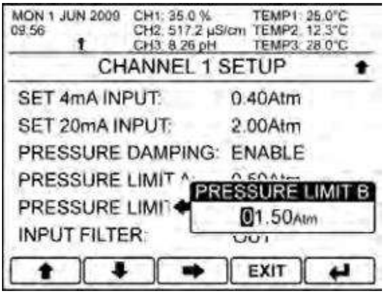
Menu only available when Pressure Damping is set to “Enable”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Pressure Limit B

Defines the Pressure Damping Limit B “To” value.

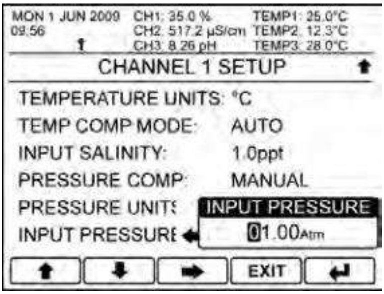
Menu only available when Pressure Damping is set to “Enable”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Input Pressure

The fixed pressure used for manual pressure compensation.

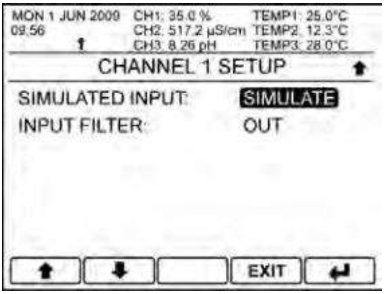
Only available when pressure compensation mode is set to “manual”.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

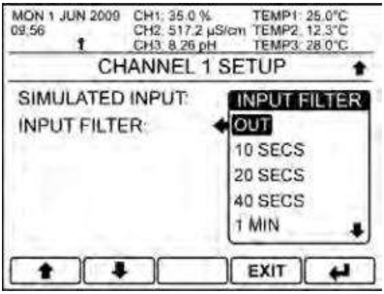
↵ – Save Value



Simulated Input

See Simulated Channels section of the Setpoints, Current Outputs, Digital Inputs Configuration Guide for more information.

🡅/🡇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Input Filtering (Averaging)

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

🡅/🡇	– Select Option
EXIT	– Cancel
↵	– Save Selection

Blank

Calibration

Calibration Procedures

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

Notes.

- As an aid to stable air calibration, a partially covered bucket can be used to shield the sensor from the temperature variations which arise from exposure to the wind and sunlight.
- It is recommended that because the OE15 oxygen cartridge has a finite life, a spare cartridge should be stocked where a significant down time is not acceptable to the application.
- The OE15 sensor requires a minimum fluid flow of $0.5ms^{-1}$ to refresh the depletion layer which forms around the sensor membrane. This applies to both air and solution readings.
- Approximate sensor current is 60nA = 100% Sat with Polargraphic sensor.
- If using a manually compensated sensor an accurate calibration solution temperature is required to compensate for the effect of temperature on the sensor's membrane. The manual calibration temperature can be entered in to the "Calibration Manual Temperature Input" menu item in the input channel's Calibration menu.
- In addition if manual pressure compensation is also being used it is important to have the sensor pressure level correctly entered in the "Calibration Manual Pressure Input" menu item, especially when the sensor is measuring in a system where pressure can vary over a wide range.
- When a Polargraphic is connected to the instrument and the system is first turned on, a polarization voltage is applied across the sensor. Initially the sensor current will be very high as oxygen is depleted from the internal electrolyte. After a few hours it should have fallen off to a steady state. So it is recommended a Polargraphic sensor is allowed to fully stabilize before calibration is started. Alternatively when not in use the sensor is connected either to a polarizing unit or a powered instrument when not in use.

Zero Check in a de-oxygenated solution

- Prepare a fresh solution of approximately 2% wt/vol. of sodium sulphite in de-mineralised water.
- Wash off any process chemicals or water from the sensor, which may contaminate the solution. Use de-mineralised water or follow the manufacturers cleaning instruction as necessary.
- It is recommended that % saturation is used as the calibration units.
- Allow the output to settle in air at (or close to) 100% saturation.
- Select the" Sensor Zero Calibration" item in the input channel's calibration menu and place the sensor in the sodium sulphite solution and observe the current reading. The reading should drop below 10% of the air saturated reading within 35 seconds.
- If this time is exceeded, cycle the sensor between the free air and the solution to improve the speed of the response. If cycling it 3 or 4 times does not improve the response significantly, store the sensor overnight in the solution and then re-test it with a fresh solution the following day. If it still does not respond within the specified time the cartridge's membrane should be checked and replaced if necessary, otherwise the electrolyte will have to be replaced (this must be done at the factory for OE15 sensors).

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

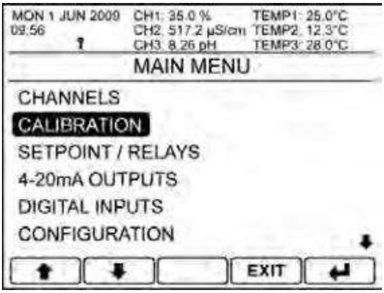
Span Calibration in Free Air

- The frequency of this check depends upon the application, but should be made generally once a month.
- Wash off any process chemicals or water from the sensor. Use de-mineralised water or follow the manufacturers cleaning instructions as necessary.
- It is recommended that % saturation is used as the calibration unit.
- Stabilise the sensor by leaving it in the process solution for up to 10 minutes. This will allow the temperature compensator networks to reach equilibrium.
- Lift the sensor so that it is just above the process solution, and therefore as close to the temperature of that solution as possible.
- Select Sensor Span Calibration item in the input channel's calibration menu and observe the instrument readings and wait until the output stabilises. If necessary enable the sensor filter to obtain a stable reading.
- Once stable press the "ENTER" key and the unit will correct the span calibration to the user selected span calibration point.

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 <u>1000</u>



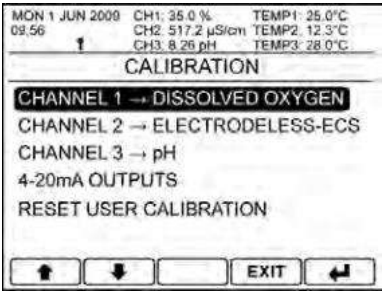
Main Menu

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

🡅/🡇 – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



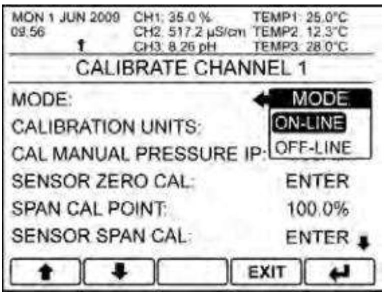
Select Channel

Select the Dissolved Oxygen input channel you wish to edit.

🡅/🡇 – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

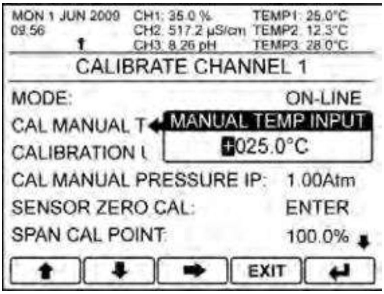
When the unit is placed in an off-line state “off-line” will appear in the channel messages section on the front screen.

If a “Cannot Edit Digital Input Has Control” message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Manual Temperature Input

This setting allows a different fixed temperature value to be used when calibrating. Makes it easier to calibrate a sensor outside of the process environment.

NB. If the manual temperature input is changed in the channel setup menu then the calibration manual temperature is changed to the same value.

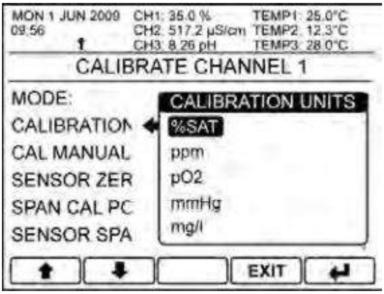
Only available when the temperature compensation mode has been set to manual in the channel setup menu.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Calibration Units

The instrument can be calibrated in any of the following units:

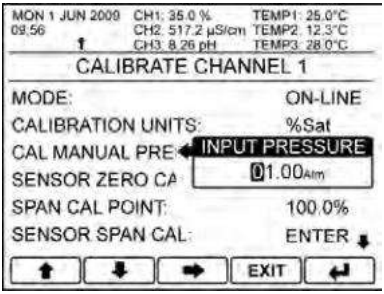
- % (saturation)
- ppm (concentration)
- pO2 (partial pressure of Oxygen)
- mmHg (millimetres of Mercury)
- mg/l (milligrams per litre)

NB. If the operating units are changed in the channel setup menu then the calibration units are automatically changed to the same.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



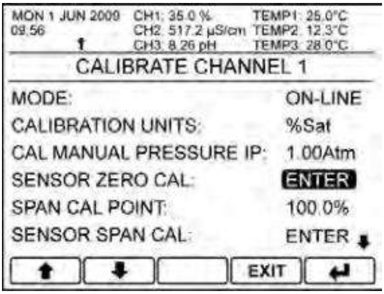
Calibration Manual Pressure Input

This setting allows a different fixed pressure value to be used when calibrating. Makes it easier to calibrate a sensor outside of the process environment.

NB. If the manual pressure input is changed in the channel setup menu then the calibration manual pressure is changed to the same value.

Only available when the pressure compensation mode is set to manual in the channel setup menu.

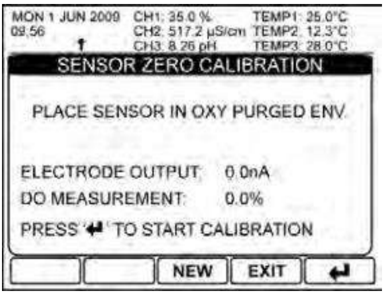
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Sensor Zero Calibration

To start the dissolved oxygen sensor's zero calibration select the "Sensor Zero Cal" item from the desired channel's calibration menu and press enter.

⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter Sensor Zero Calibration



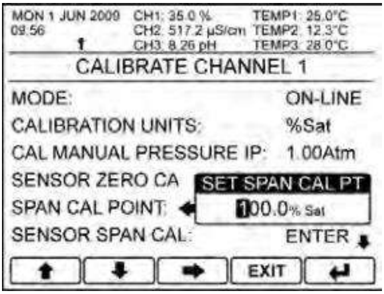
Place Sensor In Oxygen Purged Environment

Place the sensor in a 0 % saturated solution and press enter to begin sampling.

If the sensor is new, pressing the "new" button will reset the existing calibration and add a "new sensor" entry in the calibration history.

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

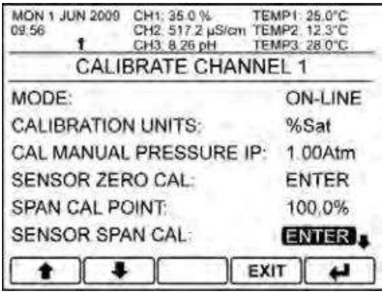
NEW	– Register New Sensor
EXIT	– Exit Calibration Without Saving
↵	– Initiate Zero Calibration



Span Calibration Point

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

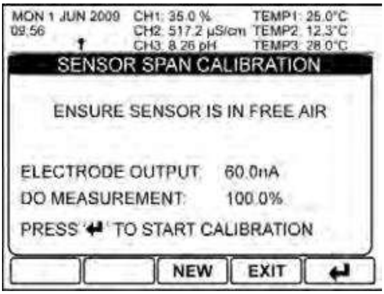
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Sensor Span Calibration

To start the dissolved oxygen sensor's span calibration select the "Sensor Span Cal" item from the desired channel's calibration menu and press enter.

⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter Sensor Span Calibration



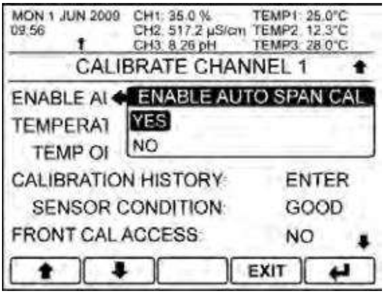
Place Sensor In Free Air

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

If the sensor is new, pressing the "new" button will reset the existing calibration and add a "new sensor" entry in the calibration history.

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

NEW	– Register New Sensor
EXIT	– Exit Calibration Without Saving
↵	– Initiate Span Calibration



Enable Auto Span Cal

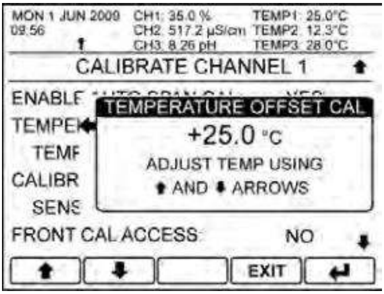
Span calibration can be initiated by an external digital input if Enable Auto Span Cal function is set to "Yes"

When the associated digital input (see Setpoints, Current Outputs and Digital Inputs Configuration Guide) is active the unit will calibrate the selected input channel to the entered span calibration point.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Temperature Offset Calibration

The temperature offset calibration enables the user to adjust the temperature reading to match a known input. Only available when the channel's temperature input is not set to disabled.

The current temperature reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

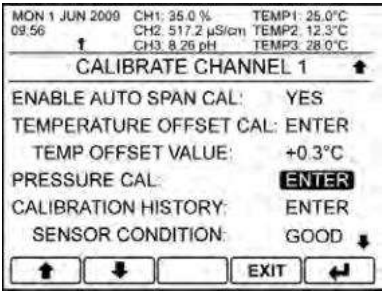
↵ – Save Calibration

Temperature 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

Channel Calibration

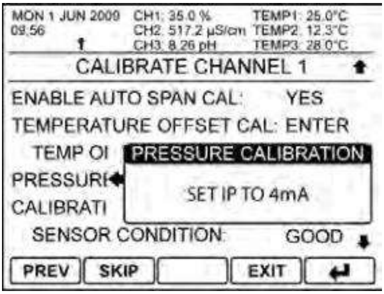


Pressure Calibration

To start the Pressure Sensor's calibration select the "Pressure Cal" item from the desired channel's calibration menu and press enter.

Menu only available when Pressure Compensation is set to "Auto" in the channel's setup menu.

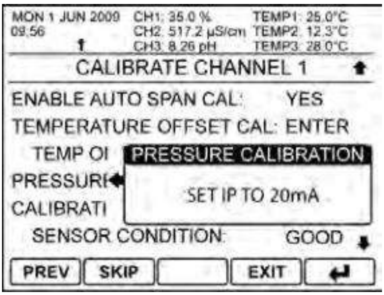
⬆/⬇	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter Pressure Calibration



Set Input to 4mA

Set the pressure transmitter's output to 4mA and then press enter to start the calibration. Once completed the display will move on to the 20mA calibration.

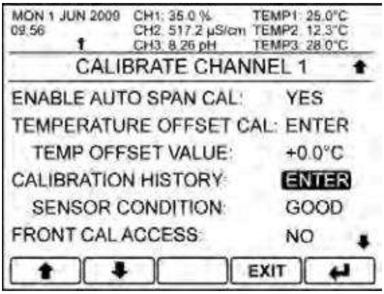
PREV	– Go to Previous Calibration Point
SKIP	– Skip to Next Calibration Point
EXIT	– Exit Calibration Without Saving
↵	– Initiate Calibration



Set Input to 20mA

Set the pressure transmitter's output to 20mA and then press enter to start the calibration. Once completed press enter when prompted to return to the main calibration menu.

PREV	– Go to Previous Calibration Point
SKIP	– Skip to Next Calibration Point
EXIT	– Exit Calibration Without Saving
↵	– Initiate Calibration

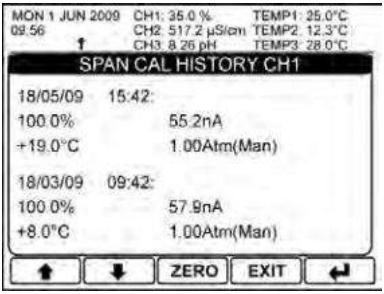


Enter Calibration History

The MXD70 series has a calibration history feature which allows the user to review the record of sensor solution calibrations.

To enter the calibration history menu press enter.

↵ – Enter Calibration History



Calibration History

The calibration history page provides a record of all Zero and Span calibrations carried out.

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

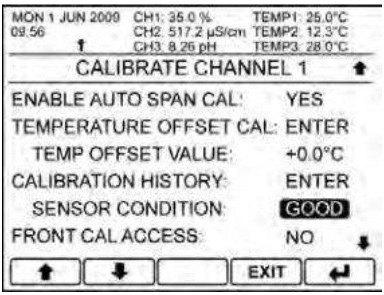
⬆/⬇ – Move To Next Page Up or Down

ZERO – Show the Zero Cal History

SPAN – Show the Span Cal History

EXIT – Return To Calibration Menu

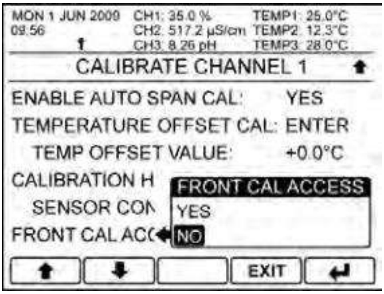
CLEAR – Clear All of the Calibration History



Sensor Condition

The MXD70 Series is capable of analysing the result of the dissolved oxygen sensor's zero and span calibration and indicates to the user the condition the sensor is in.

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



Front Screen Calibration Access Enable

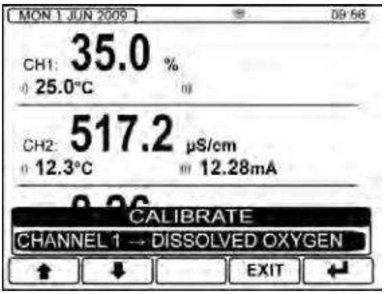
When enabled front calibration access allows direct entry into the calibration menu from the front screen. It also disables the security access system within the calibration menu enabling the calibration functions without having to enter the security access code.

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

Front Screen Calibration Access

When the calibration access is enabled press the “CAL” button to bring up pop-up to select which channel to calibrate.

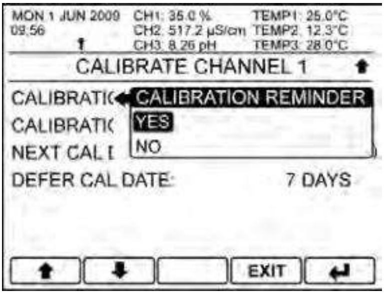
CAL	– Enter Calibrate Channel Select Menu
⬅/➡	– Scroll Around Menus
Menu	– Access Main Menu



Select Channel to Calibrate

From the pop-up select the channel the user wishes to calibrate. Only channels whose front calibration access has been enabled will appear.

⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Enter Menu



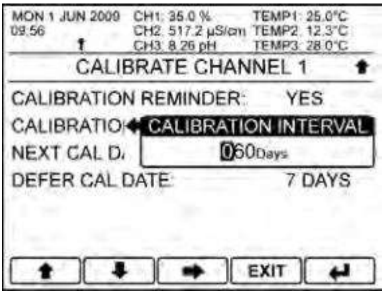
Calibration Reminder

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

If the interval has expired and the alarm has activated, then on the completion of a successful sensor calibration the next cal date will be automatically incremented by calibration interval.

If the user completes a successful sensor calibration before the calibration interval has expired, then the instrument will ask the user whether they wish to update the next cal due date by the calibration interval.

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

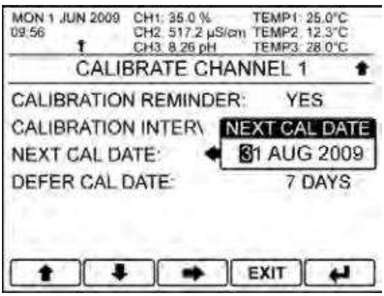


Calibration Interval

Sets the interval time for the calibration alarm.

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

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

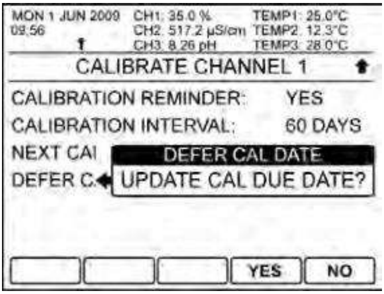


Next Calibration Date

Sets the exact date of the next calibration alarm.

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

⬆/⬇	– Increase / Decrease Digit or Text
➡	– Select Next Item
EXIT	– Cancel
↵	– Save Entry



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.

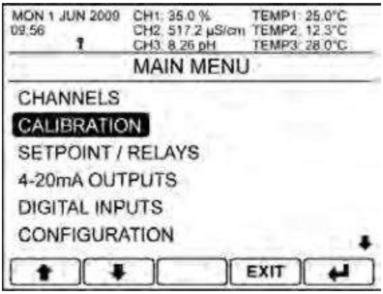
YES – Increase Interval

NO – Cancel

Resetting the User Calibration

If required the user can reset the user calibrations to their default states.

The default security access code is 1000



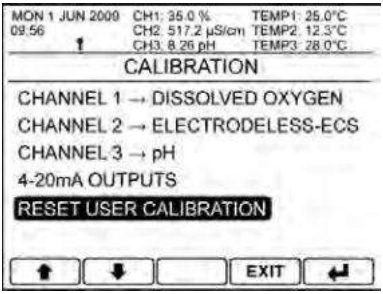
Main Menu

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

↑/↓ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



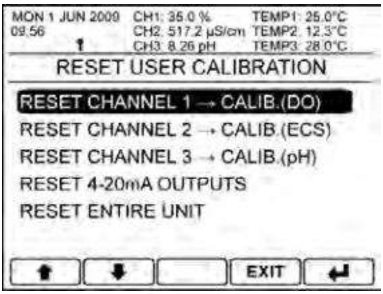
Calibration

Select Reset User Calibration.

↑/↓ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



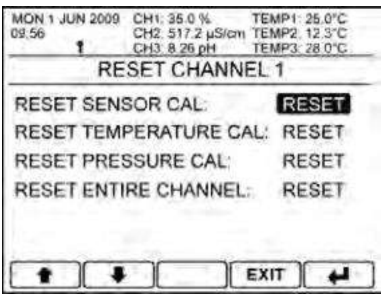
Reset User Calibration

Select the required Dissolved Oxygen input channel.

↑/↓ – Select Option

EXIT – Return to Calibration

↵ – Enter Option



Reset Channel User Calibration

Select whether to reset the sensor calibration, the temperature calibration, the pressure calibration or reset all of the channel's user calibrations.

↑/↓ – Select Option

EXIT – Return to Reset User Calibration

↵ – Enter Option

Appendix A - DO Measurement

Sensor Interface

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

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

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

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

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

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

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

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

Appendix

Membrane Correction

The membrane correction term is defined as follows:

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

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

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

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

Oxygen Solubility

The Oxygen solubility is easily defined as: % Saturation X Maximum Theoretical Solubility of Oxygen in water. The maximum theoretical solubility is heavily dependant on the temperature, pressure and salinity of the measured liquid. Tables of data for Oxygen solubility are readily available from a number of sources such as BS EN 25814, ISO5 814.

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

Solubility of Oxygen in Pure water										
Temp	ppm O_2		Temp	ppm O_2		Temp	ppm O_2		Temp	ppm O_2
0	14.59		10	11.27		20	9.07		30	7.54
1	14.19		11	11.01		21	8.90		31	7.41
2	13.81		12	10.75		22	8.73		32	7.28
3	13.44		13	10.52		23	8.55		33	7.15
4	13.08		14	10.28		24	8.40		34	7.04
5	12.75		15	10.07		25	8.24		35	6.93
6	12.42		16	9.85		26	8.08		36	6.82
7	12.12		17	9.64		27	7.94		37	6.71
8	11.82		18	9.44		28	7.80		38	6.61
9	11.54		19	9.25		29	7.66		39	6.51

Partial Pressure of Oxygen (pO2)

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

Sensor Parameters

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

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

Appendix B - Temperature Data

The table below lists approximate resistance values of temperature sensors that may be used with the MXD70 series. Not all options are available on all input types.

Temperature (°C)	PT1000 RTD	PT100 RTD	1K Thermistor	BJ 22K Thermistor
0	1000.0Ω	100.00Ω	2691Ω	64.88 kΩ
10	1039.0Ω	103.90Ω	1779Ω	41.34 kΩ
20	1077.9Ω	107.79Ω	1204Ω	26.97 kΩ
25	1097.3Ω	109.73Ω	1000Ω	22.00 kΩ
30	1116.7Ω	111.67Ω	833.7Ω	18.03 kΩ
40	1155.4Ω	115.54Ω	589.0Ω	12.30 kΩ
50	1194.0Ω	119.40Ω	423.9Ω	8.57 kΩ
60	1232.4Ω	123.24Ω	310.5Ω	6.07 kΩ
70	1270.7Ω	127.07Ω	231.0Ω	4.38 kΩ
80	1308.9Ω	130.89Ω	174.5Ω	3.21 kΩ
90	1347.0Ω	134.70Ω	133.6Ω	2.39 kΩ
100	1385.0Ω	138.50Ω	103.6Ω	1.80 kΩ

Appendix C - Pressure Conversions

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

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

Blank

Setup

Appendix D - Instrument Configuration

Instrument Configuration

Instrument Type		Serial Number		Software Version	
Power Supply Type					
Channel 1 Input Card Type		Serial Number			
Channel 2 Input Card Type		Serial Number			
Channel 3 Input Card Type		Serial Number			
Output Expansion Card Type		Serial Number			
Software Expansion		Unlock Code			
Software Expansion		Unlock Code			

Instrument Settings

Security Access Code					
Language					
Front Screen Ch1 Shown		Front Screen Ch1 Secondary Reading i)		Front Screen Ch1 Secondary Reading ii)	
Front Screen Ch2 Shown		Front Screen Ch2 Secondary Reading i)		Front Screen Ch2 Secondary Reading ii)	
Front Screen Ch3 Shown		Front Screen Ch3 Secondary Reading i)		Front Screen Ch3 Secondary Reading ii)	
Front Screen Ch1 Label					
Front Screen Ch2 Label					
Front Screen Ch3 Label					
4-20mA Output Slot 1		4-20mA Output Slot 2			
Menu Header i)		Menu Header ii)		Menu Header iii)	
Menu Header iv)		Menu Header v)		Menu Header vi)	

Channel Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Description			
Units			
Sensor / Probe Type			
Cell Constant			
Range			
Linearisation Source			
TDS Factor			
Membrane Correction Factor			
Bias Voltage			
mA Input: Loop Mode			
mA Input: Input Mode			
Set 0mA Input			
Set 4mA Input			
Set 20mA Input			
Temperature Input Sensor			
Temperature Units			
Temperature Compensation: In/Out			
Temperature Compensation Slope			
Temperature Compensation: Auto / Manual			
Fixed Temperature Input			
Input Salinity			
Pressure Compensation: Auto / Manual			
Pressure Mode: Input / 24V Loop			
Pressure Units			
Pressure 4mA Input			
Pressure 20mA Input			
Fixed Pressure Input			
Cable Compensation			
Input Filter			

Curve Setup **(available options vary with card type and configuration)**

	Channel 1		Channel 2		Channel 3	
Curve A						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						
Curve B						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						

Channel Calibration Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Calibration Principle			
Calibration Manual Temp Input			
Calibration Units			
Calibration Manual Pressure Input			
Span Cal Point			
Enable Auto Span Cal			
Offset Value			
Slope Value			
Temperature Offset			
Sensor Condition			
Front Calibration Access			
Calibration Reminder			
Calibration Interval			

Setpoints Setup (available options vary with card type and configuration)

	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5	Setpoint 6
Channel						
Input Source						
Trigger						
High Value						
Low Value						
USP Pre-Trigger						
Mode						
Cycle Time						
Proportional Band						
Delay						
Hysteresis						
Dose Alarm						
Dose Alarm Time						
Initial Charge						
Charge Time						
Charge Access						
Alarm Mode						
Clean Duration						
Clean Interval						
Clean Mode						
Clean Recovery						
Clean Delay						

Current Output Setup (available options vary with card type and configuration)

	Current Output A	Current Output B	Current Output C	Current Output D	Current Output E	Current Output F
Channel						
Input Source						
Output 0 – 20mA / 4 - 20mA						
Zero						
Span						
On Error						

Digital Inputs (available options vary with card type and configuration)

	Digital Input 1	Digital Input 2	Digital Input 3	Digital Input 4	Digital Input 5	Digital Input 6	Digital Input 7	Digital Input 8
Channel								
Function								
Range Change								
Switch Store								
Cleaning Setpoint								
Polarity								
4-20 Output Level								

Service Alarms

	Channel 1	Channel 2	Channel 3
Service Reminder			
Service Interval			
Next Service Date			

Appendix E - Error Messages

Internal Error Messages

E001	**UNIT**	**Processor RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E002	**UNIT**	**External RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E003	**UNIT**	**Internal Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, Reset Whole unit from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E004	**UNIT**	**Output Card Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E005	**UNIT**	**Internal Outputs Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E006	**UNIT**	**For Future Use**
E007	**UNIT**	**Unit Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the whole unit from the Load Default Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E008	**UNIT**	**Unit Store A Checksum Error** The data in Unit Store A has been corrupted. Save the current setup back to Unit Store A in the Save/Restore menu.
E009	**UNIT**	**Unit Store B Checksum Error** The data in Unit Store B has been corrupted. Save the current setup back to Unit Store B in the Save/Restore menu.
E010 to E013	**UNIT**	**Maths Error** There has been an internal maths calculation failure. As such, it should not appear if the software is functioning properly. The error message should clear after approx. 5 seconds. If the error continues to be displayed consult with your supplier, as this unit may require to be returned for repair.
E014	**UNIT**	**Contrast Chip Error** The Contrast Chip is not operating correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E015	**UNIT**	**Unit SD Card Checksum Error** The SD Card store from which the entire unit was restored from has become corrupted. Check the unit's settings and then save the settings again to the SD card store.
E016	**UNIT**	**SD CARD FULL** The SD card has become full. To continue use, either replace with a blank SD card or remove existing files from SD card

Input Channel Errors

E030 E080 E130	CH1 CH2 CH3	**Input Card Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E031 E081 E131	CH1 CH2 CH3	**Setup Checksum Error** The current channel's configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists reset the current channel from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E032 E082 E132	CH1 CH2 CH3	**Store A Checksum Error** The data in the channel's Store A has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store A in the Save/Restore menu.
E033 E083 E133	CH1 CH2 CH3	**Store B Checksum Error** The data in the channel's Store B has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store B in the Save/Restore menu.
E034 E084 E134	CH1 CH2 CH3	**Factory Cal Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E035 E085 E135	CH1 CH2 CH3	**User Cal Checksum Error** The Channel's User Cal has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the Channel from the Reset User Calibration option in the Calibration menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E036 E086 E136	CH1 CH2 CH3	**Sensor Cal Out Of Spec** The last Sensor Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E037 E087 E137	CH1 CH2 CH3	**Sensor Zero Cal Out Of Spec** The last Sensor Zero Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E038 E088 E138	CH1 CH2 CH3	**Sensor Span Cal Out Of Spec** The last Sensor Span Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E039 E089 E139	CH1 CH2 CH3	**No Signal** No Sensor connected or there is 'zero' detector current. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E040 E090 E140	CH1 CH2 CH3	**Signal Overload** The gain step is equal to 0 and the A/D output is over 255. This cannot happen in a liquid but could happen if the sensor is in full sunlight. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.

E041 **E091** **E141**	**CH1** **CH2** **CH3**	**Partial Depletion** Large difference between the detectors, i.e. one very dirty. This alarm will come up if there is a difference of 3:1 between the detectors. Remove sensor and clean sensor fingers. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E042 **E092** **E142**	**CH1** **CH2** **CH3**	**Full Depletion** Attenuation too high or the real probe signal goes above 14000. The probe sensor units (PSU) will be set to 16000. If this message persists, please consult with your supplier.
E043 **E093** **E143**	**CH1** **CH2** **CH3**	**Sensor User Offset At Limit** The last Sensor Offset Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E044 **E094** **E144**	**CH1** **CH2** **CH3**	**Sensor User Slope At Limit** The last Sensor Slope Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E045 **E095** **E145**	**CH1** **CH2** **CH3**	**Sensor User Slope < Spec** The last Sensor Slope Calibration was less than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E046 **E096** **E146**	**CH1** **CH2** **CH3**	**Sensor User Slope > Spec** The last Sensor Slope Calibration was greater than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E047 **E097** **E147**	**CH1** **CH2** **CH3**	**Sensor Open Circuit** The sensor input is at open circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E048 **E098** **E148**	**CH1** **CH2** **CH3**	**Sensor Short Circuit** The sensor input is at short circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E049 **E099** **E149**	**CH1** **CH2** **CH3**	**Sensor Positive Saturation** The sensor input is greater than the maximum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E050 **E100** **E150**	**CH1** **CH2** **CH3**	**Sensor Negative Saturation** The sensor input is less than the minimum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E051 **E101** **E151**	**CH1** **CH2** **CH3**	**Sensor Input Over Range** The sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E052 **E102** **E152**	**CH1** **CH2** **CH3**	**Sensor Input Under Range** The sensor reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.

E053 **E103** **E153**	**CH1** **CH2** **CH3**	**Temp Sensor Fault** The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check that the temperature sensor is set to the correct type in the channel setup menu. Under this condition, the unit will default to the fixed temperature setting for compensation purposes. If the message persists please consult with your supplier.
E054 **E104** **E154**	**CH1** **CH2** **CH3**	**Temp Input Over Range** The temperature sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E055 **E105** **E155**	**CH1** **CH2** **CH3**	**Temp Input Under Range** The temperature reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E056 **E106** **E156**	**CH1** **CH2** **CH3**	**Temp Comp Outside Limits** The temperature reading is less than 0.0C or greater than 150.0C, leading to an error in compensation.
E057 **E107** **E157**	**CH1** **CH2** **CH3**	**Polar Zero Cal At Limit** The last Polargraphic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E058 **E108** **E158**	**CH1** **CH2** **CH3**	**Polar Span Cal At Limit** The last Polargraphic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E061 **E111** **E161**	**CH1** **CH2** **CH3**	**Pressure Sensor Over Range** The pressure sensor reading is greater than the specified limit for the probe.
E062 **E112** **E162**	**CH1** **CH2** **CH3**	**Pressure Sensor Under Range** The pressure sensor reading is less than the specified limit for the probe.
E063 **E113** **E163**	**CH1** **CH2** **CH3**	**Pressure Above 20mA** The pressure sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E064 **E114** **E164**	**CH1** **CH2** **CH3**	**Pressure Below 4mA** The pressure sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E065 **E115** **E165**	**CH1** **CH2** **CH3**	**AUX mA Input Above 20mA** The sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E066 **E116** **E166**	**CH1** **CH2** **CH3**	**AUX mA Input Below 4mA** The sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E067 **E117** **E167**	**CH1** **CH2** **CH3**	**Sensor 0mV Cal Out of Spec** The pH 0mV calibration for this channel is outside recommended specifications.

E068 **E118** **E168**	**CH1** **CH2** **CH3**	**Calibration Due** The time since the last calibration was performed on this channel has exceeded the time set in the calibration menu.
E069 **E119** **E169**	**CH1** **CH2** **CH3**	**Planned Service Due** The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
E070 **E120** **E170**	**CH1** **CH2** **CH3**	**SD Card Checksum Error** The SD Card store from which this channel was restored from has become corrupted. Check the channel's settings and then save the settings again to the SD card store.
E071 **E121** **E171**	**CH1** **CH2** **CH3**	**Gain Error** The sensor gain has been exceeded. If this message persists, please consult with your supplier.
E072 **E122** **E172**	**CH1** **CH2** **CH3**	**Invalid Linearisation Curve** A minimum of 2 linearisation points are required. Please check linearisation curve settings in the channel setup menu for this channel.
E073 **E123** **E173**	**CH1** **CH2** **CH3**	**Linearisation Over-Range** The linearisation result is greater than 9999 (or 100.0% when using %).
E074 **E124** **E174**	**CH1** **CH2** **CH3**	**Linearisation Under-Range** The linearisation result is less than 0.
E075 **E125** **E175**	**CH1** **CH2** **CH3**	**Curve Low Limit** The incoming probe signal is less than the lowest point in the linearisation curve.
E076 **E126** **E176**	**CH1** **CH2** **CH3**	**Curve High Limit** The incoming probe signal is greater than the highest point in the linearization curve.
E077 **E127** **E177**	**CH1** **CH2** **CH3**	**Custom Error** Contact your supplier for details.

Setpoint Errors

E180 E190 E200 E210 E220 E230	SP1 SP2 SP3 SP4 SP5 SP6	**Dose Alarm Error** The Setpoint has been dosing for longer than the Dose Alarm time as defined in the setpoint menu.
E181 to E184 E191 to E194 E201 to E204 E211 to E214 E221 to E224 E231 to E234	SP1 SP2 SP3 SP4 SP5 SP6	**For Future Use**
E185 E195 E205 E215 E225 E235	SP1 SP2 SP3 SP4 SP5 SP6	**Store A Checksum Error** The Store A Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E186 E196 E206 E216 E226 E236	SP1 SP2 SP3 SP4 SP5 SP6	**Store B Checksum Error** The Store B Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E187 E197 E207 E217 E227 E237	SP1 SP2 SP3 SP4 SP5 SP6	**Setup Checksum Error** The Setup for this Setpoint has become corrupted. Check and correct the setpoint settings and turn the unit off and on again. If the message persists please consult with your supplier.
E188 E198 E208 E218 E228 E238	SP1 SP2 SP3 SP4 SP5 SP6	**SD Card Checksum Error** The SD Card store from which this Setpoint was restored from has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again to the SD card store.

Current Output Errors

E240 **E250** **E260** **E270** **E280** **E290**	**A** **B** **C** **D** **E** **F**	**Current OP Hardware Fault** 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.
E241 **E251** **E261** **E271** **E281** **E291**	**A** **B** **C** **D** **E** **F**	**Sensor IP<Current OP Zero** The sensor input level is below that set for the current output zero.
E242 **E252** **E262** **E272** **E282** **E292**	**A** **B** **C** **D** **E** **F**	**Sensor IP>Current OP Span** The sensor input level is above that set for the current output span.
E243 **E253** **E263** **E273** **E283** **E293**	**A** **B** **C** **D** **E** **F**	**Sensor IP<Current OP Span** The sensor input level is below that set for the current output Span.
E244 **E254** **E264** **E274** **E284** **E294**	**A** **B** **C** **D** **E** **F**	**Sensor IP>Current OP Zero** The sensor input level is above that set for the current output Zero.
 E255 **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

E245 **E255** **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

Digital Input Errors

E301 **E306** **E311** **E316** **E321** **E326** **E331** **E336**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**Store A Checksum Error** The Store A Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E302 **E307** **E312** **E317** **E322** **E327** **E332** **E337**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**Store B Checksum Error** The Store B Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E303 **E308** **E313** **E318** **E323** **E328** **E333** **E338**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**Setup Checksum Error** The Setup for this Digital Input has become corrupted. Check and correct the digital inputs settings and turn the unit off and on again. If the message persists please consult with your supplier.
E304 **E309** **E314** **E319** **E324** **E329** **E334** **E339**	**DIG 1** **DIG 2** **DIG 3** **DIG 4** **DIG 5** **DIG 6** **DIG 7** **DIG 8**	**SD Card Checksum Error** The SD Card store from which this Digital Input was restored from has become corrupted. Check the Digital Input's settings in the digital input menu and then save the settings again to the SD card store.

Communication Errors

E340 **E342** **E344**	**CH1** **CH2** **CH3**	**Comms Failure** The Channel's Input Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E341 **E343** **E345**	**CH1** **CH2** **CH3**	**Comms Error** The Channel's Input Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E346	**UNIT**	**Output Comms Failure** The Basic Internal Outputs are not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E347	**UNIT**	**Output Comms Error** The Basic Internal Outputs are not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E348	**OP**	**Output Option Comms Failure** The Output Option Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option card may require to be returned for repair.
E349	**OP**	**Output Option Comms Error** The Output Option Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option Card may require to be returned for repair.

Calculation Errors

E400 **E411**	**C1** **C2**	**Calculation Over Range** The Calculation reading is greater than the specified upper limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E401 **E411**	**C1** **C2**	**Calculation Under Range** The Calculation reading is less than the specified lower limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E402 **E412**	**C1** **C2**	**Calculation Setup Checksum** The Setup for this Calculation has become corrupted. Check and correct the calculation settings and turn the unit off and on again. If the message persists please consult with your supplier.
E403 **E413**	**C1** **C2**	**Calculation Store A Checksum** The Store A Save for the channel associated with this calculation has become corrupted. Check the calculation's settings in the calculation menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E404 **E414**	**C1** **C2**	**Calculation Store B Checksum** The Store B Save for the channel associated with this calculation has become corrupted. Check the calculation's settings in the calculation menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E405 **E415**	**C1** **C2**	**Calculation SD Card Checksum** The SD Card store from which this Calculation was restored from has become corrupted. Check the Calculation's settings in the Calculation menu and then save the settings again to the SD card store.

Modbus Errors

E420	**UNIT**	**Modbus Setup Checksum** The Modbus setup has become corrupted. Check and correct the Modbus settings and turn the unit off and on again. If the message persists please consult with your supplier.
E421	**UNIT**	**Modbus Store A Checksum** The Store A Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store A in the Save/Restore menu.
E422	**UNIT**	**Modbus Store B Checksum** The Store B Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store B in the Save/Restore menu.
E423	**UNIT**	**Modbus SD Card Checksum** The SD Card store from which the Modbus configuration was restored from has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again to the SD card store.

SensorTalk Errors

E450 **E480** **E510**	**CH1** **CH2** **CH3**	**LED Off Temperature Exceeded** The probe's photoluminescence system is turned off as a result of the probe's temperature exceeding the defined threshold setting.
E451 **E481** **E511**	**CH1** **CH2** **CH3**	**CIP Temperature Exceeded** A Clean-In-Place cycle is occurring, the probe's photoluminescence system is turned off and an CIP event is recorded to the probe's log. This is a result of the probe's temperature exceeding the defined threshold setting.
E452 **E482** **E512**	**CH1** **CH2** **CH3**	**SIP Temperature Exceeded** A Steam-In-Place cycle is occurring, the probe's photoluminescence system is turned off and an SIP event is recorded to the probe's log. This is a result of the probe's temperature exceeding the defined threshold setting.
E453 **E483** **E513**	**CH1** **CH2** **CH3**	**Smart Sensor Error** An error has occurred with operation of the smart sensor. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card or sensor may require to be returned for repair.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MXD70 Series 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 previously in this section gives a list that the MXD70 series generates, along with their probable causes. If after these checks the fault has not been cleared contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable quick diagnosis and correction of the problem.

- Serial number of the instrument, input and output cards.
- 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.
- Relay connection configuration.

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

The Instrument Appears Dead

Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the MXD70 Series allows the unit to accept from 85 to 250V AC or DC, an alternative option allows operation from 18 to 32V AC or DC, check the connection label for voltage specification. 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 is Outputting No Current

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

The Sensor Condition Is Showing "Fault"

The "Fault" setting on the sensor condition is caused by the sensor output current being too high when a zero calibration was performed. Check for the following possible causes:

- Wiring fault. Disconnect the sensor from the instrument and confirm that the reading goes to zero.
- Possible faulty sensor connector. Check to see if sensor connector pins are covered with liquid or dirt. If the connector appears clean try a new cable or a different sensor.
- Membrane is broken on mechanical tension is to low. Visually inspect membrane for any tears and replace if present. Alternatively perform an electrolyte refill and check that the resistance between the cathode and electrode is low.
- Polargraphic sensor polarization time to short. Ensure that the sensor has been polarized for the length of time as recommended by the manufacturer and that the bias voltage has been set correctly in the instrument.
- Possible contamination in sensor body. Follow manufacturer's sensor cleaning guidelines.
- The calibration sample is not completely oxygen free.
- Check that the probe type, bias voltage and membrane correction factor have been set correctly in the instrument. Also ensure all sensor protective caps have been removed.
- If using manual pressure and temperature compensation ensure that the correct values have been entered.

The Sensor Condition is Showing "Refill"

The sensor output was too low at span calibration to provide sufficient sensor accuracy. Follow the sensor manufacturer's electrolyte service guidelines. If the condition persists check for the following possible causes:

- Membrane is broken. Visually inspect membrane for any tears and replace if present.
- Contaminated membrane. Gently clean the membrane surface with a soft clean cloth or tissue wetted with distilled or D.I. water, if fouling is still present replace the membrane.
- Cathode contamination. If the membrane has been ruptured the cathode can become contaminated with the sample media. Follow the sensor manufacturer's cleaning guidelines.
- Polarization voltage is incorrect. Check the "Bias Voltage" value in the input channels setup menu matches the value given by the sensor manufacturer.
- Cathode and Anode wired wrong way round. Check the installation section of this manual.
- Check that the probe type, bias voltage and membrane correction factor have been set correctly in the instrument. Also ensure all sensor protective caps have been removed.
- If using manual pressure and temperature compensation ensure that the correct values have been entered.

The Sensor Condition is Showing "Span High"

The sensor output was too high at span calibration. Check the following possible causes.

- Possible faulty sensor connector. Check to see if sensor connector pins are covered with liquid or dirt. Clean following the sensor manufacture's guidelines and then check the resistance between the cathode and anode is low.
- Possible short-circuit between the cathode and the anode. Check both the sensor and the sensor cable.
- Cathode glass broken (on some sensors only). The sensor will need to be replaced.
- Membrane is broken. Visually inspect membrane for any tears and replace if present.
- Check that the probe type, bias voltage and membrane correction factor have been set correctly in the instrument. Also ensure all sensor protective caps have been removed.
- If using manual pressure and temperature compensation ensure that the correct values have been entered.

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached. (See Installation Section).
- Check that the temperature sensor type is correctly selected in the Channel Setup menu (See page 19).
- Where practical check the temperature sensor resistance against the table on page 44.
- Check the user calibration

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. www.lth.co.uk/distributors.asp

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MXD70 SERIES

Multi-parameter Monitor

mA

Auxiliary mA Input
Setup and Operating
Guide

Preface

Product warranty

The MXD70 Auxiliary mA Input Card has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. 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.

Contents

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Auxiliary mA Input Card Specification

Measurement Input	0 to 24mA input, fully isolated from instrument supply.
Loop Modes	mA Input – Standard mA input from transmitter, 100Ω input impedance, max loop voltage 35V. Loop Powered – The input card will supply 24V to power the current loop. 3 Wire – The input card can supply an alternative 24V 30mA Max output via the "24V" pin to power a 3 wire transmitter.
Input Mode	0 – 20 mA (Linear) 4 – 20 mA (Linear) 2 Custom Curves (Non-Linear)
Display Ranges	-9999 to +9999 0 to 999.9 0 to 99.99 0 to 9.999
Custom Units	Maximum of 5 Alphanumeric Characters.
Error States	Input under 4mA (when using 4-20mA Input) Input over 20mA
Accuracy	±0.1% of reading.
Linearity	± 0.1% of range.
Repeatability	± 0.1% of range.
Calibration Methods	Reading Offset Calibration. Automatic 2 Point 0/4mA and 20mA Calibration.
Calibration Timer	Inbuilt calibration count down timer which will trigger an alarm when calibration interval has expired.
Sensor Input filter	Adjustable filter that averages the sensor input over a user selectable time (10sec – 5mins).

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Installation

The MXD70 series Auxiliary mA Input Card allows the user to read the current output of a variety of loop powered and self powered transmitters.

Self Powered Transmitters

For self powered transmitters the current input of the input card is isolated from the instrument's power supply thus allowing the input to be connected in series with other devices on the loop if the loop is fed from a single ended transmitter.

Loop Powered Transmitters

For loop powered transmitters the following information may need to be considered:

Loop Voltage Drops
One of a current input instruments most important specification is the total resistance or burden it presents to the connected transmitter's output driver. Most transmitters' data sheets specify the maximum loop resistance the transmitter can drive while still providing a full scale 20mA output (the worst case level with regards to burden).
Therefore knowing the input impedance of the MXD70 Auxiliary mA Input Card and assuming the maximum current developed in the loop will be 20mA. By using ohms law the maximum voltage drop of the current input is as follows:

Current Input Maximum Voltage Drop = 100Ω x 0.020A = 2 Volts

Transmitter Ratings
The maximum power dissipation of the transmitter can be calculated by combining all the voltage drops in the loop with the minimum operating voltage of the transmitter, take this number away from the current loop operating voltage and them multiply it by the maximum loop current. If the power dissipation is too high then the user will need to externally power the current loop with a lower voltage.

Wiring Resistance
In addition to any voltage drop caused by the transmitter and the current input circuit the user will also have to take into account any voltage losses caused by the wiring resistance. This voltage loss can be calculated by multiplying the combined resistance to and from the transmitter by the maximum current flowing through the wire. This figure along with the voltage dropped by the transmitter and current input circuit will define the minimum operating voltage of the loop.

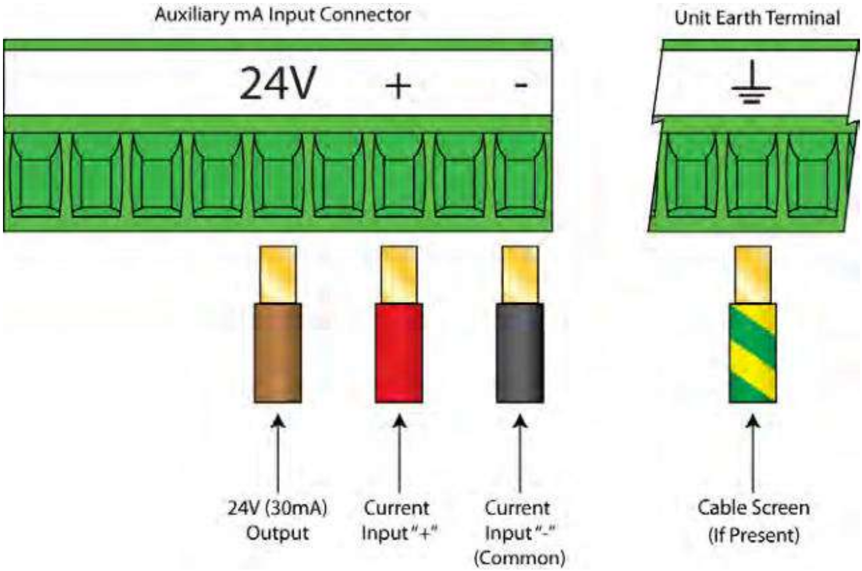
$$V_{min} = V_{Tmin} + V_{CIPmax} + (0.02 \times R_{Wiring})$$

Where: V_{min} = Loop minimum supply voltage
V_{Tmin} = Transmitter minimum operating voltage
V_{CIPmax} = Current Input Maximum Voltage Drop
R_{Wiring} = Wiring resistance = 2 x Distance x Cable Resistance (typically 0.035Ω/m)

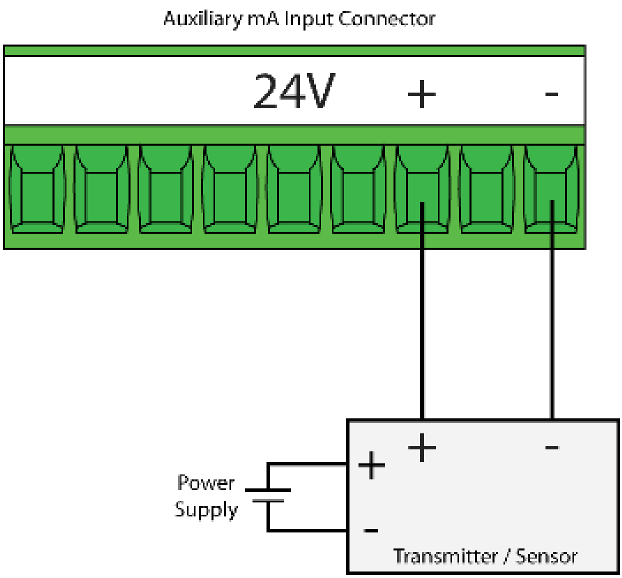
3 Wire Transmitters

For low powered 3 wire transmitters the input card can supply a 24V 30mA output via the 24V connection, thus allowing for the removal of an additional external power supply to the transmitter.

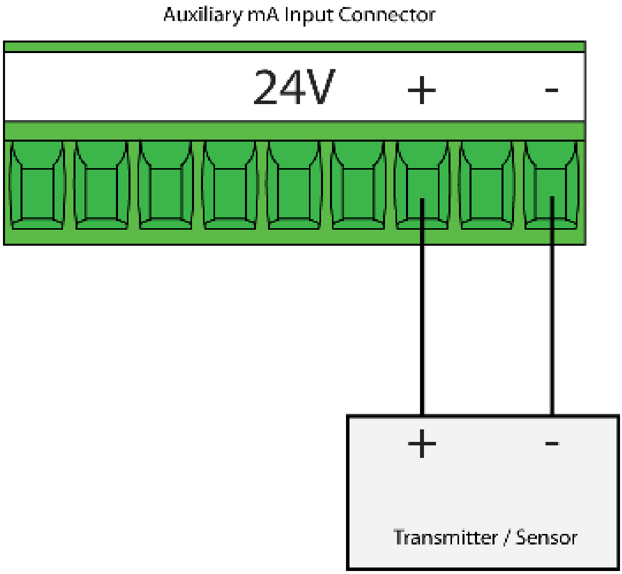
MXD73 – Panel Mount Termination Information



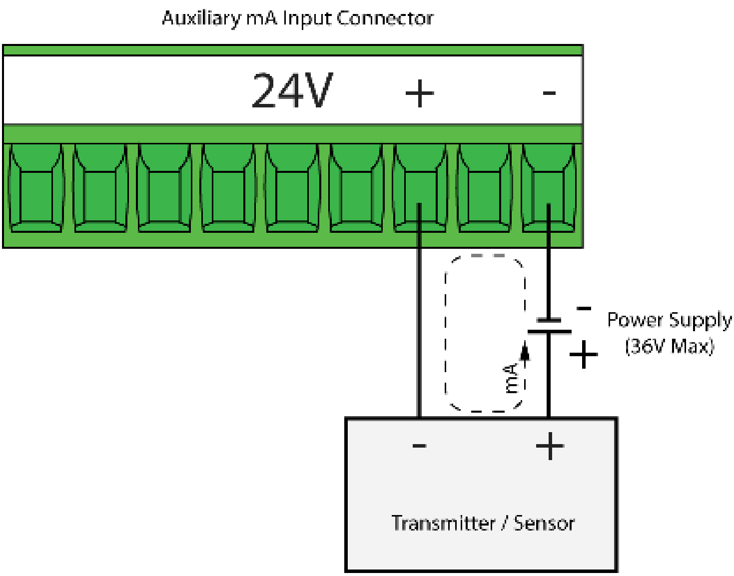
Auxiliary mA Input Connection Details



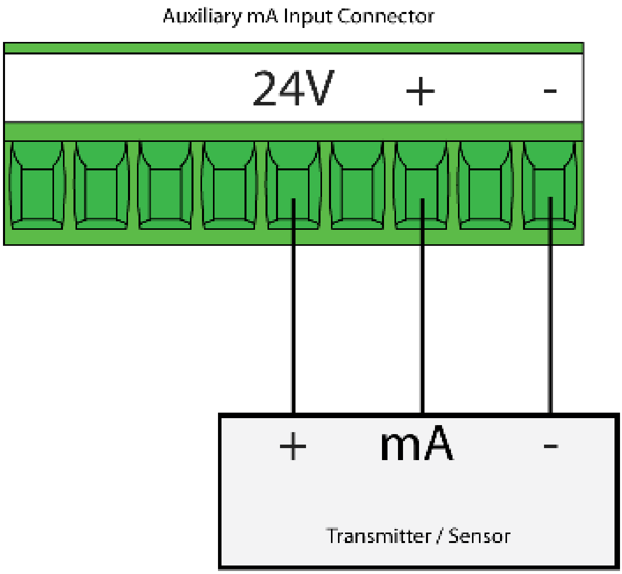
Locally Powered Transmitter Loop Connection Details
Loop Mode Set to "mA Input"



Internally Powered Loop Connection Details
Loop Mode Set to "24V Loop"
(MXD70 powers the loop with 24V)

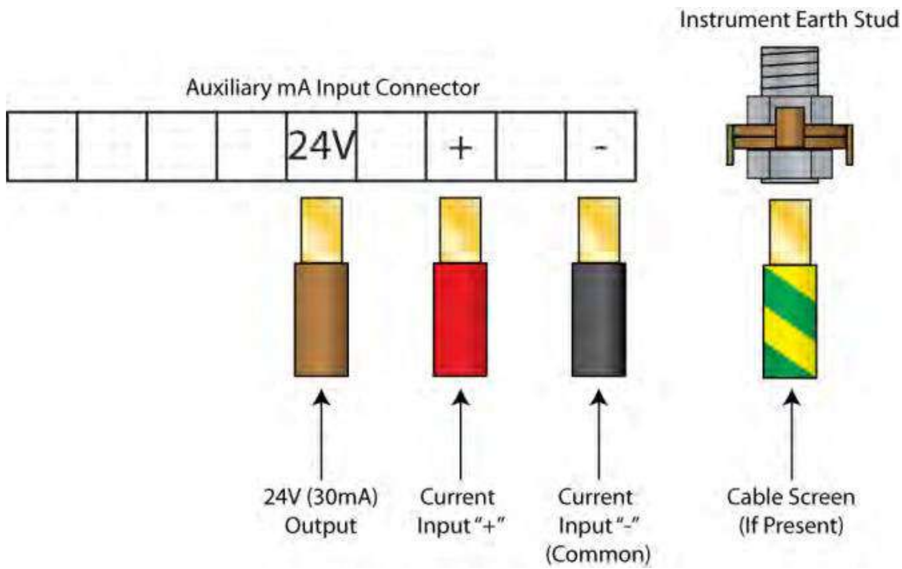


Externally Powered Loop Connection Details
Loop Mode Set to "mA Input"

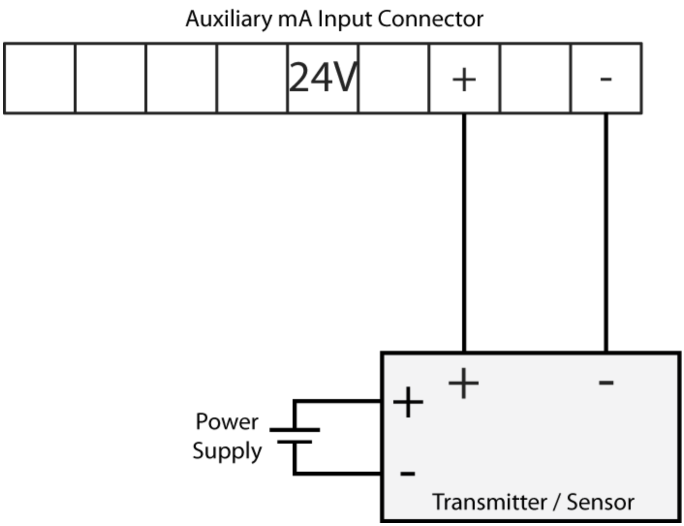


3 Wire Transmitter Loop Connection Details
(NB. The 24V Can Supply 30mA Max)
Loop Mode Set to "mA Input"

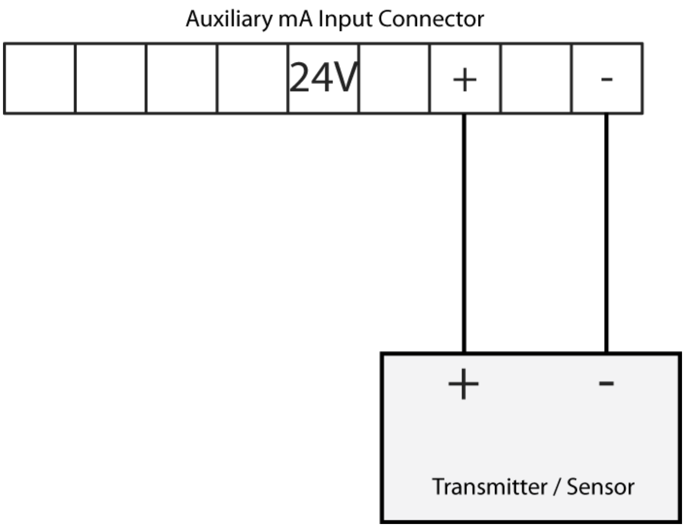
MXD75 – Surface Mount Termination Information



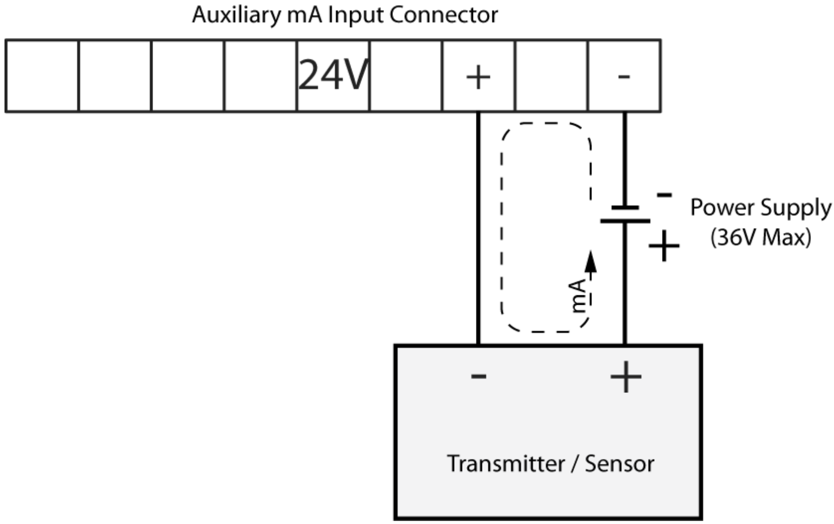
Auxiliary mA Input Connection Details



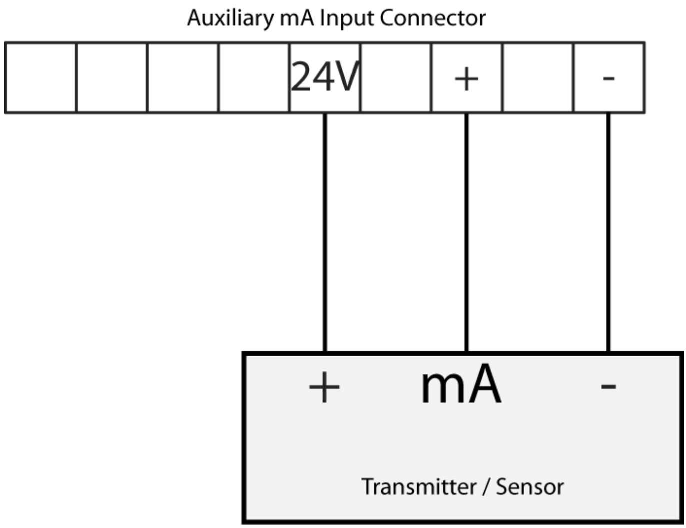
Self Powered Transmitter Loop Connection Details
Loop Mode Set to "mA Input"



Internally Powered Loop Connection Details
Loop Mode Set to "24V Loop"
(MXD70 powers the loop with 24V)



Externally Powered Loop Connection Details
Loop Mode Set to "mA Input"

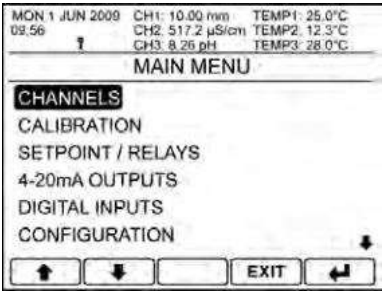


3 Wire Transmitter Loop Connection Details
(NB. The 24V Can Supply 30mA Max)
Loop Mode Set to "mA Input"

Auxiliary mA Input Channel Setup

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

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



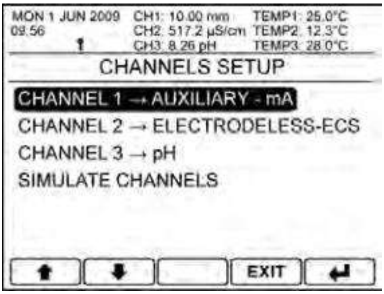
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



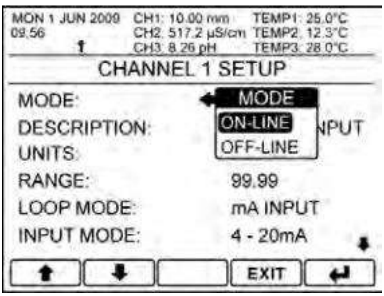
Select Channel

Select the Auxiliary mA input channel you wish to edit.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

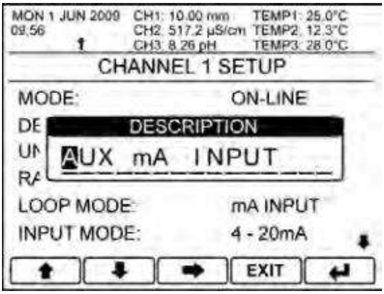
When the unit is placed in an off-line state "off-line" will appear in the channel messages section on the front screen.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Description

Change the menu description of the Auxiliary mA Input Card. Improves the ease of use throughout the instrument.

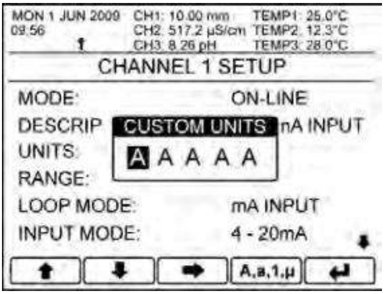
Limited to 15 characters, though in some menus only the first 5 characters will be displayed.

⬆/⬇ – Change Character

➡ – Select Next Character

EXIT – Cancel

↵ – Save Selection



Units

Set the operating units of the scaled input using a maximum of 5 characters.

Note: If you hold down the “A,a,1,µ“ Button for approximately 5 seconds the unit will automatically set the character to “blank”.

Only the first two characters of the units are displayed in the menu header.

Available characters:

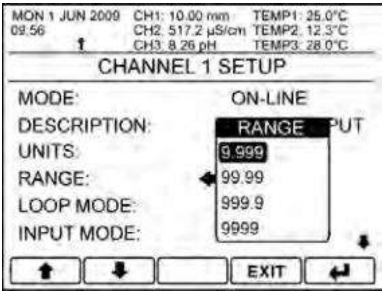
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	a	b	c	d
e	f	g	h	i	j	k	l	m	n
o	p	q	r	s	t	u	v	w	x
y	z	1	2	3	4	5	6	7	8
9	0	µ		#	%	(	)	+	-
.	/	:	=	\	^	Σ	Ω	π	°
±	^{2}	^{3}	^{0}	β					

⬆/⬇ – Change Character

➡ – Select Next Character

A,a,1,µ – Jump To Next Character Subset

↵ – Save Selection



Range

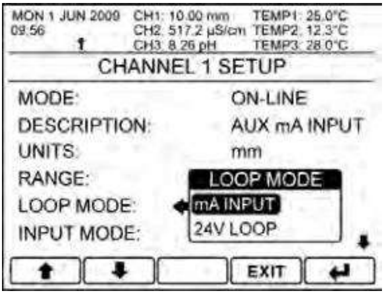
Select the operating range over which the input is scaled.

Note only the "9999" range allows signed values.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Loop Mode

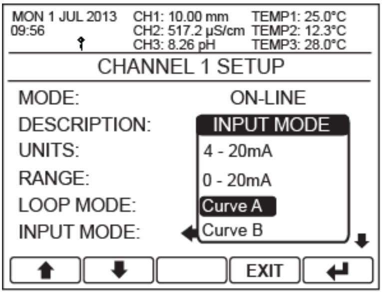
The input channel has the ability to support both direct mA input and 24V looped powered systems by setting this parameter.

Note. For direct input configuration the input resistance is 100Ω.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Input Mode

The input can be configured so that the incoming current is scaled across a 4 – 20mA, 0 – 20mA or linearized across desired points entered in to one of the two available custom curves.

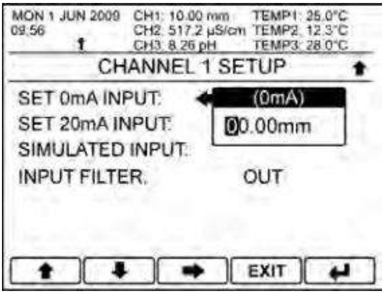
If 4-20mA is selected and the input current falls below 4mA, a channel error is generated.

If a curve is chosen and the input falls below the lowest or highest entered mA input point, a channel error will be generated.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Set 0mA Input

Enter the displayed value equivalent to a 0mA input.

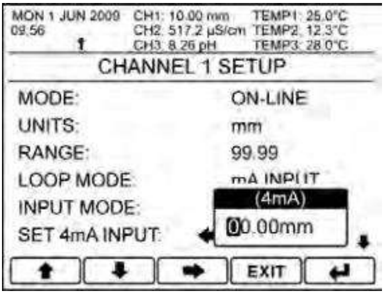
Note. Only available when input mode is set to 0mA – 20mA input.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Set 4mA Input

Enter the displayed value equivalent to a 4mA input.

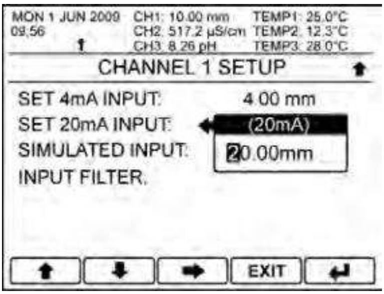
Note. Only available when input mode is set to 4mA – 20mA input.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Set 20mA Input

Enter the displayed value equivalent to a 20mA input.

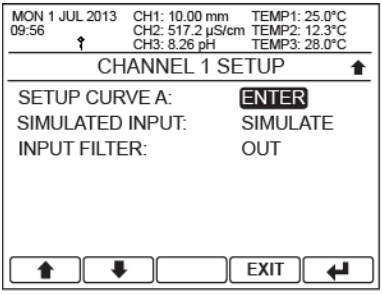
Note. Only available when input mode is set to 4mA – 20mA input.

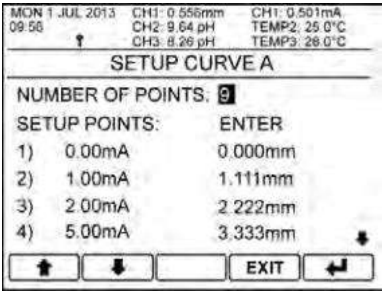
⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value





Setup Custom Curve

The Auxiliary mA input provides the user with the facility to enter a custom relationship between the incoming mA measurement and the displayed value.

To enter the relationship, first set the input mode to “Curve A”, or “Curve B”. Then select the “Setup Curve X” menu.

The new screen provides the following options.

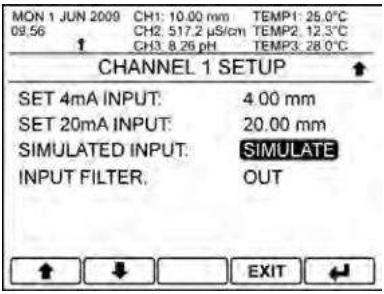
- Number of points – Define the number of data entry points which make up the custom curve (Maximum of 10)
- Setup Points – Automatically define the points one after another.
- Data Points – Alternatively the user can edit a single point by selecting it in the menu.
- Reset Curve – Reset all points back to zero

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



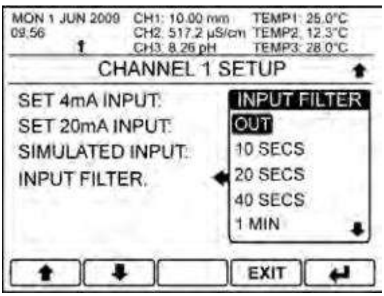
Simulated Input

See Simulated Channels section of the Setpoints, Current Outputs, Digital Inputs Configuration Guide for more information.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Input Filtering (Averaging)

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

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option

BLANK

Calibration

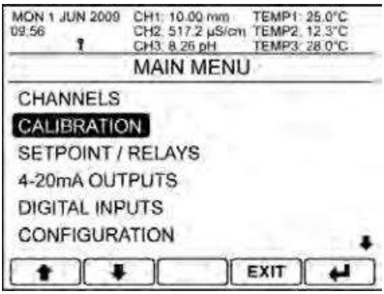
Calibration Procedures
The user is provided with two methods of calibrating the Auxiliary mA Input Card.

- 2 Point Calibration – Selected by entering the “Aux mA Input Cal” menu item in the calibration menu. This allows the user to calibrate a fixed mA input of 0mA, 4mA, or 20mA against a known current source. Available calibration values depend upon the “Input Mode” menu setting in the channel setup menu.
- Solution Calibration – Selected by entering the “Sensor Solution Cal” menu item in the calibration menu, this allows the user to adjust the scaled reading to match a known input. The amount of offset applied is shown in the “Offset value” menu item and is effective across the full scale of the current input.

Calibration Menu

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

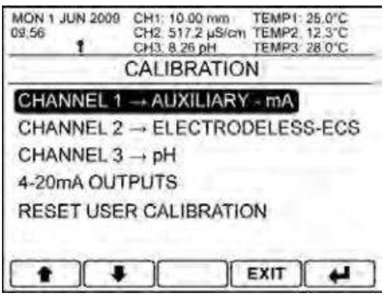
The default security access code is 1000



Main Menu

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

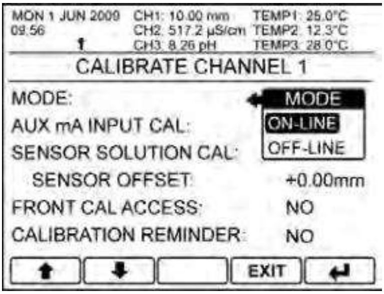
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Select Channel

Select the Auxiliary mA input channel you wish to edit.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



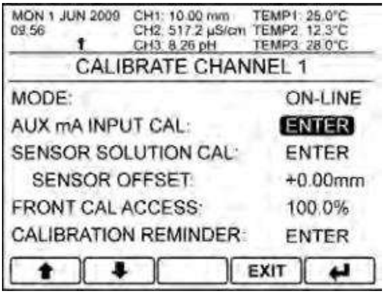
Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

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

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

↑/↓	– Select Option
EXIT	– Cancel
↵	– Save Selection

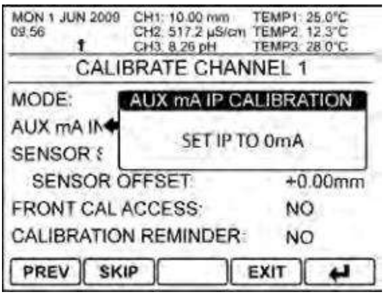


Auxiliary mA Input Calibration

Enter the Auxiliary mA Input Calibration routine.

Allows the user to calibrate the mA input to a known current source.

↑/↓	– Select Option
EXIT	– Return to Select Calibration Channel
↵	– Enter pH Auto Calibration

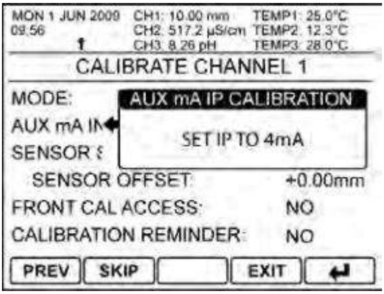


0 mA Input Calibration

Set the known current input to 0mA and press enter to initiate a calibration.

Only available when the input mode is set to 0 – 20mA in the channel setup menu.

PREV	– Go to Previous Calibration Point
SKIP	– Skip to Next Calibration Point
EXIT	– Exit Calibration Without Saving
↵	– Initiate Calibration



4 mA Input Calibration

Set the known current input to 4mA and press enter to initiate a calibration.

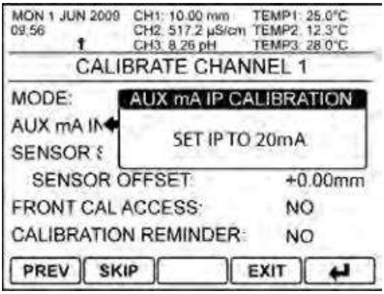
Only available when the input mode is set to 4 – 20mA in the channel setup menu.

PREV – Go to Previous Calibration Point

SKIP – Skip to Next Calibration Point

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration



20 mA Input Calibration

Set the known current input to 20mA and press enter to initiate a calibration.

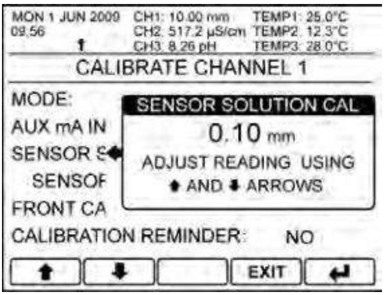
Only available when the input mode is set to 4 – 20mA in the channel setup menu.

PREV – Go to Previous Calibration Point

SKIP – Skip to Next Calibration Point

EXIT – Exit Calibration Without Saving

↵ – Initiate Calibration



Sensor Solution Calibration

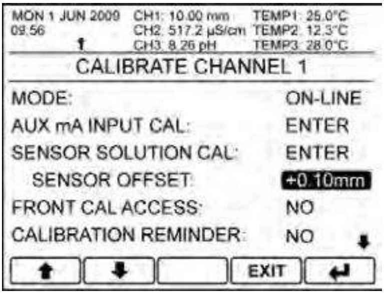
The Sensor Solution calibration enables the user to adjust the sensor reading to match a known input.

The current reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the calibration.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

↵ – Save Calibration

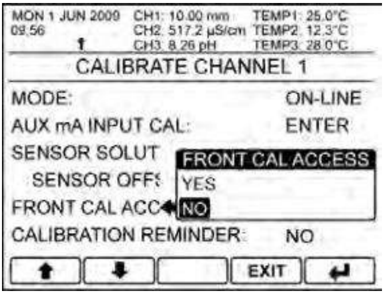


Sensor Offset Value

Displays the Sensor Offset currently being used by the instrument.

Cannot be edited.

Changed by using sensor solution calibration.



Front Screen Calibration Access Enable

When enabled front calibration access allows direct entry into the calibration menu from the front screen. It also disables the security access system within the calibration menu enabling the calibration functions without having to enter the security access code.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Front Screen Calibration Access

When the calibration access is enabled press the “CAL” button to bring up pop-up to select which channel to calibrate.

CAL – Enter Calibrate Channel Select Menu

⬅/➡ – Scroll Around Menus

Menu – Access Main Menu

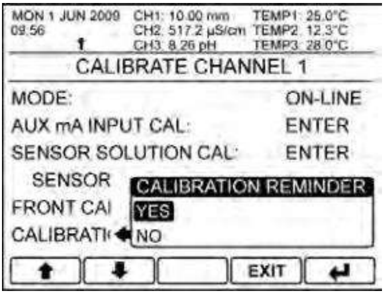
Select Channel to Calibrate

From the pop-up select the channel the user wishes to calibrate. Only channels whose front calibration access has been enabled will appear.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Enter Menu



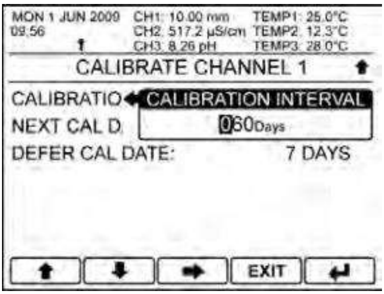
Calibration Reminder

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

If the interval has expired and the alarm has activated, then on the completion of a successful sensor calibration the next cal date will be automatically incremented by calibration interval.

If the user completes a successful sensor calibration before the calibration interval has expired, then the instrument will ask the user whether they wish to update the next cal due date by the calibration interval.

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

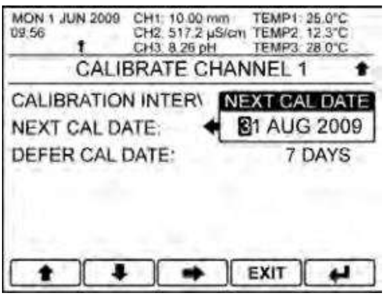


Calibration Interval

Sets the interval time for the calibration alarm.

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

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

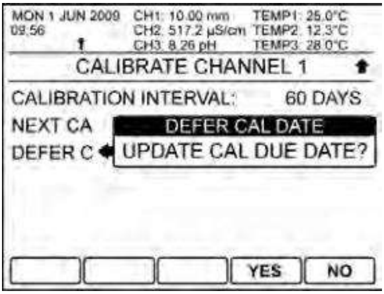


Next Calibration Date

Sets the exact date of the next calibration alarm.

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

⬆/⬇	– Increase / Decrease Digit or Text
➡	– Select Next Item
EXIT	– Cancel
↵	– Save Entry



Defer Calibration Date

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

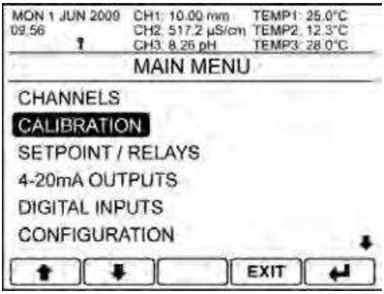
Only appears once the calibration interval has expired.

YES – Increase Interval

NO – Cancel

Resetting the User Calibration

If required the user can reset the user calibrations to their default states.



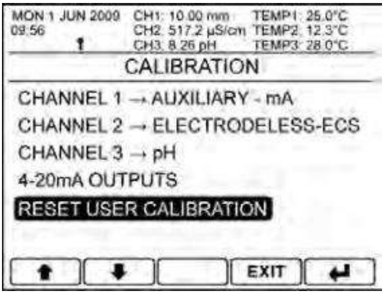
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



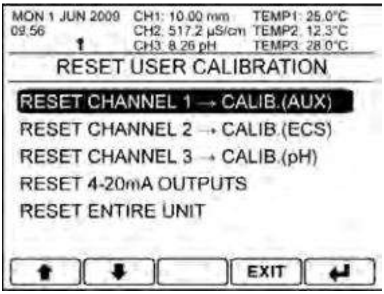
Calibration

Select Reset User Calibration.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



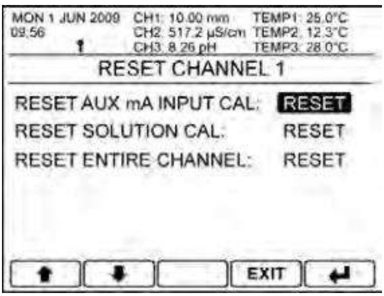
Reset User Calibration

Select the required Auxiliary mA input channel.

⬆/⬇ – Select Option

EXIT – Return to Calibration

↵ – Enter Option



Reset Channel User Calibration

Select whether to reset the sensor calibration, solution calibration or reset all of the channel's user calibrations.

⬆/⬇ – Select Option

EXIT – Return to Reset User Calibration

↵ – Enter Option

Blank

Appendix A - Instrument Configuration

Instrument Configuration

Instrument Type		Serial Number		Software Version	
Power Supply Type					
Channel 1 Input Card Type		Serial Number			
Channel 2 Input Card Type		Serial Number			
Channel 3 Input Card Type		Serial Number			
Output Expansion Card Type		Serial Number			
Software Expansion		Unlock Code			
Software Expansion		Unlock Code			

Instrument Settings

Security Access Code					
Language					
Front Screen Ch1 Shown		Front Screen Ch1 Secondary Reading i)		Front Screen Ch1 Secondary Reading ii)	
Front Screen Ch2 Shown		Front Screen Ch2 Secondary Reading i)		Front Screen Ch2 Secondary Reading ii)	
Front Screen Ch3 Shown		Front Screen Ch3 Secondary Reading i)		Front Screen Ch3 Secondary Reading ii)	
Front Screen Ch1 Label					
Front Screen Ch2 Label					
Front Screen Ch3 Label					
4-20mA Output Slot 1		4-20mA Output Slot 2			
Menu Header i)		Menu Header ii)		Menu Header iii)	
Menu Header iv)		Menu Header v)		Menu Header vi)	

Channel Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Description			
Units			
Sensor / Probe Type			
Cell Constant			
Range			
Linearisation Source			
TDS Factor			
Membrane Correction Factor			
Bias Voltage			
mA Input: Loop Mode			
mA Input: Input Mode			
Set 0mA Input			
Set 4mA Input			
Set 20mA Input			
Temperature Input Sensor			
Temperature Units			
Temperature Compensation: In/Out			
Temperature Compensation Slope			
Temperature Compensation: Auto / Manual			
Fixed Temperature Input			
Input Salinity			
Pressure Compensation: Auto / Manual			
Pressure Mode: Input / 24V Loop			
Pressure Units			
Pressure 4mA Input			
Pressure 20mA Input			
Fixed Pressure Input			
Cable Compensation			
Input Filter			

Curve Setup (available options vary with card type and configuration)

	Channel 1		Channel 2		Channel 3	
Curve A						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						
Curve B						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						

Channel Calibration Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Calibration Principle			
Calibration Manual Temp Input			
Calibration Units			
Calibration Manual Pressure Input			
Span Cal Point			
Enable Auto Span Cal			
Offset Value			
Slope Value			
Temperature Offset			
Sensor Condition			
Front Calibration Access			
Calibration Reminder			
Calibration Interval			

Setpoints Setup (available options vary with card type and configuration)

	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5	Setpoint 6
Channel						
Input Source						
Trigger						
High Value						
Low Value						
USP Pre-Trigger						
Mode						
Cycle Time						
Proportional Band						
Delay						
Hysteresis						
Dose Alarm						
Dose Alarm Time						
Initial Charge						
Charge Time						
Charge Access						
Alarm Mode						
Clean Duration						
Clean Interval						
Clean Mode						
Clean Recovery						
Clean Delay						

Current Output Setup (available options vary with card type and configuration)

	Current Output A	Current Output B	Current Output C	Current Output D	Current Output E	Current Output F
Channel						
Input Source						
Output 0 – 20mA / 4 - 20mA						
Zero						
Span						
On Error						

Digital Inputs (available options vary with card type and configuration)

	Digital Input 1	Digital Input 2	Digital Input 3	Digital Input 4	Digital Input 5	Digital Input 6	Digital Input 7	Digital Input 8
Channel								
Function								
Range Change								
Switch Store								
Cleaning Setpoint								
Polarity								
4-20 Output Level								

Service Alarms

	Channel 1	Channel 2	Channel 3
Service Reminder			
Service Interval			
Next Service Date			

Appendix B - Error Messages

Internal Error Messages

E001	**UNIT**	**Processor RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E002	**UNIT**	**External RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E003	**UNIT**	**Internal Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, Reset Whole unit from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E004	**UNIT**	**Output Card Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E005	**UNIT**	**Internal Outputs Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E006	**UNIT**	**For Future Use**
E007	**UNIT**	**Unit Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the whole unit from the Load Default Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E008	**UNIT**	**Unit Store A Checksum Error** The data in Unit Store A has been corrupted. Save the current setup back to Unit Store A in the Save/Restore menu.
E009	**UNIT**	**Unit Store B Checksum Error** The data in Unit Store B has been corrupted. Save the current setup back to Unit Store B in the Save/Restore menu.
E010 to E013	**UNIT**	**Maths Error** There has been an internal maths calculation failure. As such, it should not appear if the software is functioning properly. The error message should clear after approx. 5 seconds. If the error continues to be displayed consult with your supplier, as this unit may require to be returned for repair.
E014	**UNIT**	**Contrast Chip Error** The Contrast Chip is not operating correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E015	**UNIT**	**Unit SD Card Checksum Error** The SD Card store from which the entire unit was restored from has become corrupted. Check the unit's settings and then save the settings again to the SD card store.
E016	**UNIT**	**SD CARD FULL** The SD card has become full. To continue use, either replace with a blank SD card or remove existing files from SD card

Input Channel Errors

E030 **E080** **E130**	**CH1** **CH2** **CH3**	**Input Card Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E031 **E081** **E131**	**CH1** **CH2** **CH3**	**Setup Checksum Error** The current channel's configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists reset the current channel from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E032 **E082** **E132**	**CH1** **CH2** **CH3**	**Store A Checksum Error** The data in the channel's Store A has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store A in the Save/Restore menu.
E033 **E083** **E133**	**CH1** **CH2** **CH3**	**Store B Checksum Error** The data in the channel's Store B has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store B in the Save/Restore menu.
E034 **E084** **E134**	**CH1** **CH2** **CH3**	**Factory Cal Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E035 **E085** **E135**	**CH1** **CH2** **CH3**	**User Cal Checksum Error** The Channel's User Cal has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the Channel from the Reset User Calibration option in the Calibration menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E036 **E086** **E136**	**CH1** **CH2** **CH3**	**Sensor Cal Out Of Spec** The last Sensor Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E037 **E087** **E137**	**CH1** **CH2** **CH3**	**Sensor Zero Cal Out Of Spec** The last Sensor Zero Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E038 **E088** **E138**	**CH1** **CH2** **CH3**	**Sensor Span Cal Out Of Spec** The last Sensor Span Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E039 **E089** **E139**	**CH1** **CH2** **CH3**	**No Signal** No Sensor connected or there is 'zero' detector current. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E040 **E090** **E140**	**CH1** **CH2** **CH3**	**Signal Overload** The gain step is equal to 0 and the A/D output is over 255. This cannot happen in a liquid but could happen if the sensor is in full sunlight. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.

E041 **E091** **E141**	**CH1** **CH2** **CH3**	**Partial Depletion** Large difference between the detectors, i.e. one very dirty. This alarm will come up if there is a difference of 3:1 between the detectors. Remove sensor and clean sensor fingers. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E042 **E092** **E142**	**CH1** **CH2** **CH3**	**Full Depletion** Attenuation too high or the real probe signal goes above 14000. The probe sensor units (PSU) will be set to 16000. If this message persists, please consult with your supplier.
E043 **E093** **E143**	**CH1** **CH2** **CH3**	**Sensor User Offset At Limit** The last Sensor Offset Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E044 **E094** **E144**	**CH1** **CH2** **CH3**	**Sensor User Slope At Limit** The last Sensor Slope Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E045 **E095** **E145**	**CH1** **CH2** **CH3**	**Sensor User Slope < Spec** The last Sensor Slope Calibration was less than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E046 **E096** **E146**	**CH1** **CH2** **CH3**	**Sensor User Slope > Spec** The last Sensor Slope Calibration was greater than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E047 **E097** **E147**	**CH1** **CH2** **CH3**	**Sensor Open Circuit** The sensor input is at open circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E048 **E098** **E148**	**CH1** **CH2** **CH3**	**Sensor Short Circuit** The sensor input is at short circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E049 **E099** **E149**	**CH1** **CH2** **CH3**	**Sensor Positive Saturation** The sensor input is greater than the maximum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E050 **E100** **E150**	**CH1** **CH2** **CH3**	**Sensor Negative Saturation** The sensor input is less than the minimum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E051 **E101** **E151**	**CH1** **CH2** **CH3**	**Sensor Input Over Range** The sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E052 **E102** **E152**	**CH1** **CH2** **CH3**	**Sensor Input Under Range** The sensor reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.

E053 E103 E153	CH1 CH2 CH3	**Temp Sensor Fault** The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check that the temperature sensor is set to the correct type in the channel setup menu. Under this condition, the unit will default to the fixed temperature setting for compensation purposes. If the message persists please consult with your supplier.
E054 E104 E154	CH1 CH2 CH3	**Temp Input Over Range** The temperature sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E055 E105 E155	CH1 CH2 CH3	**Temp Input Under Range** The temperature reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E056 E106 E156	CH1 CH2 CH3	**Temp Comp Outside Limits** The temperature reading is less than 0.0C or greater than 150.0C, leading to an error in compensation.
E057 E107 E157	CH1 CH2 CH3	**Polar Zero Cal At Limit** The last Polargraphic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E058 E108 E158	CH1 CH2 CH3	**Polar Span Cal At Limit** The last Polargraphic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E059 E109 E159	CH1 CH2 CH3	**Galvanic Zero Cal At Limit** The last Galvanic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E060 E110 E160	CH1 CH2 CH3	**Galvanic Span Cal At Limit** The last Galvanic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E061 E111 E161	CH1 CH2 CH3	**Pressure Sensor Over Range** The pressure sensor reading is greater than the specified limit for the probe.
E062 E112 E162	CH1 CH2 CH3	**Pressure Sensor Under Range** The pressure sensor reading is less than the specified limit for the probe.
E063 E113 E163	CH1 CH2 CH3	**Pressure Above 20mA** The pressure sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E064 E114 E164	CH1 CH2 CH3	**Pressure Below 4mA** The pressure sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E065 E115 E165	CH1 CH2 CH3	**AUX mA Input Above 20mA** The sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.

E066 **E116** **E166**	**CH1** **CH2** **CH3**	**AUX mA Input Below 4mA** The sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E067 **E117** **E167**	**CH1** **CH2** **CH3**	**Sensor 0mV Cal Out of Spec** The pH 0mV calibration for this channel is outside recommended specifications.
E068 **E118** **E168**	**CH1** **CH2** **CH3**	**Calibration Due** The time since the last calibration was performed on this channel has exceeded the time set in the calibration menu.
E069 **E119** **E169**	**CH1** **CH2** **CH3**	**Planned Service Due** The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
E070 **E120** **E170**	**CH1** **CH2** **CH3**	**SD Card Checksum Error** The SD Card store from which this channel was restored from has become corrupted. Check the channel's settings and then save the settings again to the SD card store.
E071 **E121** **E171**	**CH1** **CH2** **CH3**	**Gain Error** The sensor gain has been exceeded. If this message persists, please consult with your supplier.
E072 **E122** **E172**	**CH1** **CH2** **CH3**	**Invalid Linearisation Curve** A minimum of 2 linearisation points are required. Please check linearisation curve settings in the channel setup menu for this channel.
E073 **E123** **E173**	**CH1** **CH2** **CH3**	**Linearisation Over-Range** The linearisation result is greater than 9999 (or 100.0% when using %).
E074 **E124** **E174**	**CH1** **CH2** **CH3**	**Linearisation Under-Range** The linearisation result is less than 0.
E075 **E125** **E175**	**CH1** **CH2** **CH3**	**Curve Low Limit** The incoming probe signal is less than the lowest point in the linearisation curve.
E076 **E126** **E176**	**CH1** **CH2** **CH3**	**Curve High Limit** The incoming probe signal is greater than the highest point in the linearization curve.
E077 **E127** **E177**	**CH1** **CH2** **CH3**	**Custom Error** Contact your supplier for details.

Setpoint Errors

E180 SP1 **E190 SP2** **E200 SP3** **E210 SP4** **E220 SP5** **E230 SP6**	**Dose Alarm Error** The Setpoint has been dosing for longer than the Dose Alarm time as defined in the setpoint menu.	
E181 to E184 SP1 **E191 to E194 SP2** **E201 to E204 SP3** **E211 to E214 SP4** **E221 to E224 SP5** **E231 to E234 SP6**	**For Future Use**	
E185 SP1 **E195 SP2** **E205 SP3** **E215 SP4** **E225 SP5** **E235 SP6**	**Store A Checksum Error** The Store A Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store A in the Save/Restore menu.	
E186 SP1 **E196 SP2** **E206 SP3** **E216 SP4** **E226 SP5** **E236 SP6**	**Store B Checksum Error** The Store B Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store B in the Save/Restore menu.	
E187 SP1 **E197 SP2** **E207 SP3** **E217 SP4** **E227 SP5** **E237 SP6**	**Setup Checksum Error** The Setup for this Setpoint has become corrupted. Check and correct the setpoint settings and turn the unit off and on again. If the message persists please consult with your supplier.	
E188 SP1 **E198 SP2** **E208 SP3** **E218 SP4** **E228 SP5** **E238 SP6**	**SD Card Checksum Error** The SD Card store from which this Setpoint was restored from has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again to the SD card store.	

Current Output Errors

E240	**A**	**Current OP Hardware Fault**
E250	**B**	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.
E260	**C**	
E270	**D**	
E280	**E**	
E290	**F**	
E241	**A**	**Sensor IP<Current OP Zero**
E251	**B**	The sensor input level is below that set for the current output zero.
E261	**C**	
E271	**D**	
E281	**E**	
E291	**F**	
E242	**A**	**Sensor IP>Current OP Span**
E252	**B**	The sensor input level is above that set for the current output span.
E262	**C**	
E272	**D**	
E282	**E**	
E292	**F**	
E243	**A**	**Sensor IP<Current OP Span**
E253	**B**	The sensor input level is below that set for the current output Span.
E263	**C**	
E273	**D**	
E283	**E**	
E293	**F**	
E244	**A**	**Sensor IP>Current OP Zero**
E254	**B**	The sensor input level is above that set for the current output Zero.
E264	**C**	
E274	**D**	
E284	**E**	
E294	**F**	
	A	**Store A Checksum Error**
E255	**B**	The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E265	**C**	
E275	**D**	
E285	**E**	
E295	**F**	
E246	**A**	**Store B Checksum Error**
E256	**B**	The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E266	**C**	
E276	**D**	
E286	**E**	
E296	**F**	

Faults

E245 **E255** **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

Digital Input Errors

E301 E306 E311 E316 E321 E326 E331 E336	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store A Checksum Error** The Store A Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E302 E307 E312 E317 E322 E327 E332 E337	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store B Checksum Error** The Store B Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E303 E308 E313 E318 E323 E328 E333 E338	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Setup Checksum Error** The Setup for this Digital Input has become corrupted. Check and correct the digital inputs settings and turn the unit off and on again. If the message persists please consult with your supplier.
E304 E309 E314 E319 E324 E329 E334 E339	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**SD Card Checksum Error** The SD Card store from which this Digital Input was restored from has become corrupted. Check the Digital Input's settings in the digital input menu and then save the settings again to the SD card store.

Communication Errors

E340 **E342** **E344**	**CH1** **CH2** **CH3**	**Comms Failure** The Channel's Input Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E341 **E343** **E345**	**CH1** **CH2** **CH3**	**Comms Error** The Channel's Input Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E346	**UNIT**	**Output Comms Failure** The Basic Internal Outputs are not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E347	**UNIT**	**Output Comms Error** The Basic Internal Outputs are not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E348	**OP**	**Output Option Comms Failure** The Output Option Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option card may require to be returned for repair.
E349	**OP**	**Output Option Comms Error** The Output Option Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option Card may require to be returned for repair.

Calculation Errors

E400 **E410**	**C1** **C2**	**Calculation Over Range** The Calculation reading is greater than the specified upper limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E401 **E411**	**C1** **C2**	**Calculation Under Range** The Calculation reading is less than the specified lower limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E402 **E412**	**C1** **C2**	**Calculation Setup Checksum** The Setup for this Calculation has become corrupted. Check and correct the calculation settings and turn the unit off and on again. If the message persists please consult with your supplier.
E403 **E413**	**C1** **C2**	**Calculation Store A Checksum** The Store A Save for the channel associated with this calculation has become corrupted. Check the calculation's settings in the calculation menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E404 **E414**	**C1** **C2**	**Calculation Store B Checksum** The Store B Save for the channel associated with this calculation has become corrupted. Check the calculation's settings in the calculation menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E405 **E415**	**C1** **C2**	**Calculation SD Card Checksum** The SD Card store from which this Calculation was restored from has become corrupted. Check the Calculation's settings in the Calculation menu and then save the settings again to the SD card store.

Modbus Errors

E420	**UNIT**	**Modbus Setup Checksum** The Modbus setup has become corrupted. Check and correct the Modbus settings and turn the unit off and on again. If the message persists please consult with your supplier.
E421	**UNIT**	**Modbus Store A Checksum** The Store A Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store A in the Save/Restore menu.
E422	**UNIT**	**Modbus Store B Checksum** The Store B Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store B in the Save/Restore menu.
E423	**UNIT**	**Modbus SD Card Checksum** The SD Card store from which the Modbus configuration was restored from has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again to the SD card store.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MXD70 Series has been designed to include a wide range of self diagnostic tests, some of which are performed at switch on, and some on a continuous basis. This guide aims to provide a route to diagnosing and correcting any faults that may occur during normal operation. The table shown previously in this section gives a list that the MXD70 series generates, along with their probable causes. If after these checks the fault has not been cleared contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable quick diagnosis and correction of the problem.

- Serial number of the instrument, input and output cards.
- 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 transmitter type, cable length and type.
- Current output configuration.
- Relay connection configuration.

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

The Instrument Appears Dead
Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the MXD70 Series allows the unit to accept from 85 to 250V AC or DC, an alternative option allows operation from 18 to 32V AC or DC, check the connection label for voltage specification. 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 Input Reading Is Constantly Over-range, Under-range or Incorrect
- Ensure that the transmitter input is correctly connected (see Installation Section) and that the transmitter is not faulty or damaged.
- Check that loop mode is correctly set within the Channel Setup menu (see page 15).
- Check that Input mode is correctly set within the Channel Setup menu (see page 15).
- Check that the input scaling has been configured correctly (see Auxiliary mA Input Channel Setup, page 13).
- Check that no error messages are being displayed.
- Check the instrument calibration using a mA simulator, Adjust the channel calibration if necessary (see Calibration Section).
- Use another instrument to check the transmitter.

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 he current output has been configured properly.

Relays Appear to Malfunction

- Check that the unit is “On-Line” (see page 13)
- Check that the set point configuration is correct (see Setpoints, Current Outputs and Digital Input Configuration Guide)
- If the relays are vibrating or “chattering” as they pass the set point, check the hysteresis setting and increase if necessary.
- Ensure that the relays are connected properly (see MXD73 Installation guide or MXD75 Installation guide) and that the voltage/current levels are not exceeding 5A @ 30V DC or 5A @ 250V AC.
- Check that the instrument input cables are not picking up excessive noise.

Guarantee and Service

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

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

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

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

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Main Display ↔ Current Output Bargraphs ↔ Live Trends 1, 2 & 3* ↔ Channels Setup ↔ Setpoint / Relays Setup ↔ 4-20mA Outputs Setup ↔ Digital Inputs Setup ↔ Error Messages

*Optional Extra

Auxiliary mA Input Channel Setup - Auxiliary mA Input Calibration

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Menu

Main Menu
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- Reset Channel 1
- Reset Channel 2
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- Reset Entire Unit

Reset Channel
- Reset Sensor Cal
- Reset Solution Cal

4-20mA Outputs Reset
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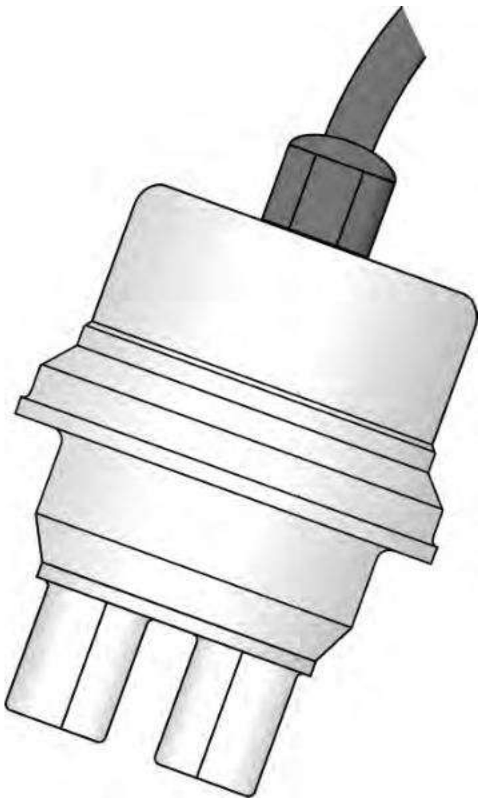
- 4-20mA Output B
- 4-20mA Output C
- 4-20mA Output D
- 4-20mA Output E
- 4-20mA Output F
- All 4-20mA Outputs

MXD70 SERIES

Multi-parameter Monitor



Suspended Solids / Turbidity
Setup and Operating
Guide

Preface

Product warranty

Both the MXD70 Suspended Solids Input Card and MXD70 Turbidity Input Card have 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. Sensor warranty is 12 months from date of shipment.

Limitation of warranty

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

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

Disclaimer

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

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

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 613-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. 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.

Contents

Blank

Suspended Solids Input Card Specification

Supported Sensor Types	Quadbeam S Series.
Sensor Input	Proportional probe signal from 0 to 16000
Linearization	The incoming probe signal can be converted to standard engineering units using one of two user definable linearization curves consisting of up to 10 points.
Sensor Cable Length	Up to 100 meters
Display Units	User selectable from, %, NTU, FTU, mg/l, g/l, ppm, ppt, EBC, OD In ranges of 0-10.00, 0-100.0, 0 – 9.999, 99.99, 999.9 and 9999 (ranges available vary depending on which units have been selected).
Repeatability	±10 Probe input signal.
Repeatability	± 0.1% of range.
Calibration Timer	Inbuilt calibration count down timer which will trigger an alarm when calibration interval has expired.
Sensor Input filter	Adjustable filter that averages the sensor input over a user selectable time (1 – 32 Seconds).

Turbidity Input Card Specification

Supported Sensor Types	Quadbeam T Series.
Sensor Input	Proportional probe signal from 0 to 32000
Linearization	The incoming probe signal can be converted to standard engineering units using one of two user definable linearization curves consisting of up to 10 points.
Sensor Cable Length	Up to 100 meters
Display Units	User selectable from, %, NTU, FTU, mg/l, g/l, ppm, ppt, EBC, OD In ranges of 0-10.00, 0-100.0, 0 – 9.999, 99.99, 999.9 and 9999 (ranges available vary depending on which units have been selected).
Repeatability	±10 Probe input signal.
Repeatability	± 0.1% of range.
Calibration Timer	Inbuilt calibration count down timer which will trigger an alarm when calibration interval has expired.
Sensor Input filter	Adjustable filter that averages the sensor input over a user selectable time (1 – 32 Seconds).

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Installation and Choice of Suspended Solids / Turbidity Sensors

Quadbeam Sensors incorporate engineering improvements to eliminate water ingress and also withstand the rapid temperature cycling (from 10^{0}C to 80^{0}C) which occurs during CIP cleaning cycles. By design, Quadbeam™ sensors automatically compensate for component ageing, sensor fouling and daylight interference.

The Quadbeam alternating light principle is based on a fundamental method of suspended solids measurement by shining a light of known intensity a fixed distance through a medium at a photocell detector. Suspended solids in the medium attenuate some of the light. The detector current gives a measure of the attenuation that corresponds to the suspended solids and turbidity measurement.

The Quadbeam alternating light principle compensates for variations in light intensity and detector sensitivity and detector sensitivity by using two detectors and two light sources switched on and off alternatively. The resulting probe signal can then be converted to appropriate engineering units by using the instruments linearisation curve (see page 14).

However some factors are far too complicated to be modelled or compensated for (e.g. bubbles, refraction effects due to elevated temperatures etc.) and must be minimised at the monitoring point.

The sensors are available with different sensitivity levels and measuring ranges by changing the distances between the light sources and detectors. Sensors with shorter path lengths can measure higher concentrations and have larger measuring ranges where as sensors with longer path lengths are more sensitive to small changes in suspended solids concentration.

S Series Suspended Solids Sensors

The S Series of suspended solids sensors are available as immersion or hygienic style sensors and both are capable of operating in temperatures up to 85^{0}C.

The immersion sensors are designed for continuous on-line monitoring of suspended solids in industrial and municipal water and waste water treatment plants, mining and refining operations.
Applications include: Effluent monitoring in clarifier overflow weirs, Final effluent monitoring, Mixed liquor suspended solids, Product loss in milk processing plants, Return activated sludge, Sludge blanket detection, White water solids concentration.

The hygienic style sensors are designed for installation directly into food product lines where CIP cleaning is used. The one piece Polypropylene construction with a surface finish of better than 0.9µm Ra eliminates bacteria traps. The sensors have an industry standard triclover connection.
Applications include: Milk fat measurement in the dairy industry, Percentage solids measurement in fruit and vegetable juices, Product breakthrough on plate heat exchanges, Solids content in whey.

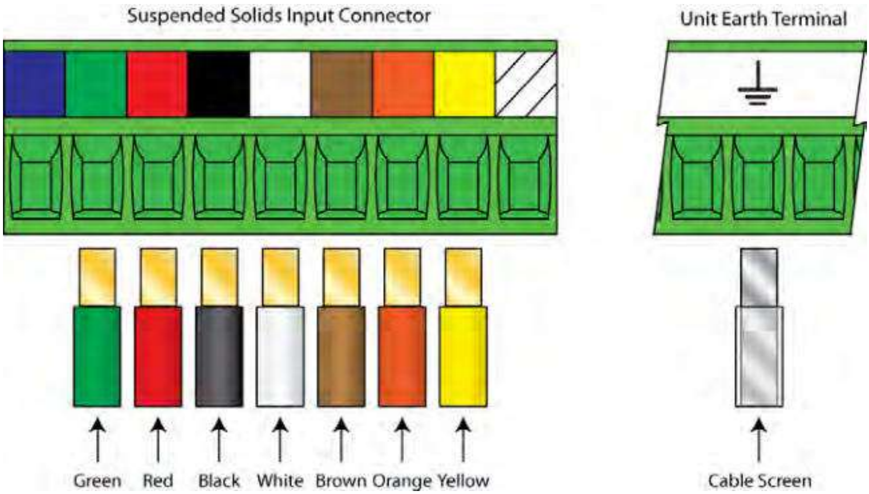
High temperature immersion and hygienic versions of the S series of suspended solids sensors are available. These sensors are manufactured from PVDF with a maximum working temperature of 105^{0}C.

T Series Turbidity Sensors

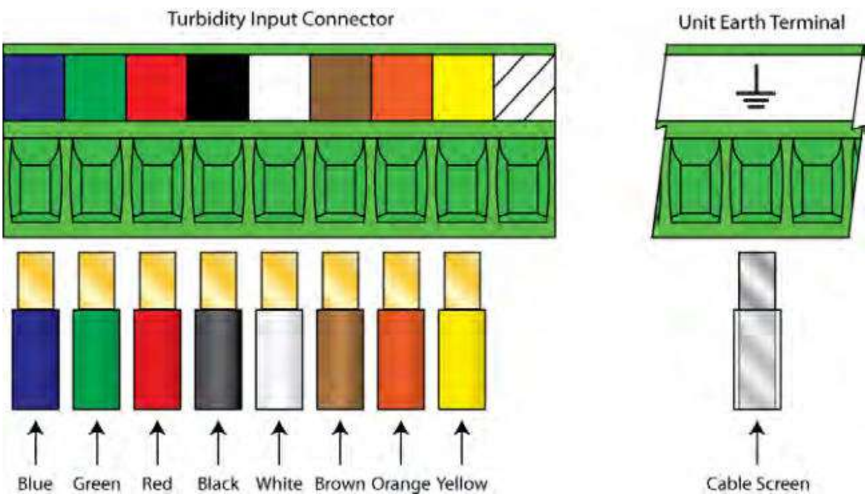
The T series of sensors are a new generation of Quadbeam turbidity process sensors, which combine both light attenuation and 90 degree scattered light measurements in a ratiometric sensor with digital communication. This technique vastly increases the sensitivity compared to sensors using just light attenuation. The T series of sensors are designed to meet the international standards for turbidity measurement – ISO 27027 and are capable of operating in temperatures up to 80^{0}C.

Applications include: Monitoring of clarifier overflow weirs, Final outlet of effluent from DAF plants, Raw water inlet measurements in water treatment plants, Surface water monitoring, Solids loading in rivers and streams, Product breakthrough on plate heat exchangers, Percentage solids in fruit and vegetable juices.

MXD73 – Panel Mount Termination Information

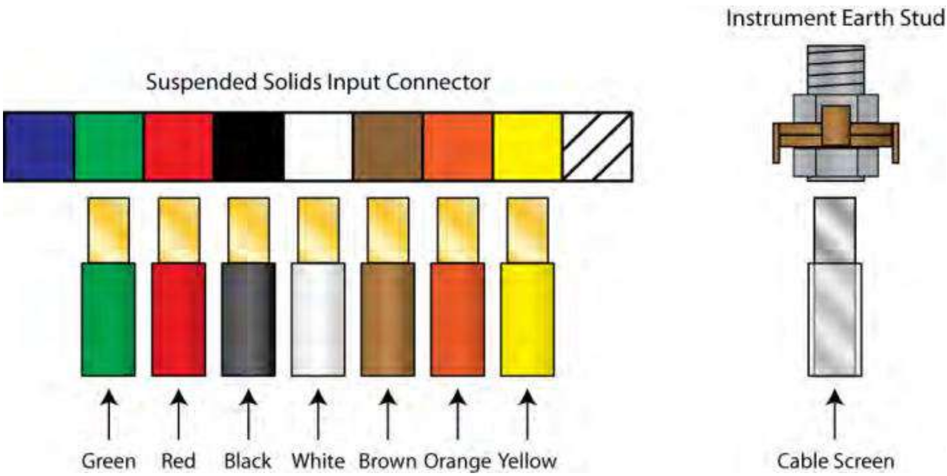


Suspended Solids Input Connection Details

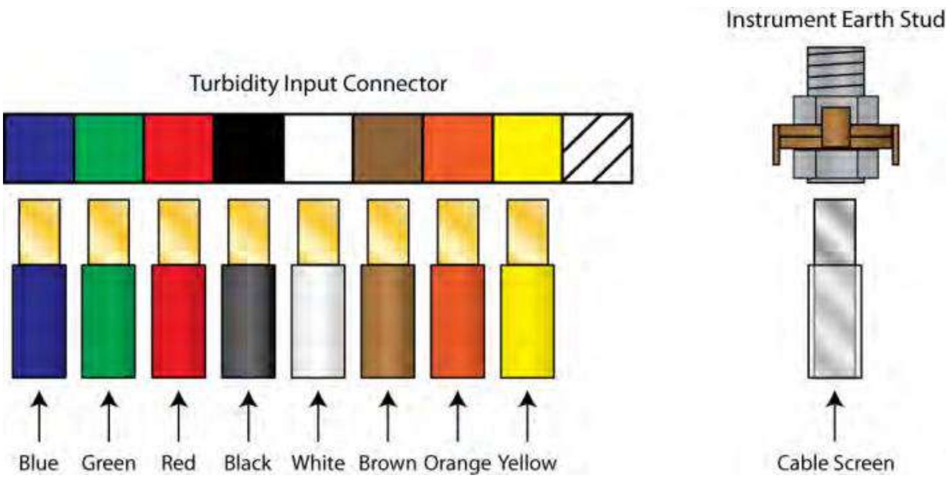


Turbidity Input Connection Details

MXD75 – Surface Mount Termination Information



Suspended Solids Input Connection Details

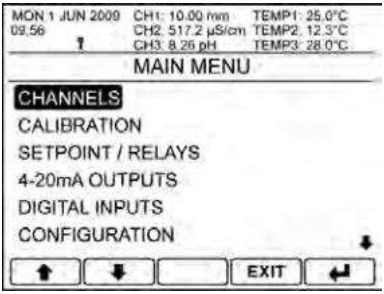


Turbidity Input Connection Details

Suspended Solids / Turbidity Input Channel Setup

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

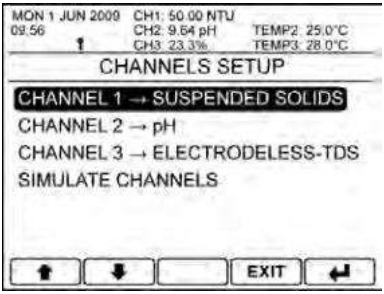
The default security access code is 1000

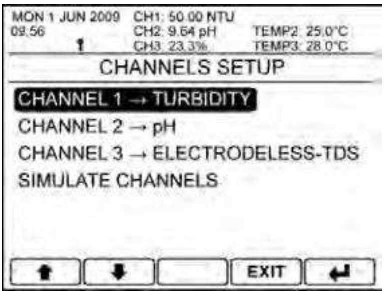


Main Menu

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

⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option

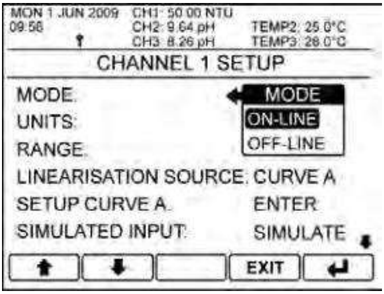




Select Channel

Depending on the installed card select either the Suspended Solids or Turbidity input channel you wish to edit.

⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

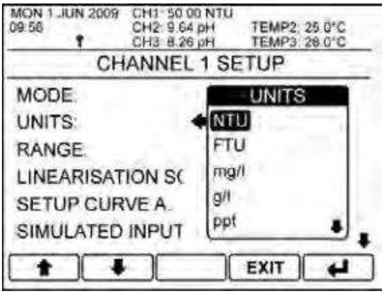
When the unit is placed in an off-line state “off-line” will appear in the channel messages section on the front screen.

If a “Cannot Edit Digital Input Has Control” message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Units

The channel can be setup to display the reading with the following units: NTU, FTU, mg/l, g/l, ppm, ppt, EBC, OD and %.

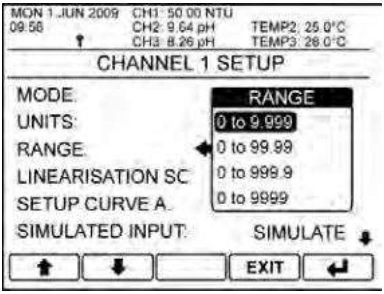
The relationship between these units and the incoming probe signal is determined by the linearisation curve data (see page 14) and range setting (see next item). They provide a qualitative rather than quantitative representation of the solids present in the sample for display purposes and setpoint / current output processing.

Optionally the instrument can be configured to work only with the raw probe units by setting the units to PS.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Range

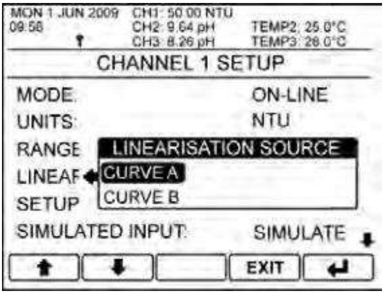
The range for the display can be set by selecting the decimal point position giving 9.999, 99.99, 999.9 and 9999. These again are for display and setpoint / current output purposes only.

Note. The ranges for the “%” units also include 100.0 and 10.00.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



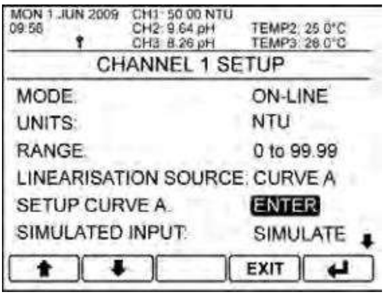
Linearisation Source

Select which of the two user defined curves A or B are used for calculation of the displayed reading.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



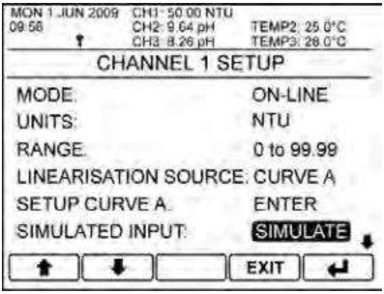
Setup Curve A / B

Enter the setup curve submenu. See page 14 for further information on setting up the linearisation curve.

🡅/🡇 – Select Option

EXIT – Return to Select Setup Channel

↵ – Enter Option



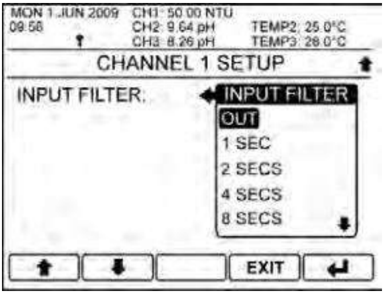
Simulated Input

See Simulated Channels section of the Setpoints, Current Outputs, Digital Inputs Configuration Guide for more information.

⬆/⬇ – Select Option

EXIT – Return to Select Setup Channel

↵ – Enter Option



Input Filtering (Averaging)

When very noisy environments are encountered, this function will allow the user to filter the sensor readings by taking a running average over the time period selected (from 1 to 32 seconds).

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

CIP Input

When assigned to a suspended solids channel the MXD70 series digital inputs feature a CIP function. This CIP input indicates to the instrument that a CIP event is in progress so that the sensor can be disabled so not to cause overstressing of the probe. For further information about setting the CIP input please consult the Setpoints, Current Outputs and Digital Input Configuration Guide.

Linearisation Curve Setup

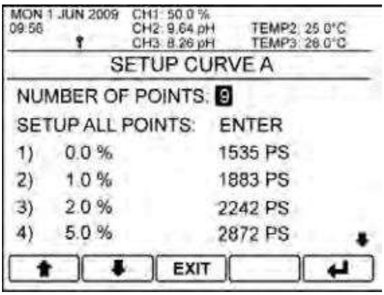
With many solutions the rate of infra-red absorption is non linear as the solids concentration increases. The purpose of this function is to take the probe signal values from several samples and convert this non-linearity to a straight line output. In many cases this is the only calibration procedure required.

It is recommended that the user should first prepare or obtain from the process a sample, which is as close as possible to the maximum range of suspended solids for which the instrument is to be configured. This will be your 100% point. For a two point linearisation curve the lower point is usually water. Where you want to enter more than two points, dilute your process sample to correspond with, for example, 25%, 50% and 75%. Up to10 points can be entered, with the more points that are used the more precise the conversion will be.

The MXD70 provides two methods, automatic and manual, for entering the curve data into the instrument.

Automatic Curve Entry

Automatic Curve Entry allows the user to set the number of points used in the curve. Then for each point define the engineering value and equate it to a live reading taken from the sensor placed in the desired sample. Note that the points can be sampled in any order as they are sorted into ascending probe signal values from within the software.

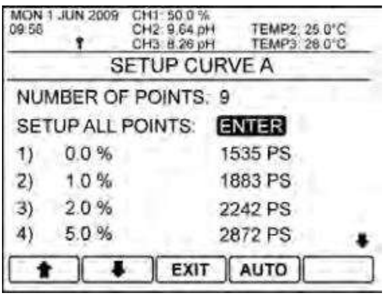


Number Of Points

Set the number of points used to define the linearisation curve. The instrument will ignore any points whose equivalent probe signal value is set to zero.

The curve can use between 2 – 10 points.

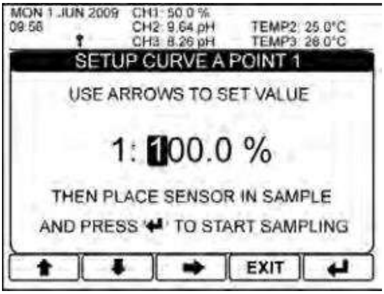
⬆/⬇	– Select Option
EXIT	– Return to Channel Setup
↵	– Enter Option



Setup All Points

Enter here to start the automatic linearisation routine and setup all curve points.

⬆/⬇	– Select Option
EXIT	– Return to Channel Setup
AUTO	– Enter Routine

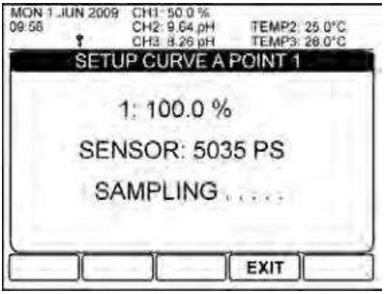


Setup Curve Point

Enter the equivalent engineering value for this point. Units and scale depend upon the settings in the channel setup menu.

The sensor must be placed in the required sample before pressing the enter button.

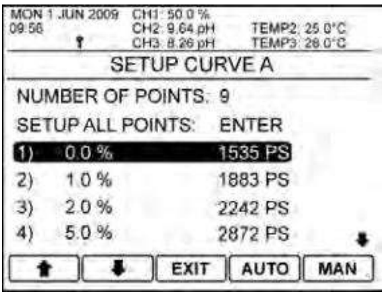
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Exit Setup Routine
↵	– Save Value and start sampling



Sensor Sampling

After each point has been set the instrument will sample the sensor and store the observed reading as the equivalent sensor value for that point. Once this value has been stored the instrument will automatically proceed to the next point to be entered.

EXIT	– Exit Setup Routine



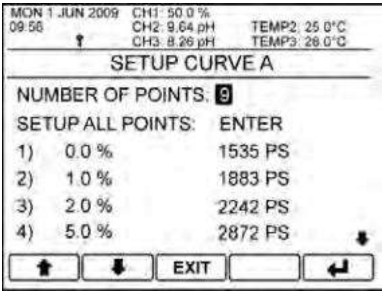
Auto Setup Individual Curve Point

If the user requires to automatically setup an individual point in the curve, they can select it from the available list and press the Auto button.

⬆/⬇	– Select point
EXIT	– Return to Channel Setup
AUTO	– Begin Auto Routine For This Point
MAN	– Begin Manual Routine For This Point

Manual Curve Entry

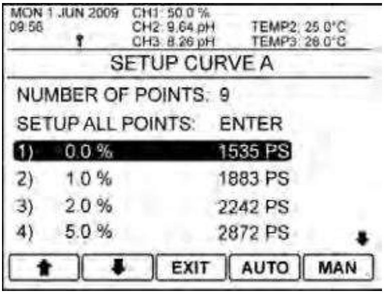
Manual Curve Entry also allows the user to set the number of points used in the curve. Then for each point the user can define the engineering value and then equate it to a known probe reading previously obtained. Note that the points can be entered in any order as they are sorted into ascending probe signal values from within the software.



Number Of Points

Set the number of points used to define the linearisation curve. The instrument will ignore any points whose equivalent probe signal value is set to zero. The curve can use between 2 – 10 points.

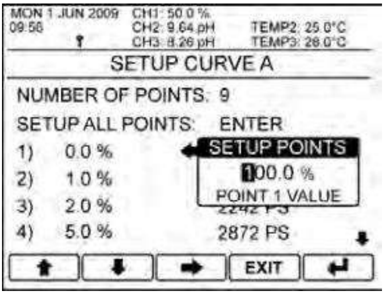
⬆/⬇	– Select Option
EXIT	– Return to Channel Setup
↵	– Enter Option



Manually Setup Individual Curve Point

If the user requires to manually setup an individual point in the curve, they can select it from the available list and press the Man button.

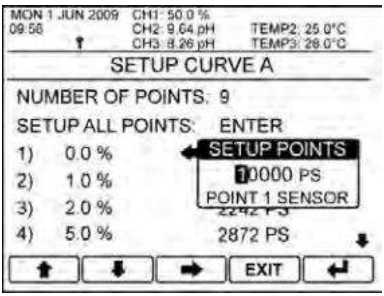
⬆/⬇	– Select point
EXIT	– Return to Channel Setup
AUTO	– Begin Auto Routine For This Point
MAN	– Begin Manual Routine For This Point



Enter Curve Point Data

Enter the equivalent engineering value for this point. Units and scale depend upon the settings in the channel setup menu.

⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Exit Setup Routine
↵	– Save Value



After entering the engineering value the instrument will automatically ask for the equivalent probe reading to be manually entered.

⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Exit Setup Routine
↵	– Save Value

Calibration

Calibration Procedures

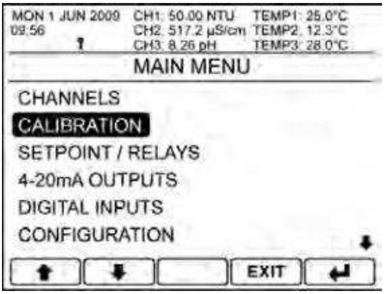
When trying to calibrate an instrument to measure suspended solids it is often difficult to keep the solids in suspension long enough for an accurate calibration to be made. The use of a magnetic stirrer in many cases will improve this.

In the linearisation setup menu the probe signals should have been entered from the prepared samples and the output will now be linear with percent solids. In many cases this is all that is required.

When the instrument is installed into the process the indicated readings can be verified by sample analysis in the laboratory. The readings produced from the laboratory may not correlate with the instrument readings. This is more likely in liquids, which have large particles, which separate out easily. For example: yeast, waste water, or white water in the paper industry. To correct for any discrepancies the instrument allows for both a Sensor Zero Adjustment and Sensor Span Adjustment.

Calibration Menu

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



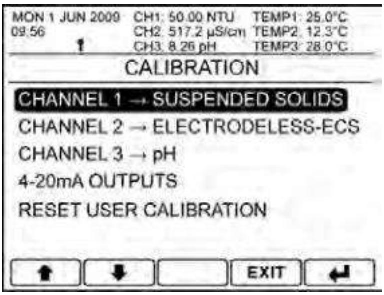
Main Menu

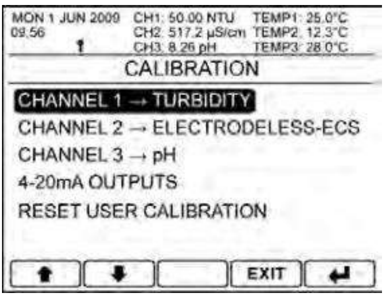
From the front screen press the menu button to show the main menu options and select Calibration.

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option





Select Channel

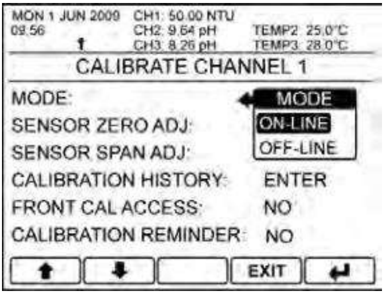
Depending on the installed card select either the Suspended Solids or Turbidity input channel you wish to calibrate.

Note. Calibration is not available when units set to PS.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Mode

Selecting off-line causes any setpoints associated with this channel to de-energise. Also causes any current outputs associated to hold their current value, useful for when commissioning or calibrating the instrument.

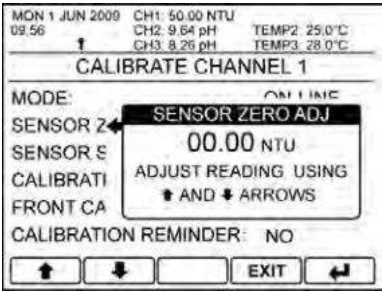
When the unit is placed in an off-line state "off-line" will appear in the channel messages section on the front screen.

If a "Cannot Edit Digital Input Has Control" message appears, then an associated digital input is currently controlling the on-line / off-line state of the channel.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Sensor Zero Adjustment

The sensor zero adjustment will either add or subtract a bias value to the zero point, which will shift the entire curve by this value. The slope of the curve is unchanged.

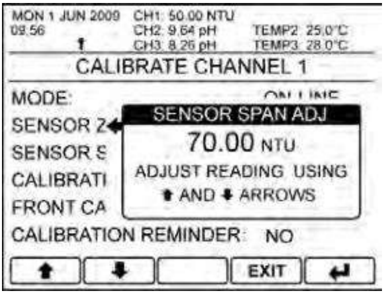
The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the adjustment.

The amount of zero offset adjustment currently being applied to the sensor is shown in the channel's calibration menu.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

↵ – Save Adjustment



Sensor Span Adjustment

If the zero point of the measuring point is correct but the highest calibration point is incorrect then the sensor span adjustment will shift the end point of the curve up or down. This changes the slope of the output curve.

The current sensor reading can be seen in the pop-up window and is adjusted by pressing the up and down arrows. When the reading is correct press the enter button to store the adjustment.

The amount of slope adjustment currently being applied to the sensor is shown in the channels calibration menu as a %. Where 100% equals no adjustment, a slope of greater than 100% equals a steeper slope and a slope of less than 100% equals a shallower slope.

⬆/⬇ – Adjust the Reading Up or Down

EXIT – Cancel

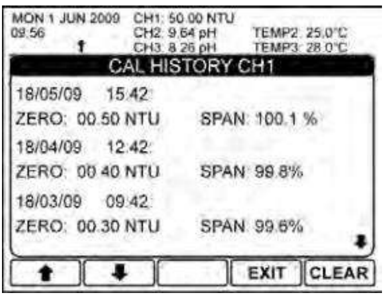
↵ – Save Adjustment

Enter Calibration History

The MXD70 series has a calibration history feature which allows the user to review the record of sensor calibrations.

To enter the calibration history menu press enter.

↵ – Enter Calibration History



Calibration History

The calibration history page provides a record of all Offset and Slope calibrations carried out.

The data includes the date and time of the calibration, the calculated Zero Offset and the calculated Span Slope.

⬆/⬇ – Move To Next Page Up or Down

EXIT – Return To Calibration Menu

CLEAR – Clear All of the Calibration History

Front Screen Calibration Access Enable

When enabled front calibration access allows direct entry into the calibration menu from the front screen. It also disables the security access system within the calibration menu enabling the calibration functions without having to enter the security access code.

🡅/🡇	– Select Option
EXIT	– Cancel
↵	– Save Selection

Front Screen Calibration Access

When the calibration access is enabled press the “CAL” button to bring up the pop-up to select which channel to calibrate.

CAL	– Enter Calibrate Channel Select Menu
🡄/🡆	– Scroll Around Menus
Menu	– Access Main Menu

Select Channel to Calibrate

From the pop-up select the channel the user wishes to calibrate. Only channels whose front calibration access has been enabled will appear.

🡅/🡇	– Select Option
EXIT	– Cancel
↵	– Enter Menu

Calibration Reminder

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

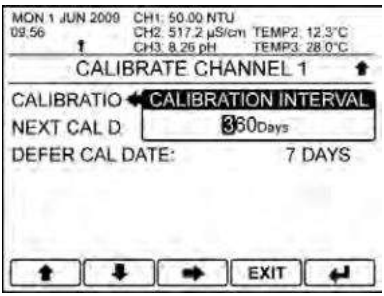
If the interval has expired and the alarm has activated, then on the completion of a successful sensor calibration, the alarm will clear and the next cal date will be automatically incremented by calibration interval.

If the user completes a successful sensor calibration before the calibration interval has expired, then the instrument will ask the user whether they wish to update the next cal due date by the calibration interval.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Calibration Interval

Sets the interval time for the calibration alarm.

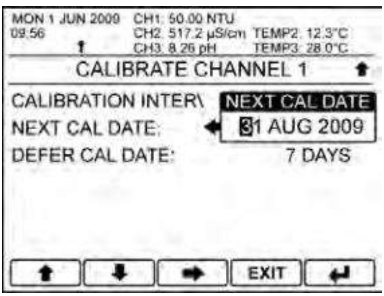
The Next Cal Date will update to show the date of the next calibration alarm.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Next Calibration Date

Sets the exact date of the next calibration alarm.

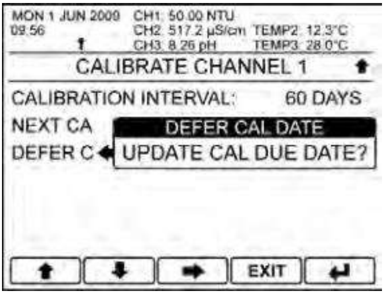
The Calibration Interval will update to show the number of days to the next calibration date.

⬆/⬇ – Increase / Decrease Digit or Text

➡ – Select Next Item

EXIT – Cancel

↵ – Save Entry



Defer Calibration Date

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

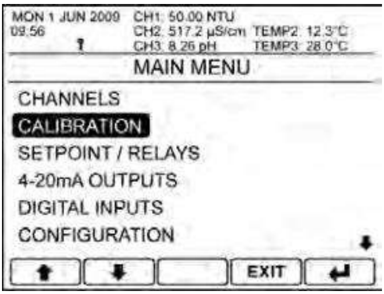
Only appears once the calibration interval has expired.

YES – Increase Interval

NO – Cancel

Resetting the User Calibration

If required the user can reset the user calibrations to their default states.



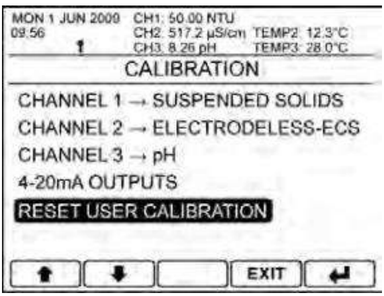
Main Menu

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

🡅/🡇 – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



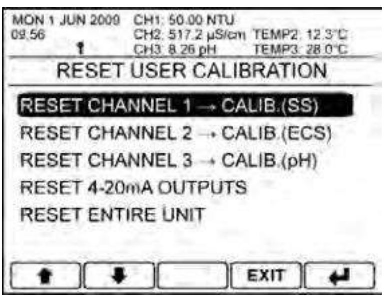
Calibration

Select Reset User Calibration.

🡅/🡇 – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



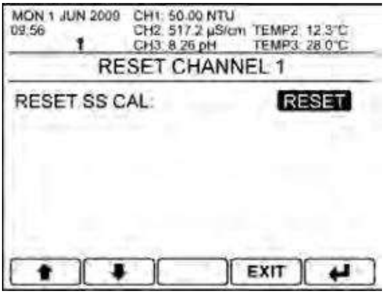
Reset User Calibration

Select the required Suspended Solids or Turbidity input channel.

🡅/🡇 – Select Option

EXIT – Return to Calibration

↵ – Enter Option



Reset Channel User Calibration

Select to reset the channels user calibration.

⬆/⬇	– Select Option
EXIT	– Return to Reset User Calibration
↵	– Enter Option

Channel Calibration

Blank

Appendix A – Example Dairy Readings

The table below lists example sensor readings when immersed in milk and cream. These are only guidelines and it is recommended that you enter values using samples from your own process.

Example No.1: Whole Milk (4% Fat) using a S20 series sensor

100% Water	Probe Signal = 1535
1% Milk	Probe Signal = 1883
2% Milk	Probe Signal = 2242
5% Milk	Probe Signal = 2872
10% Milk	Probe Signal = 3294
25% Milk	Probe Signal = 3911
50% Milk	Probe Signal = 4525
100% Milk	Probe Signal = 5035

Example No.2: Cream (40% Fat) using a S10 series sensor

100% Water	Probe Signal = 1510
100% Milk (4% Fat)	Probe Signal = 4074
50% Cream (20% Fat)	Probe Signal = 4919
100% cream (40 % Fat)	Probe Signal = 5244

Blank

Appendix B – Instrument Configuration

Instrument Configuration

Instrument Type		**Serial Number**		**Software Version**	
Power Supply Type					
Channel 1 Input Card Type		**Serial Number**			
Channel 2 Input Card Type		**Serial Number**			
Channel 3 Input Card Type		**Serial Number**			
Output Expansion Card Type		**Serial Number**			
Software Expansion		**Unlock Code**			
Software Expansion		**Unlock Code**			

Instrument Settings

Security Access Code					
Language					
Front Screen Ch1 Shown		**Front Screen Ch1 Secondary Reading i)**		**Front Screen Ch1 Secondary Reading ii)**	
Front Screen Ch2 Shown		**Front Screen Ch2 Secondary Reading i)**		**Front Screen Ch2 Secondary Reading ii)**	
Front Screen Ch3 Shown		**Front Screen Ch3 Secondary Reading i)**		**Front Screen Ch3 Secondary Reading ii)**	
Front Screen Ch1 Label					
Front Screen Ch2 Label					
Front Screen Ch3 Label					
4-20mA Output Slot 1		**4-20mA Output Slot 2**			
Menu Header i)		**Menu Header ii)**		**Menu Header iii)**	
Menu Header iv)		**Menu Header v)**		**Menu Header vi)**	

Channel Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Description			
Units			
Sensor / Probe Type			
Cell Constant			
Range			
Linearisation Source			
TDS Factor			
Membrane Correction Factor			
Bias Voltage			
mA Input: Loop Mode			
mA Input: Input Mode			
Set 0mA Input			
Set 4mA Input			
Set 20mA Input			
Temperature Input Sensor			
Temperature Units			
Temperature Compensation: In/Out			
Temperature Compensation Slope			
Temperature Compensation: Auto / Manual			
Fixed Temperature Input			
Input Salinity			
Pressure Compensation: Auto / Manual			
Pressure Mode: Input / 24V Loop			
Pressure Units			
Pressure 4mA Input			
Pressure 20mA Input			
Fixed Pressure Input			
Cable Compensation			
Input Filter			

Curve Setup (available options vary with card type and configuration)

	Channel 1		Channel 2		Channel 3	
Curve A						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						
Curve B						
No. of points						
Input Range						
Custom Units						
Custom Range						
Point 1						
Point 2						
Point 3						
Point 4						
Point 5						
Point 6						
Point 7						
Point 8						
Point 9						
Point 10						

Channel Calibration Setup (available options vary with card type and configuration)

	Channel 1	Channel 2	Channel 3
Mode: Online / Offline			
Calibration Principle			
Calibration Manual Temp Input			
Calibration Units			
Calibration Manual Pressure Input			
Span Cal Point			
Enable Auto Span Cal			
Offset Value			
Slope Value			
Temperature Offset			
Sensor Condition			
Front Calibration Access			
Calibration Reminder			
Calibration Interval			

Setpoints Setup (available options vary with card type and configuration)

	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5	Setpoint 6
Channel						
Input Source						
Trigger						
High Value						
Low Value						
USP Pre-Trigger						
Mode						
Cycle Time						
Proportional Band						
Delay						
Hysteresis						
Dose Alarm						
Dose Alarm Time						
Initial Charge						
Charge Time						
Charge Access						
Alarm Mode						
Clean Duration						
Clean Interval						
Clean Mode						
Clean Recovery						
Clean Delay						

Current Output Setup (available options vary with card type and configuration)

	Current Output A	Current Output B	Current Output C	Current Output D	Current Output E	Current Output F
Channel						
Input Source						
Output 0 – 20mA / 4 - 20mA						
Zero						
Span						
On Error						

Digital Inputs (available options vary with card type and configuration)

	Digital Input 1	Digital Input 2	Digital Input 3	Digital Input 4	Digital Input 5	Digital Input 6	Digital Input 7	Digital Input 8
Channel								
Function								
Range Change								
Switch Store								
Cleaning Setpoint								
Polarity								
4-20 Output Level								

Service Alarms

	Channel 1	Channel 2	Channel 3
Service Reminder			
Service Interval			
Next Service Date			

Appendix C – Error Messages

Internal Error Messages

E001	**UNIT**	**Processor RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E002	**UNIT**	**External RAM Read/Write Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E003	**UNIT**	**Internal Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists, Reset Whole unit from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E004	**UNIT**	**Output Card Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E005	**UNIT**	**Internal Outputs Setup Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E006	**UNIT**	**For Future Use**
E007	**UNIT**	**Unit Setup Checksum Error** The instrument configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the whole unit from the Load Default Settings option in the Save/Restore menu or consult with your supplier, as this unit may require a repair.
E008	**UNIT**	**Unit Store A Checksum Error** The data in Unit Store A has been corrupted. Save the current setup back to Unit Store A in the Save/Restore menu.
E009	**UNIT**	**Unit Store B Checksum Error** The data in Unit Store B has been corrupted. Save the current setup back to Unit Store B in the Save/Restore menu.
E010 to E013	**UNIT**	**Maths Error** There has been an internal maths calculation failure. As such, it should not appear if the software is functioning properly. The error message should clear after approx. 5 seconds. If the error continues to be displayed consult with your supplier, as this unit may require to be returned for repair.
E014	**UNIT**	**Contrast Chip Error** The Contrast Chip is not operating correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as this unit may require to be returned for repair.
E015	**UNIT**	**Unit SD Card Checksum Error** The SD Card store from which the entire unit was restored from has become corrupted. Check the unit's settings and then save the settings again to the SD card store.
E016	**UNIT**	**SD CARD FULL** The SD card has become full. To continue use, either replace with a blank SD card or remove existing files from SD card

Input Channel Errors

E030 **E080** **E130**	**CH1** **CH2** **CH3**	**Input Card Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E031 **E081** **E131**	**CH1** **CH2** **CH3**	**Setup Checksum Error** The current channel's configuration has for some reason become corrupted. Try switching the unit off and then on again. If the message persists reset the current channel from the Reset Unit Settings option in the Save/Restore menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E032 **E082** **E132**	**CH1** **CH2** **CH3**	**Store A Checksum Error** The data in the channel's Store A has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store A in the Save/Restore menu.
E033 **E083** **E133**	**CH1** **CH2** **CH3**	**Store B Checksum Error** The data in the channel's Store B has become corrupted. Check the channel's current setup. Then save the setup back to channel's Store B in the Save/Restore menu.
E034 **E084** **E134**	**CH1** **CH2** **CH3**	**Factory Cal Checksum Error** Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E035 **E085** **E135**	**CH1** **CH2** **CH3**	**User Cal Checksum Error** The Channel's User Cal has for some reason become corrupted. Try switching the unit off and then on again. If the message persists Reset the Channel from the Reset User Calibration option in the Calibration menu or consult with your supplier, as the channel's input card may require to be returned for repair.
E036 **E086** **E136**	**CH1** **CH2** **CH3**	**Sensor Cal Out Of Spec** The last Sensor Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E037 **E087** **E137**	**CH1** **CH2** **CH3**	**Sensor Zero Cal Out Of Spec** The last Sensor Zero Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E038 **E088** **E138**	**CH1** **CH2** **CH3**	**Sensor Span Cal Out Of Spec** The last Sensor Span Calibration was out of specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E039 **E089** **E139**	**CH1** **CH2** **CH3**	**No Signal** No Sensor connected or there is 'zero' detector current. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E040 **E090** **E140**	**CH1** **CH2** **CH3**	**Signal Overload** The gain step is equal to 0 and the A/D output is over 255. This cannot happen in a liquid but could happen if the sensor is in full sunlight. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.

E041 **E091** **E141**	**CH1** **CH2** **CH3**	**Partial Depletion** Large difference between the detectors, i.e. one very dirty. This alarm will come up if there is a difference of 3:1 between the detectors. Remove sensor and clean sensor fingers. The probe sensor units (PSU) will be set to 16000 or 32000 if turbidity. If this message persists, please consult with your supplier.
E042 **E092** **E142**	**CH1** **CH2** **CH3**	**Full Depletion** Attenuation too high or the real probe signal goes above 14000. The probe sensor units (PSU) will be set to 16000. If this message persists, please consult with your supplier.
E043 **E093** **E143**	**CH1** **CH2** **CH3**	**Sensor User Offset At Limit** The last Sensor Offset Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E044 **E094** **E144**	**CH1** **CH2** **CH3**	**Sensor User Slope At Limit** The last Sensor Slope Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E045 **E095** **E145**	**CH1** **CH2** **CH3**	**Sensor User Slope < Spec** The last Sensor Slope Calibration was less than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E046 **E096** **E146**	**CH1** **CH2** **CH3**	**Sensor User Slope > Spec** The last Sensor Slope Calibration was greater than the recommended specification, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E047 **E097** **E147**	**CH1** **CH2** **CH3**	**Sensor Open Circuit** The sensor input is at open circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E048 **E098** **E148**	**CH1** **CH2** **CH3**	**Sensor Short Circuit** The sensor input is at short circuit, check sensor condition and connections. If the message persists please consult with your supplier.
E049 **E099** **E149**	**CH1** **CH2** **CH3**	**Sensor Positive Saturation** The sensor input is greater than the maximum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E050 **E100** **E150**	**CH1** **CH2** **CH3**	**Sensor Negative Saturation** The sensor input is less than the minimum measurable input level, Check Sensor condition and connections. If the message persists please consult with your supplier.
E051 **E101** **E151**	**CH1** **CH2** **CH3**	**Sensor Input Over Range** The sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E052 **E102** **E152**	**CH1** **CH2** **CH3**	**Sensor Input Under Range** The sensor reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.

E053 **E103** **E153**	**CH1** **CH2** **CH3**	**Temp Sensor Fault** The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check that the temperature sensor is set to the correct type in the channel setup menu. Under this condition, the unit will default to the fixed temperature setting for compensation purposes. If the message persists please consult with your supplier.
E054 **E104** **E154**	**CH1** **CH2** **CH3**	**Temp Input Over Range** The temperature sensor reading is greater than the specified upper limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E055 **E105** **E155**	**CH1** **CH2** **CH3**	**Temp Input Under Range** The temperature reading is less than the specified limit, check channel settings, Sensor condition and connections. If the message persists please consult with your supplier.
E056 **E106** **E156**	**CH1** **CH2** **CH3**	**Temp Comp Outside Limits** The temperature reading is less than 0.0C or greater than 150.0C, leading to an error in compensation.
E057 **E107** **E157**	**CH1** **CH2** **CH3**	**Polar Zero Cal At Limit** The last Polargraphic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E058 **E108** **E158**	**CH1** **CH2** **CH3**	**Polar Span Cal At Limit** The last Polargraphic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E059 **E109** **E159**	**CH1** **CH2** **CH3**	**Galvanic Zero Cal At Limit** The last Galvanic Zero Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E060 **E110** **E160**	**CH1** **CH2** **CH3**	**Galvanic Span Cal At Limit** The last Galvanic Span Calibration was out of limits, check sensor condition and connections and repeat calibration. If the message persists please consult with your supplier.
E061 **E111** **E161**	**CH1** **CH2** **CH3**	**Pressure Sensor Over Range** The pressure sensor reading is greater than the specified limit for the probe.
E062 **E112** **E162**	**CH1** **CH2** **CH3**	**Pressure Sensor Under Range** The pressure sensor reading is less than the specified limit for the probe.
E063 **E113** **E163**	**CH1** **CH2** **CH3**	**Pressure Above 20mA** The pressure sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.
E064 **E114** **E164**	**CH1** **CH2** **CH3**	**Pressure Below 4mA** The pressure sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E065 **E115** **E165**	**CH1** **CH2** **CH3**	**AUX mA Input Above 20mA** The sensor input is greater than 20mA, check sensor condition and connections. If the message persists please consult with your supplier.

E066 **E116** **E166**	**CH1** **CH2** **CH3**	**AUX mA Input Below 4mA** The sensor input is less than 4mA, check sensor condition and connections. If the message persists please consult with your supplier.
E067 **E117** **E167**	**CH1** **CH2** **CH3**	**Sensor 0mV Cal Out of Spec** The pH 0mV calibration for this channel is outside recommended specifications.
E068 **E118** **E168**	**CH1** **CH2** **CH3**	**Calibration Due** The time since the last calibration was performed on this channel has exceeded the time set in the calibration menu.
E069 **E119** **E169**	**CH1** **CH2** **CH3**	**Planned Service Due** The Planned Service interval for this unit has expired. Please contact LTH Electronics at the details below: LTH Electronics ltd Chaul End Lane Luton Beds LU4 8EZ Tel. 0044 (0) 1582 593693 Fax 0044 (0) 1582 598036 Email sales@lth.co.uk NB. LTH overseas users should contact their LTH distributor – See www.lth.co.uk for details.
E070 **E120** **E170**	**CH1** **CH2** **CH3**	**SD Card Checksum Error** The SD Card store from which this channel was restored from has become corrupted. Check the channel's settings and then save the settings again to the SD card store.
E071 **E121** **E171**	**CH1** **CH2** **CH3**	**Gain Error** The sensor gain has been exceeded. If this message persists, please consult with your supplier.
E072 **E122** **E172**	**CH1** **CH2** **CH3**	**Invalid Linearisation Curve** A minimum of 2 linearisation points are required. Please check linearisation curve settings in the channel setup menu for this channel.
E073 **E123** **E173**	**CH1** **CH2** **CH3**	**Linearisation Over-Range** The linearisation result is greater than 9999 (or 100.0% when using %).
E074 **E124** **E174**	**CH1** **CH2** **CH3**	**Linearisation Under-Range** The linearisation result is less than 0.
E075 **E125** **E175**	**CH1** **CH2** **CH3**	**Curve Low Limit** The incoming probe signal is less than the lowest point in the linearisation curve.
E076 **E126** **E176**	**CH1** **CH2** **CH3**	**Curve High Limit** The incoming probe signal is greater than the highest point in the linearization curve.
E077 **E127** **E177**	**CH1** **CH2** **CH3**	**Custom Error** Contact your supplier for details.

Setpoint Errors

E180 SP1 E190 SP2 E200 SP3 E210 SP4 E220 SP5 E230 SP6		**Dose Alarm Error** The Setpoint has been dosing for longer than the Dose Alarm time as defined in the setpoint menu.
E181 to E184 E191 to E194 E201 to E204 E211 to E214 E221 to E224 E231 to E234	SP1 SP2 SP3 SP4 SP5 SP6	**For Future Use**
E185 SP1 E195 SP2 E205 SP3 E215 SP4 E225 SP5 E235 SP6		**Store A Checksum Error** The Store A Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E186 SP1 E196 SP2 E206 SP3 E216 SP4 E226 SP5 E236 SP6		**Store B Checksum Error** The Store B Save for the Channel associated with this Setpoint has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E187 SP1 E197 SP2 E207 SP3 E217 SP4 E227 SP5 E237 SP6		**Setup Checksum Error** The Setup for this Setpoint has become corrupted. Check and correct the setpoint settings and turn the unit off and on again. If the message persists please consult with your supplier.
E188 SP1 E198 SP2 E208 SP3 E218 SP4 E228 SP5 E238 SP6		**SD Card Checksum Error** The SD Card store from which this Setpoint was restored from has become corrupted. Check the setpoint's settings in the setpoint menu and then save the settings again to the SD card store.

Current Output Errors

E240	A	**Current OP Hardware Fault** 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.
E250	B	
E260	C	
E270	D	
E280	E	
E290	F	
E241	A	**Sensor IP<Current OP Zero** The sensor input level is below that set for the current output zero.
E251	B	
E261	C	
E271	D	
E281	E	
E291	F	
E242	A	**Sensor IP>Current OP Span** The sensor input level is above that set for the current output span.
E252	B	
E262	C	
E272	D	
E282	E	
E292	F	
E243	A	**Sensor IP<Current OP Span** The sensor input level is below that set for the current output Span.
E253	B	
E263	C	
E273	D	
E283	E	
E293	F	
E244	A	**Sensor IP>Current OP Zero** The sensor input level is above that set for the current output Zero.
E254	B	
E264	C	
E274	D	
E284	E	
E294	F	
	A	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E255	B	
E265	C	
E275	D	
E285	E	
E295	F	
E246	A	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E256	B	
E266	C	
E276	D	
E286	E	
E296	F	

E245 **E255** **E265** **E275** **E285** **E295**	**A** **B** **C** **D** **E** **F**	**Store A Checksum Error** The Store A Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E246 **E256** **E266** **E276** **E286** **E296**	**A** **B** **C** **D** **E** **F**	**Store B Checksum Error** The Store B Save for the channel associated with this current output has become corrupted. Check the current output's settings in the current output menu and then save the settings again in the Channel's Store B in the Save/Restore menu.

Digital Input Errors

E301 E306 E311 E316 E321 E326 E331 E336	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store A Checksum Error** The Store A Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E302 E307 E312 E317 E322 E327 E332 E337	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Store B Checksum Error** The Store B Save for the channel associated with this digital input has become corrupted. Check the digital input's settings in the digital input menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E303 E308 E313 E318 E323 E328 E333 E338	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**Setup Checksum Error** The Setup for this Digital Input has become corrupted. Check and correct the digital inputs settings and turn the unit off and on again. If the message persists please consult with your supplier.
E304 E309 E314 E319 E324 E329 E334 E339	DIG 1 DIG 2 DIG 3 DIG 4 DIG 5 DIG 6 DIG 7 DIG 8	**SD Card Checksum Error** The SD Card store from which this Digital Input was restored from has become corrupted. Check the Digital Input's settings in the digital input menu and then save the settings again to the SD card store.

Communication Errors

E340 **E342** **E344**	**CH1** **CH2** **CH3**	**Comms Failure** The Channel's Input Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E341 **E343** **E345**	**CH1** **CH2** **CH3**	**Comms Error** The Channel's Input Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the channel's input card may require to be returned for repair.
E346	**UNIT**	**Output Comms Failure** The Basic Internal Outputs are not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E347	**UNIT**	**Output Comms Error** The Basic Internal Outputs are not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the unit may require to be returned for repair.
E348	**OP**	**Output Option Comms Failure** The Output Option Card is not responding. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option card may require to be returned for repair.
E349	**OP**	**Output Option Comms Error** The Output Option Card is not Operating Correctly. Try switching the unit off and then on again. If the message persists, consult with your supplier, as the Output Option Card may require to be returned for repair.

Calculation Errors

E400 **C1** **E411** **C2**		**Calculation Over Range** The Calculation reading is greater than the specified upper limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E401 **C1** **E411** **C2**		**Calculation Under Range** The Calculation reading is less than the specified lower limit, check channel settings, calculation configuration, sensor condition and connections. If the message persists please consult with your supplier.
E402 **C1** **E412** **C2**		**Calculation Setup Checksum** The Setup for this Calculation has become corrupted. Check and correct the calculation settings and turn the unit off and on again. If the message persists please consult with your supplier.
E403 **C1** **E413** **C2**		**Calculation Store A Checksum** The Store A Save for the channel associated with this calculation has become corrupted. Check the calculation’s settings in the calculation menu and then save the settings again in the Channel's Store A in the Save/Restore menu.
E404 **C1** **E414** **C2**		**Calculation Store B Checksum** The Store B Save for the channel associated with this calculation has become corrupted. Check the calculation’s settings in the calculation menu and then save the settings again in the Channel's Store B in the Save/Restore menu.
E405 **C1** **E415** **C2**		**Calculation SD Card Checksum** The SD Card store from which this Calculation was restored from has become corrupted. Check the Calculation's settings in the Calculation menu and then save the settings again to the SD card store.

Modbus Errors

E420	**UNIT**	**Modbus Setup Checksum** The Modbus setup has become corrupted. Check and correct the Modbus settings and turn the unit off and on again. If the message persists please consult with your supplier.
E421	**UNIT**	**Modbus Store A Checksum** The Store A Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store A in the Save/Restore menu.
E422	**UNIT**	**Modbus Store B Checksum** The Store B Save for the Modbus Configuration has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again into Store B in the Save/Restore menu.
E423	**UNIT**	**Modbus SD Card Checksum** The SD Card store from which the Modbus configuration was restored from has become corrupted. Check the Modbus settings in the Modbus menu and then save the settings again to the SD card store.

Fault Finding

NOTE: THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MXD70 Series has been designed to include a wide range of self diagnostic tests, some of which are performed at switch on, and some on a continuous basis. This guide aims to provide a route to diagnosing and correcting any faults that may occur during normal operation. The table shown previously in this section gives a list that the MXD70 series generates, along with their probable causes. If after these checks the fault has not been cleared contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable quick diagnosis and correction of the problem.

- Serial number of the instrument, input and output cards.
- The approximate date of purchase.
- The software version number.
- 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 transmitter type, cable length and type.
- Current output configuration.
- Relay connection configuration.

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

The Instrument Appears Dead
Check that power is available to the unit. Using a voltmeter, set to AC or DC, check the power supply voltage at the connector. The design of the MXD70 Series allows the unit to accept from 85 to 250V AC or DC; an alternative option allows operation from 18 to 32V AC or DC, check the connection label for voltage specification. 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 Input Reading Is Constantly Over-range, Under-range or Incorrect
- Ensure that the probe input is correctly connected (see Installation Section) and that the transmitter is not faulty or damaged.
- Check that linearisation curve has been correctly entered within the Channel Setup menu (see page 14).
- Check the probe for fouling or damage.
- Check the raw probe signal reading in a high and low sample. If the probe signal is not reading as expected contact a service engineer for guidance.
- Try resetting the offset and slope calibration (see page 22) and re-calibrate the probe in high and low samples.
- Where extension cables have been used, try connecting the sensor directly to the instrument.

Faults

The sensor Reading is Incorrect

- Ensure the sensor is mounted properly, that there is at least 25mm (1”) of clearance around the head of the probe.
- Establish that the sensor is specified to work within the range that is being monitored.

Current Output Is Incorrect or Noisy

- Check that the unit is “On-Line” (see page 10)
- 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 he current output has been configured properly.

Relays Appear to Malfunction

- Check that the unit is “On-Line” (see page 10)
- Check that the set point configuration is correct (see Setpoints, Current Outputs and Digital Input Configuration Guide)
- If the relays are vibrating or “chattering” as they pass the set point, check the hysteresis setting and increase if necessary.
- Ensure that the relays are connected properly (see MXD73 Installation guide or MXD75 Installation guide) and that the voltage/current levels are not exceeding 5A @ 30V DC or 5A @ 250V AC.
- Check that the instrument input cables are not picking up excessive noise.

Guarantee and Service

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

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

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

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

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Menu

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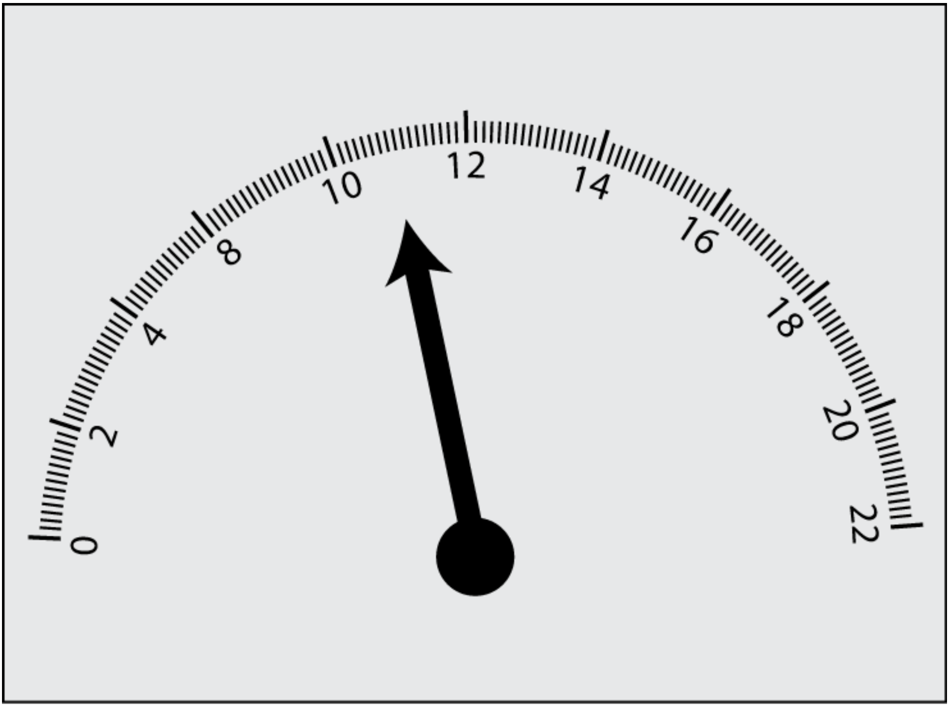
MXD70 SERIES

Multi-parameter Monitor



Setpoints, Current Outputs, And Digital Inputs Configuration Guide

Preface

Product warranty

The MXD70 Series has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. Certificate No: FM 13843

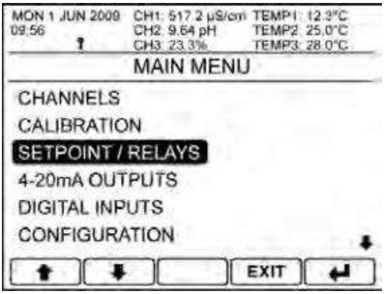
Note: The standards referred to in the design and construction of LTH products are those prevailing at the time of product launch. As the standards are altered from time to time, we reserve the right to include design modifications that are deemed necessary to comply with the new or revised regulations.

Contents

Blank

Setpoints

The MXD70 Series can be fitted with up to six setpoint relays designated 1 – 6. Setpoints 1 – 4 are “Change Over” relays while 5 – 6 are “Normally Open” relays. Each individual setpoint can be assigned to any one of the Sensor Input Channels. The Setpoint/Relays menu contains all of the necessary setup functions to configure the setpoint sources. The instrument indicates the status of the enabled setpoints by means of 6 LED indicators located above the main instrument display. A lit LED indicates that the setpoint / Relay is active. If the LED is blinking it indicates a dose alarm has occurred on that setpoint.



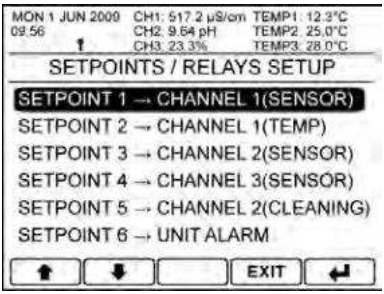
Main Menu

From the front screen press the menu button to show the main menu options and select Setpoint/Relays.

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



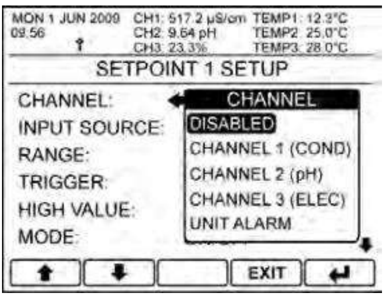
Setpoints / Relays Setup

Select the Setpoint you wish to edit.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



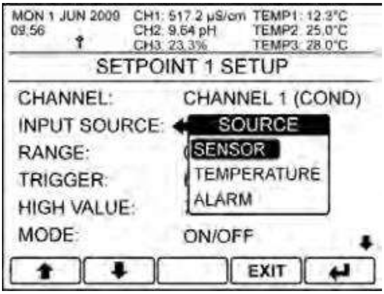
Channel

The “Sensor Input Channel” the setpoint is to be associated with. The channels shown depend on the configuration of the instrument. For more information regarding the Unit Alarm option see the setpoint alarm mode section.
To disable the setpoint select the disabled option. This will turn off the setpoint and clear any error messages associated with it.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



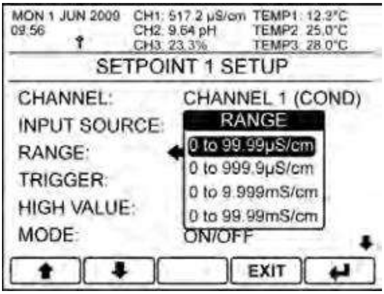
Input Source

The input source for the selected setpoint.
Available options vary depending on whether the appropriate source is enabled in the channel's setup menu.
Alarm option – see the setpoint alarm mode section.
Cleaning option – see the setpoint cleaning mode section (not available on all input card types.)

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



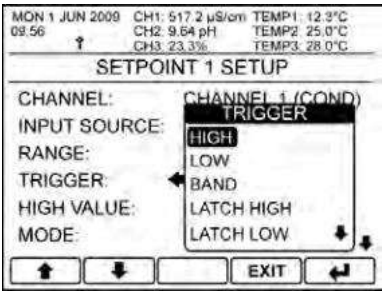
Range

The setpoint's operating range.
This is only available if the associated Sensor Input Channel has a range option and is set to Auto in the channel's setup menu.
The available options will depend on the cell constant of the sensor used, consult the input card's manual for more information.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Trigger

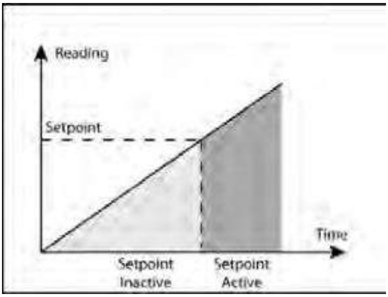
The setpoints can be configured to trigger in the following ways:

- High
- Low
- Band
- Latch High
- Latch Low
- USP (Conductivity Only – see Conductivity manual for information)

🡅/🡇 – Select Option

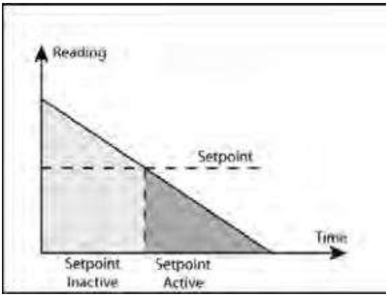
EXIT – Cancel

↵ – Save Selection



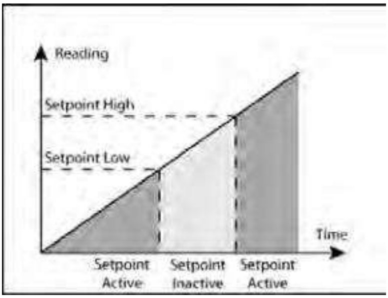
High

The setpoint will activate when the associated Sensor Input Channel's input becomes greater than the setpoint level.



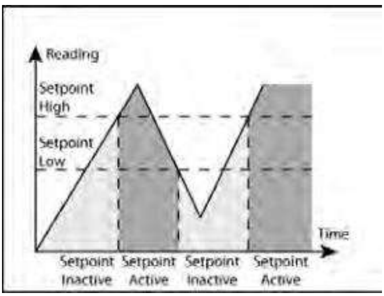
Low

The setpoint will activate when the associated Sensor Input Channel's input becomes less than the setpoint level.



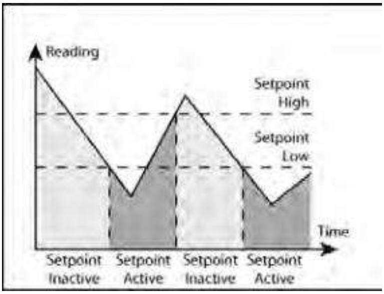
Band

The setpoint will activate when the associated Sensor Input Channel's input is either greater than the setpoint high level or less than the setpoint low level.



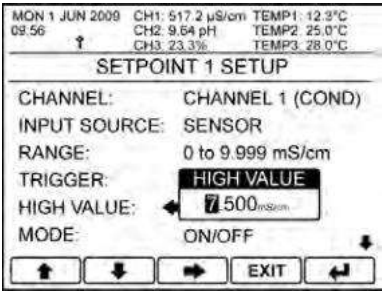
Latch Hi

The setpoint will activate when the associated Sensor Input Channel's input is greater than the setpoint high level and will remain active until the input falls below the setpoint low level. It will then remain inactive until the input level rises above the setpoint high level.



Latch Low

The setpoint will activate when the associated Sensor Input Channel's input is less than the setpoint low level and will remain active until the input rises above the setpoint high level. It will then remain inactive until the input level falls below the setpoint low level.



High Value

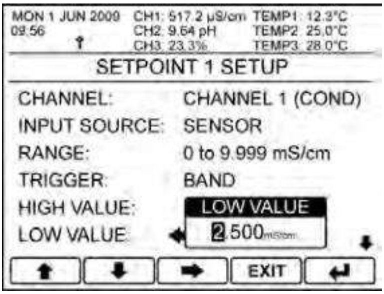
The Setpoint High value.

🠉/🠋 – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Low Value

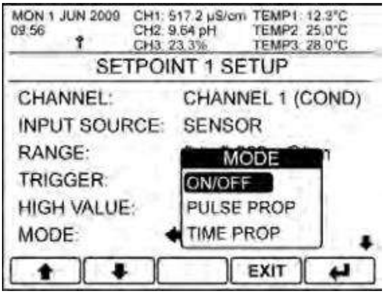
The Setpoint Low value.

🠉/🠋 – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Mode

The Setpoints can operate in one of three modes.

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

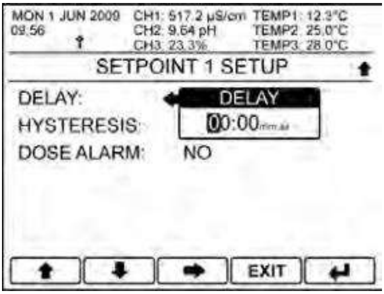
Pulse Proportional – See Setpoint proportional Mode Section.

Time Proportional – See Setpoint proportional Mode Section.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



Delay

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

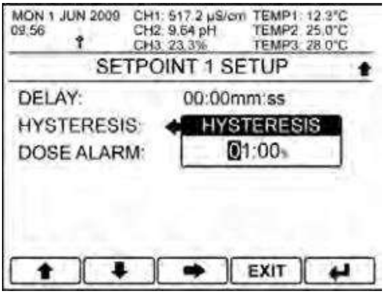
Note- Only available when Trigger is set to High or Low and Mode is On/Off.

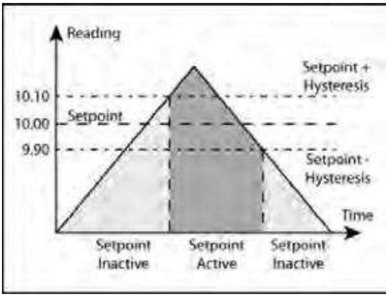
🡅/🡇 – Increase / Decrease Digit

🡆 – Select Next Digit

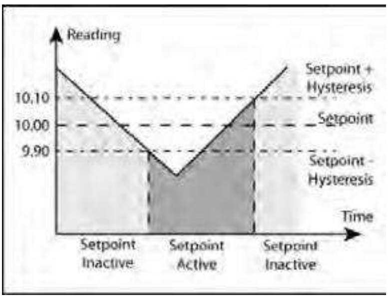
EXIT – Cancel

↵ – Save Value





Setpoint Trigger: High – Hysteresis



Setpoint Trigger: Low – Hysteresis

Hysteresis

A facility to apply hysteresis to the setpoint level allows the user to avoid setpoint “Chatter” when the sensor input level approaches the setpoint level.

“Chatter” is caused when the sensor input is sufficiently close to the set point value and noise on the signal repeatedly crosses the set point level, thus causing the relay to switch on and off rapidly.

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

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

Hysteresis operates as follows:

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

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

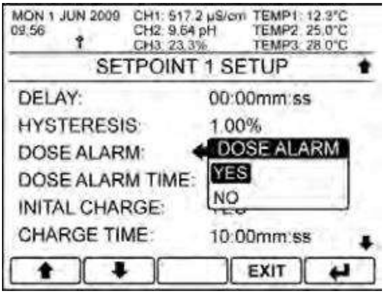
Trigger Band – The setpoint uses both high and low.

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

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

Setpoint Dose Alarm

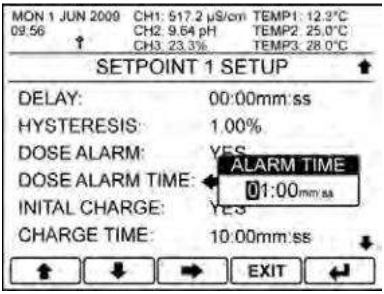
The dose alarm timer can be used to prevent overdosing under many different fault conditions, such as sensor failure or application problems.



Dose Alarm

Enable the dose alarm for the selected setpoint.

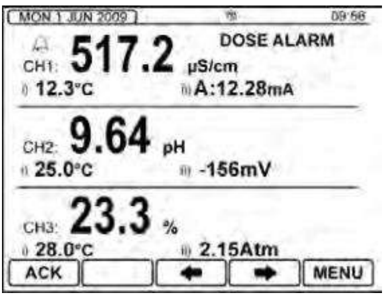
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Alarm Time

Sets the time which if the setpoint is active for longer than causes the dose alarm to activate.
During pulse or time proportional mode the cumulative "on" time that the setpoint is active will be measured.

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

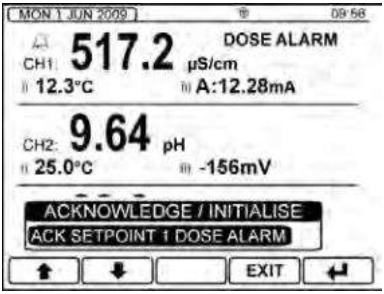


Dose Alarm Active

When the dose alarm activates the following happens:-

- The setpoint will de-energise.
- The associated setpoint led will flash.
- The Dose Alarm error message will appear next to the associated input channel on the front screen.
- ACK will appear as a function to acknowledge the setpoint on the front screen.
- An error will be set for that input channel.

ACK	– Enter Setpoint Acknowledge Menu
⬅/➡	– Scroll Around Menus
Menu	– Access Main Menu



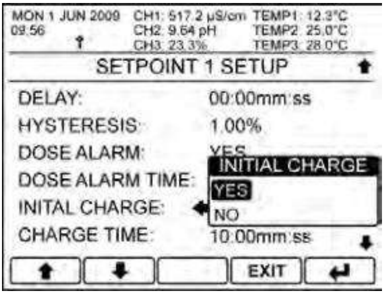
Dose Alarm Acknowledge

To cancel the dose alarm and reactivate the setpoint, select the required setpoint from the shown list and press enter.
Note – If, once reset, the setpoint again remains energised for the length of the dose alarm timer then the dose alarm will once again activate. If this problem persists then a dosing problem will need to be investigated.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



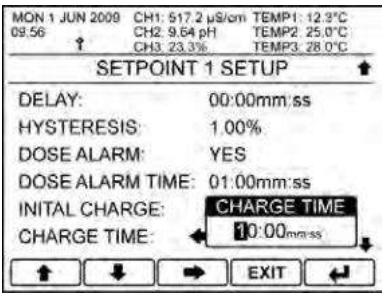
Initial Charge

This allows the user to have a one time over-ride of the Dose Alarm to use for example when filling a tank for the first time.
The user enters a charge time and then initiates the charge time. The unit will then disable the dose alarm until either the relay becomes inactive because the setpoint has been reached or the charge timer reaches zero in which event the unit will automatically display a Dose Alarm.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Charge Time

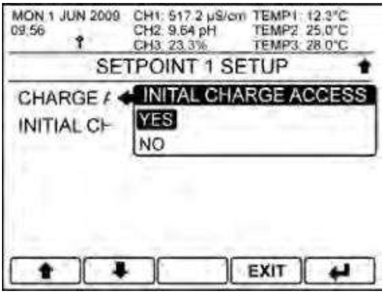
Sets the initial charge time.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Initial Charge Access

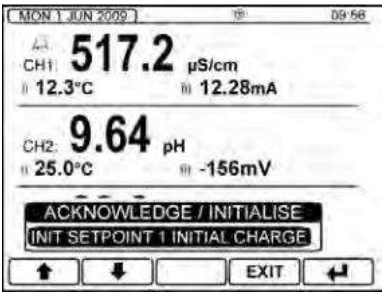
Enabling this allows the user to initialise the initial charge by means of a menu on the front screen.

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

Front Screen Initial Charge

Enter the Initial Charge Menu by means of the INIT button.

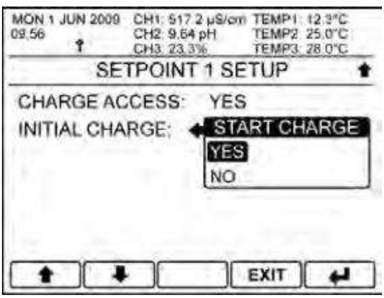
INIT	– Enter Initial Charge Menu
⬅/➡	– Scroll Around Menus
Menu	– Access Main Menu



Initialise Initial Charge

Select which setpoint to initialise the initial charge.
Note – Once started the Initial charge timer will appear next to the associated input channel on the front screen.

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



Start Initial Charge
The user can also start the initial charge via this option in the setpoint menu.
Note – Once started the Initial charge timer will appear next to the associated input channel on the front screen.

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

Setpoint Proportional Mode

In addition to On/Off mode the MXD70 Series also provides two forms of pseudo proportional control, which can be used to control the levels to a defined value when used in conjunction with a pump or valve. When the reading deviates from the programmed set point level the relay pulses at a rate proportional to that deviation. Note – Only available when Setpoint Trigger is set to either High or Low.

Pulse Proportional Mode

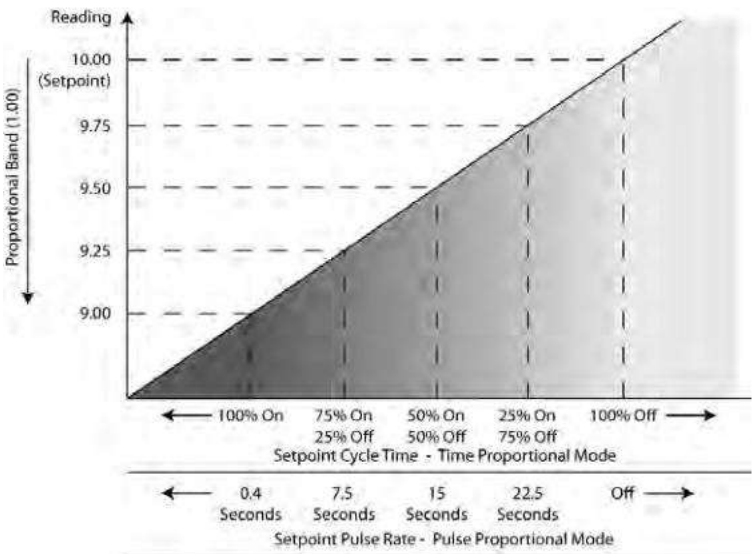
The Pulse Proportional mode is intended to drive solenoid type dosing pumps which have the facility to accept an external pulse input. The setpoint relay operates by producing a pulse of 0.2 seconds in duration and with a maximum period of one pulse per 30 seconds. The pulse rate increases as the measurement moves further from the set point, until it reaches the minimum period of one pulse per 0.4 seconds at the limit of the proportional band.

For example if the user sets a proportional band of 1.00, the setpoint trigger to LOW, and a setpoint value of 10.00. When the reading falls just below 10.00 the setpoint will begin to pulse at its longest period of once per 30 seconds. As the reading falls further from the setpoint the period will decrease until it reaches its minimum of one pulse every 0.4 seconds at the limit of the proportional band. (See Setpoint Pulse Rate – Pulse Proportional Mode section on the diagram below.)

Time Proportional Mode

Time Proportional Mode allows a user defined cycle time to control any on/off device such as a solenoid valve or dosing pump over a user set proportional band.

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



Cycle Time

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

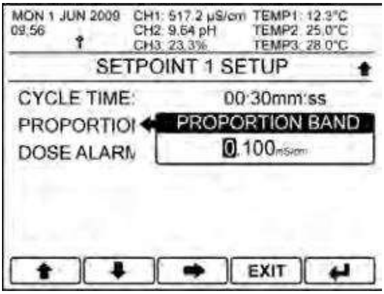
Note – Time Proportional mode only.

🡅/🡇 – Increase / Decrease Digit

🡆 – Select Next Digit

EXIT – Cancel

↵ – Save Value



Proportional Band

Enter the size of the proportional band in measurement units.

🡅/🡇 – Increase / Decrease Digit

🡆 – Select Next Digit

EXIT – Cancel

↵ – Save Value

Setpoint Alarm Mode

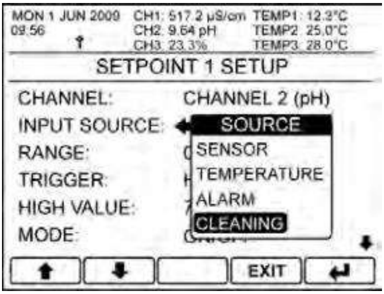
By Selecting Alarm in the setpoints input source the setpoint can be configured as an alarm output triggered by one of a number of events.

- **Sensor Error –** When a sensor related error is detected on the associated sensor input channel.
- **Dose Alarm –** When any of the dose alarms active on a setpoint associated with this setpoints sensor input channel.
- **Calibration –** When a calibration is in progress on the associated sensor input channel.
- **Off-Line –** When the associated sensor input channel has been taken “Off-Line.”
- **Any Error –** When any error is detected on the associated sensor input channel.
- **Cleaning –** When a cleaning operation is in progress on a setpoint associated with this setpoints sensor input channel.
- **Calibration Due –** When if enabled the calibration due timer has expired on the associated sensor input channel.
- **Gain Error –** When a gain error is present on the associated sensor input channel. Only available when set to a suspended solids input channel.
- **Power Failure –** Holds the relay in a permanently energised state until the unit is powered down. Only available when using unit alarm

Note – By selecting Unit Alarm in the setpoint channel option each alarm option will activate if they occur on any of the instruments three sensor input channels.

Setpoint Cleaning Mode

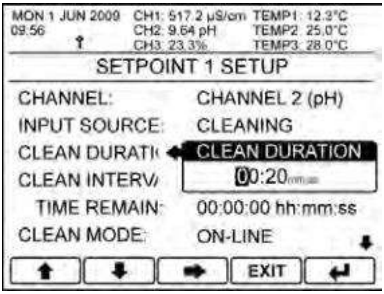
The Setpoints can be configured to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. Its purpose is to prevent accumulation of particulate matter on the active surfaces of the sensor. Note that cleaning is not available on all sensor input types.



Input Source

If available select cleaning from the list of options.

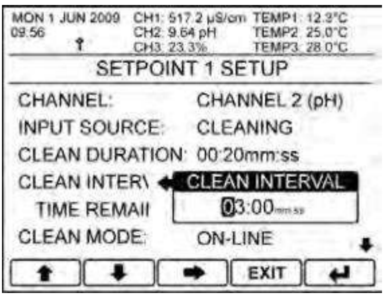
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Clean Duration

Enter the duration of the cleaning operation.
For the duration of the clean, cleaning will appear in the associated sensor input display section on the front screen.

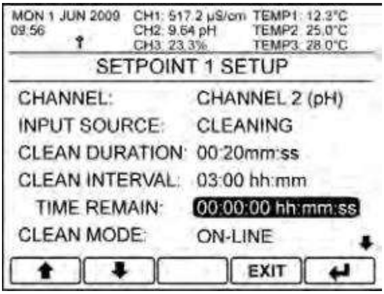
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Clean Interval

Enter the time between cleaning operations.

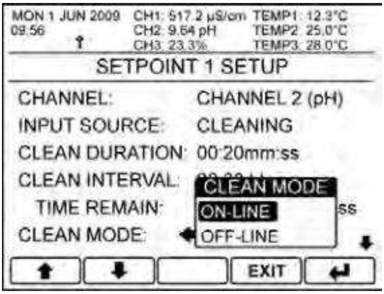
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Time Remaining

Shows the time remaining till the next clean operation.

Note – Cannot be edited.



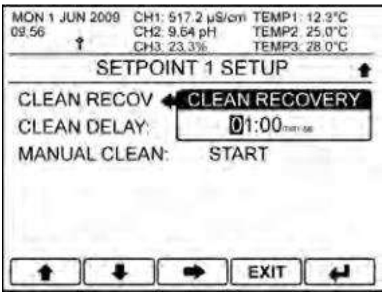
Clean Mode

Associated sensor input channel state when cleaning. It is recommended that off-line is selected. This will automatically take the associated sensor input channel offline, de-energise associated setpoints and hold associated current outputs, during a clean operation. This will prevent any undesired control actions resulting from spraying cleaning solution onto the sensor.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Clean Recovery

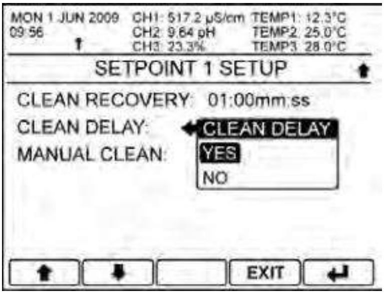
If cleaning "Off-line" then the user can introduce an additional post cleaning delay before coming back "On-line", this provides the sensor a period to stabilise.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Clean Delay

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

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Manual Clean

This manually starts a clean cycle.

Note this can also be accomplished via the digital inputs, see Digital Inputs section.

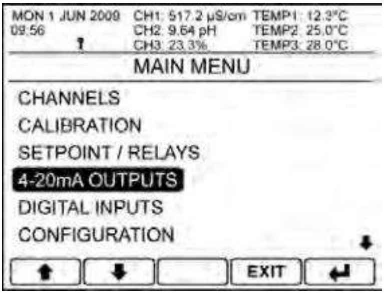
⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Current Outputs

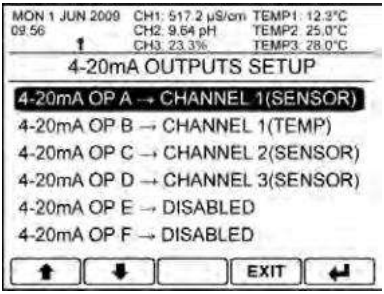
The MXD70 Series can be fitted with up to six current outputs designated A – F. Each individual current output can be assigned to any one of the Sensor Input Channels. The current output menu contains all of the necessary setup functions to configure the current output sources. The instrument can display all of the enabled current outputs on one trend screen or alternatively if displaying only one sensor input channel, two trends can be shown on the front screen (see Configuration – Setup Front Screen , User Interface).



Main Menu

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

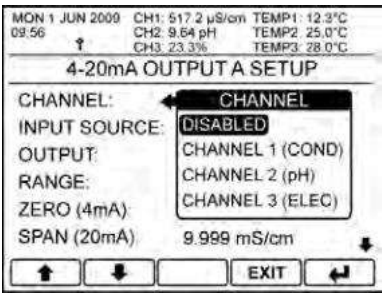
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Outputs Setup

Select the Current Output you wish to edit.

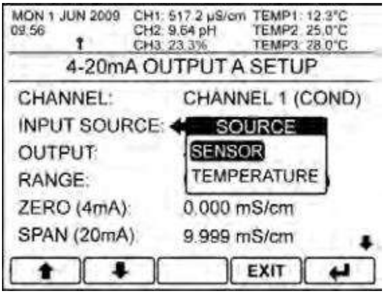
⬆/⬇	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Channel

The "Sensor Input Channel" the current output is to be associated with. The channels shown depend on the configuration of the instrument.
To disable the current output select the disabled option. This will turn off the output, remove it's reading from the front screen, the current output trend screen and the menu header. It will also clear any error messages associated with it.

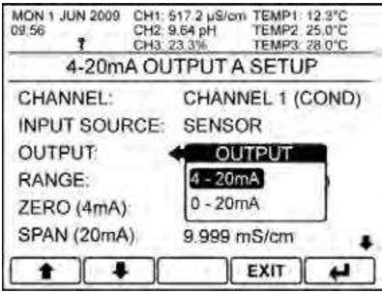
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Input Source

The input source for the selected current output. Available options vary depending on whether the appropriate source is enabled in the channel's setup menu.

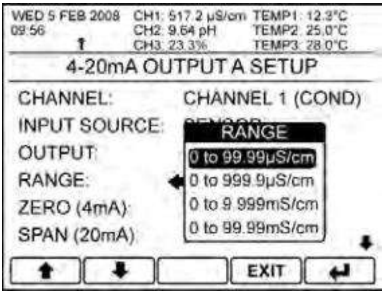
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Output

The current output can be scaled across either 4 – 20mA or 0 – 20mA

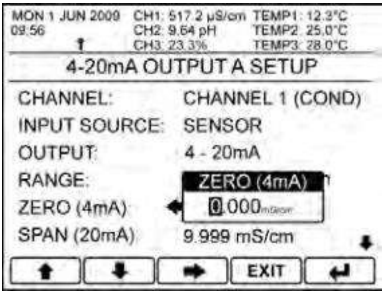
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Range

The current output's operating range.
This is only available if the associated Sensor Input Channel has a range option and is set to Auto in the channel's setup menu.
The available options will depend on the cell constant of the sensor used, consult the input cards manual form more information.

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



Zero (0/4mA)

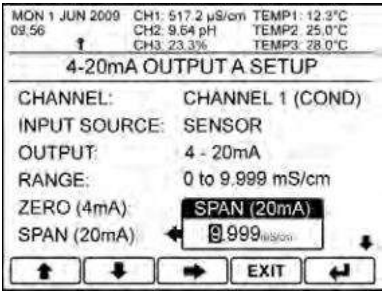
Enter the desired sensor value to be represented by 0mA or 4mA (depends on current output scaling). An inverse relationship can be achieved by setting the Zero greater than the Span.
If the sensor reading falls outside this and the span value an error / alarm will be activated.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



Span (20mA)

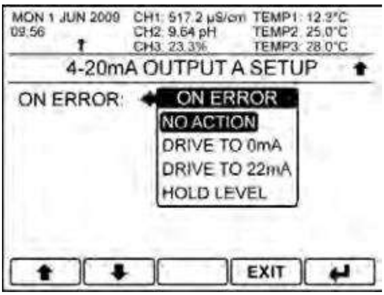
Enter the desired sensor value to be represented by 20mA. An inverse relationship can be achieved by setting the Span less than the Zero.
If the sensor reading falls outside this and the zero value an error / alarm will be activated.

⬆/⬇ – Increase / Decrease Digit

➡ – Select Next Digit

EXIT – Cancel

↵ – Save Value



On Error

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

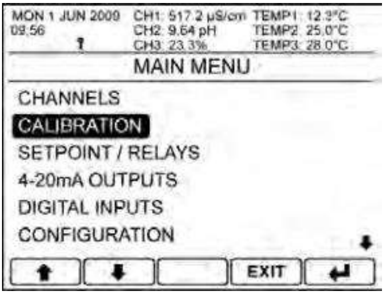
⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Current Output Calibration

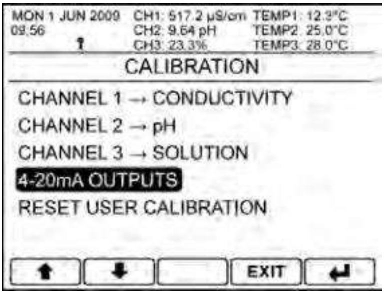
The user is provided with an opportunity to adjust the current output to calibrate any equipment that may be being used to monitor the current output signal.



Main Menu

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

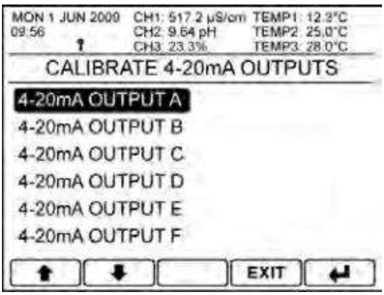
↑/↓	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Calibration

Select 4-20mA Outputs.

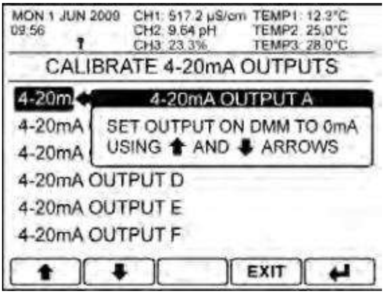
↑/↓	– Select Option
EXIT	– Return to Main Menu
↵	– Enter Option



Calibrate 4-20mA Outputs

Select the current output you wish to calibrate.

↑/↓	– Select Option
EXIT	– Return to Calibration
↵	– Enter Option



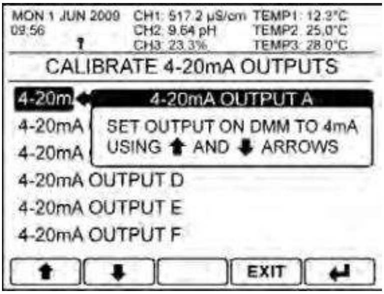
Adjust 0mA Output

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

⬆/⬇ – Adjust Output

EXIT – Cancel

↵ – Save Adjustment



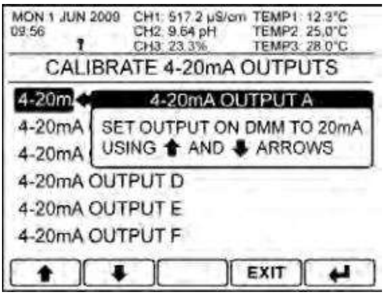
Adjust 4mA Output

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

⬆/⬇ – Adjust Output

EXIT – Cancel

↵ – Save Adjustment



Adjust 20mA Output

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

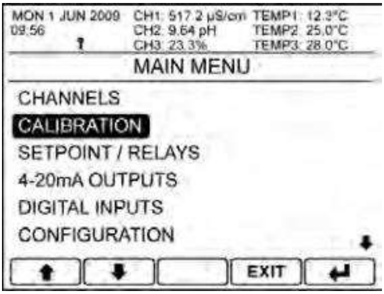
⬆/⬇ – Adjust Output

EXIT – Cancel

↵ – Save Adjustment

Resetting the current Output user Calibration

If required the user can reset the current output user calibration back to factory settings.



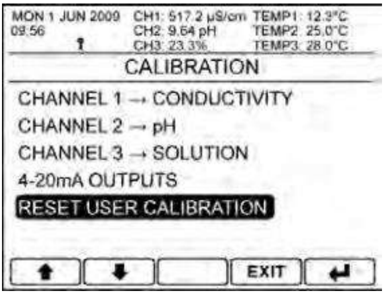
Main Menu

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

↑/↓ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



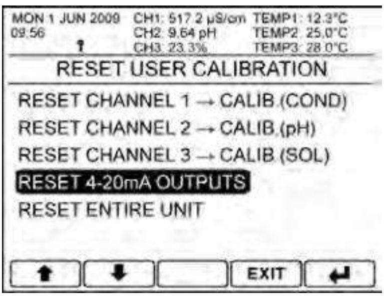
Calibration

Select Reset User Calibration.

↑/↓ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



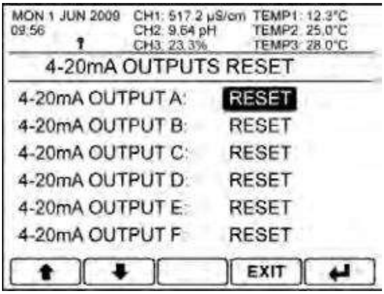
Reset User Calibration

Select Reset 4-20mA Outputs.

↑/↓ – Select Option

EXIT – Return to Calibration

↵ – Enter Option



4-20mA Outputs Reset

Select the required 4-20mA Output to Reset its user calibration back to factory settings.

⬆/⬇ – Select Option

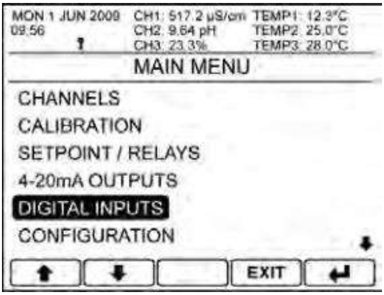
EXIT – Return to Reset User Calibration

↵ – Enter Option

Blank

Digital Inputs

The MXD70 Series is fitted with eight digital inputs designated 1 – 8. Each individual digital input can be assigned to any one of the Sensor Input Channels or to the instrument as a whole. The digital input menu contains all of the necessary setup functions to configure the digital input sources. These inputs are 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.



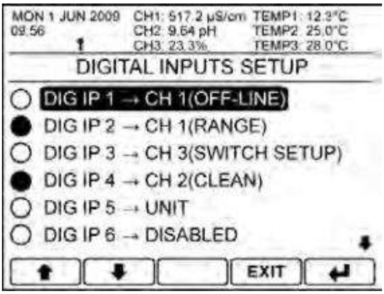
Main Menu

From the front screen press the menu button to show the main menu options and select Digital Inputs.

⬆/⬇ – Select Option

EXIT – Return to Calibration

↵ – Enter Option



Digital Inputs Setup

Select the Digital Input you wish to edit.

The status of the Digital Input is also shown to the left of each item.

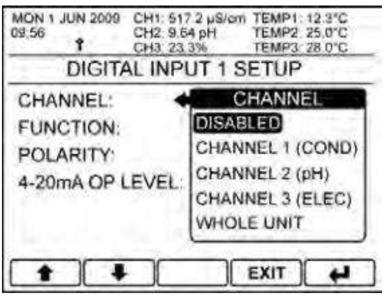
○ – Digital Input Open Circuit

● – Digital Input Closed Circuit

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



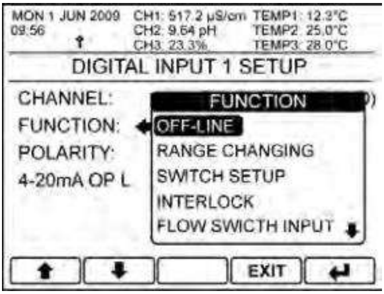
Channel

The "Sensor Input Channel" the digital input is to be associated with. The channels shown depend on the configuration of the instrument. Alternatively if Whole Unit is selected the action will affect all of the input channels.
To disable the digital input select the disabled option.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Function

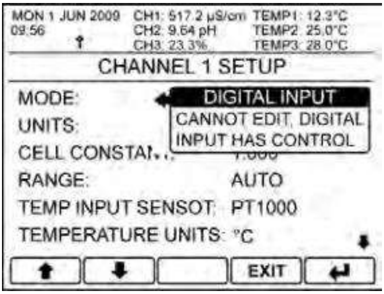
The digital input can be configured to operate in the following ways:

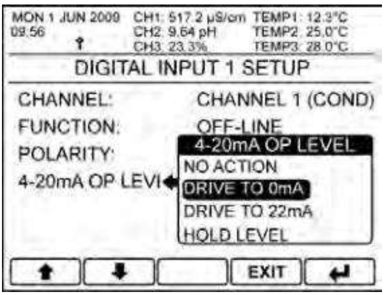
- ❖ Offline
- ❖ Interlock
- ❖ Flow Switch Input
- ❖ Tank Level Switch
- ❖ Clean
- ❖ Range Changing
- ❖ Switch Setup
- ❖ Calibration
- ❖ CIP

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection





Offline, Interlock, Flow Switch Input, Tank Level Switch

These four functions when active will take the associated sensor input channel "offline". This causes any setpoints associated with the channel to de-energise.
They are also accompanied by a message on the front screen informing the user which action is currently active.

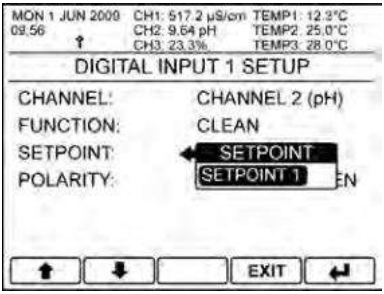
Note – When a digital input is assigned to one of these functions the user can no longer take the associated channel offline using the menu item in the channel setup menu or the channel calibration menu. As indicated by the "Cannot Edit, Digital Input Has Control" message.

In addition to de-energising any associated setpoints the user can also define the operation the current outputs associated with the sensor input channel.

🡅/🡇 – Select Option

EXIT – Cancel

↵ – Save Selection



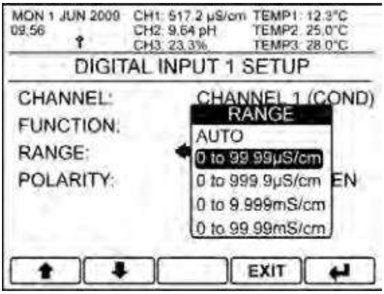
Clean

If the selected Input Sensor Channel has a setpoint configured for a cleaning operation, a external cleaning cycle can be initiated using this function.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



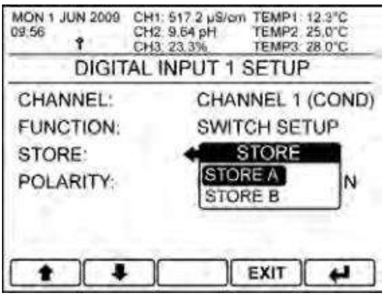
Range Changing

The digital input is used to change the displayed range of the selected sensor input channel. This also affects the operating range of both the setpoints and current outputs associated with the sensor input channel. When Auto is selected the setpoints and current outputs will revert to the internally set ranges.
The available options will depend on the cell constant of the sensor used, consult the input cards manual for more information.
Note – This is only available if the associated Sensor Input Channel has a range option.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection



Switch Setup

The digital input is used to load in an alternative sensor input channel configuration (Sensor Setup, Setpoint Setup and Current Output Setup) that have been stored in one of the two internal channel stores. Whilst the digital input is active no parameters assigned to the sensor input channel can be edited. The original configuration is restored upon the digital input going inactive.

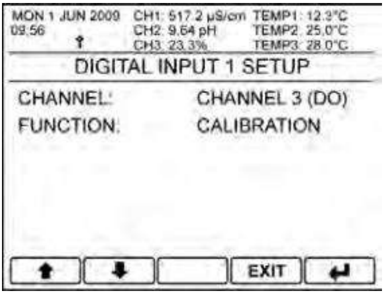
For information regarding saving the setup, see the Save and Restore section of the user interface guide.

NOTE – Only one store at a time can be loaded per channel.

⬆/⬇ – Select Option

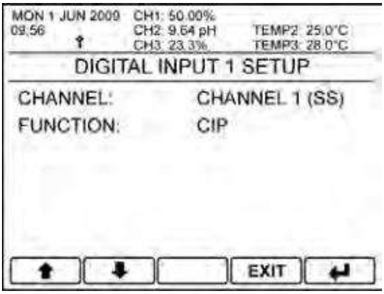
EXIT – Cancel

↵ – Save Selection



Calibration

Initialise a dissolved oxygen span calibration. See Dissolved Oxygen input card manual for more information.

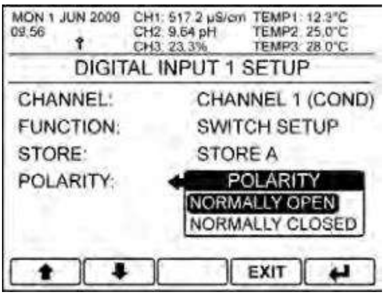


CIP

The CIP input indicates to the associated sensor channel that a CIP event is in progress so that the sensor can be disabled, to prevent overstressing the probe. When active a “CIP ACTIVE” message appears next to the associated channel and the probe signal will go to 0000.

As this will affect the setpoints and current outputs associated with this channel the user is recommended to assign an additional digital input to this channel set it to offline and energise the digital input in tandem with the CIP input.

Note. CIP is only available on Suspended Solids and Turbidity input channels.



Polarity

Configure whether the digital input activates on the closing of circuit (normally open) or the opening of the circuit (normally closed).

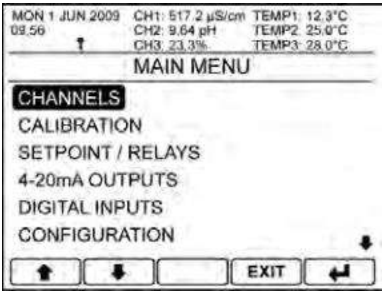
⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Simulate Channels

The facility exists within the MXD70 series to simulate the input sensor levels to test the setpoint and current output operation. This function allows the user to cycle up and down through the sensor range whilst displaying the current output level, and with the relays responding accordingly.



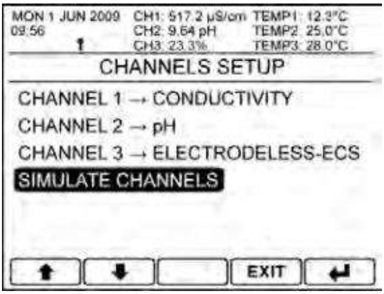
Main Menu

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

⬆/⬇ – Select Option

EXIT – Return to Front Screen

↵ – Enter Option



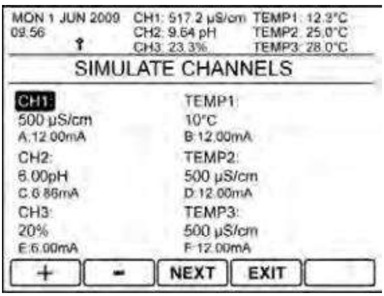
Channels Setup

Select Simulate Channels, or alternatively to only simulate one channel select Simulated Input in the individual channel setup menu.

⬆/⬇ – Select Option

EXIT – Return to Main Menu

↵ – Enter Option



Simulate Channels

Select the sensor or temperature you wish to simulate and observe the associated setpoints operate and current outputs move. Only input sensors or temperatures with setpoints or current outputs associated with them will appear.

Note – This menu will not "time out" back to the front screen.

+ – Increase Selected Value

– – Decrease Selected Value

NEXT – Select Next Value

EXIT – Return to Channels Setup

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*Optional Extra

Setpoint/Relays - 4-20mA Outputs - Digital Inputs

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Setpoint Setup (Alarm)
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*N.B. Sensor - Range option only avilable on Conductivity and Electrodeless input types.

**N.B. Cleaning option only avilable on pH/Redox and Dissolved Oxygen input types.

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MXD70 Series

Multi-parameter Monitor

Modbus RS485 Interface
Operating Guide

Preface

Product warranty

The MXD70 Series has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'as is' without warranty.

Limitation of warranty

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

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

Disclaimer

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

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

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Manufacturing Standards

Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive 2004/108/EC using BS EN 61326-1: 2013

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive 2006/95/EC using BS EN 61010-1: 2010

Quality

This instrument has been manufactured under the following quality standard:

ISO 9001:2008. 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.

Contents

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Modbus RS485

MODBUS is an open application layer messaging protocol, which is deployed in areas of manufacturing automation, process automation and building automation. It provides client/server communication between devices connected over a RS485 connection.

Modbus RS485 networks consist of two different devices, a Master and a Slave.

Master Device - Master devices determine the data traffic on the network. They can send data without an external request.

Slave Device - Slave devices are peripheral devices. They do not have their own access rights to the data traffic on the network and only send their data due to an external request from a master. The MXD70 Series operates as a slave device on the network.

Modbus Telegram Structure - The data is transferred between the master and slave by means of a telegram. A request telegram from the master contains the following four telegram fields:

- Slave address - The slave address can be in an address range from 1 to 247. The master talks to all the slaves simultaneously by means of the slave address 0 (broadcast message).
- Function code - The function code determines which read, write and test operations should be executed by means of the MODBUS protocol.
- Data - Depending on the function code, the following values are transmitted in this data field: Register start address (from which the data is transmitted), Number of registers, Write/read data, Data length, etc.
- Checksum - The telegram check sum forms the end of the telegram.

The master can send another telegram to the slave as soon as it has received an answer to the previous telegram or once the time-out period set at the master has expired. This time-out period can be specified or modified by the user and depends on the slave response time.
If an error occurs during data transfer or if the slave cannot execute the command from the master, the slave returns an error telegram (exception response) to the master.
The slave response telegram consists of telegram fields which contain the requested data or which confirm that the action requested by the master has been executed. It also contains a check sum.

MXD70 Series Modbus communications is indicated in the top of the screen by the following symbol:


Supported Modbus Function Codes

Function Code	Type	Function
2	Read Discrete Inputs	Reads one or more discrete inputs of the MXD70 Series 1 to a maximum of 2000 consecutive registers can be read with a telegram. The discrete inputs in the response message are packed as one discrete input per bit of the data field. Status is indicated as 1= ON and 0= OFF. ! Note. If the returned output quantity is not a multiple of eight, the remaining bits in the final data byte will be padded with zeros. Application: For reading the status of the instrument and its error messages.

Function Code	Type	Function
3	Read Holding Register	Reads one or more registers of the MXD70 Series. 1 to a maximum of 125 consecutive registers (1 register = 2 bytes) can be read with a telegram. Application: For reading measurements and the configuration of the instrument's parameters.
5	Write Single Coil	Writes a single output to either ON or OFF in the MXD70 Series. The requested ON/OFF state is specified by the following data field: FF 00 hex = ON. 00 00 hex = OFF. All other values are illegal and will not affect the output. Application: Activates a single function in the MXD70 Series by writing the On state to the coil address once. Note, on completion the function will automatically move to the Off state.
6	Write Single Register	Write a single MXD70 Series register with a new value. Application: For configuring a single parameter in the instrument. ! 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 MXD70 Series registers with a new value. A maximum of 120 consecutive registers can be written with a single telegram. Application: For configuring parameters in the instrument.
23	Read & Write Multiple Registers	Simultaneous reading and writing of registers in the MXD70 Series. 1 to a maximum of 118 registers in a single telegram. Write access is executed before read access. Application: For configuring and then checking the status of the parameters in the instrument.

! Maximum number of writes - If a non-volatile parameter is modified via the MODBUS this change is saved in the EEPROM of the instrument. The number of writes to the EEPROM 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 instrument failure. For this reason, avoid constantly writing non-volatile instrument parameters via the MODBUS.

Response Times - The time it takes the instrument 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 instrument. 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 instrument:

• **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	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)
INT	Byte 1 (MSB)	Byte 0 (LSB)		
LONG	Byte 3 (MSB)	Byte 2	Byte 1	Byte 0 (LSB)

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Modbus RS485 Connection Details

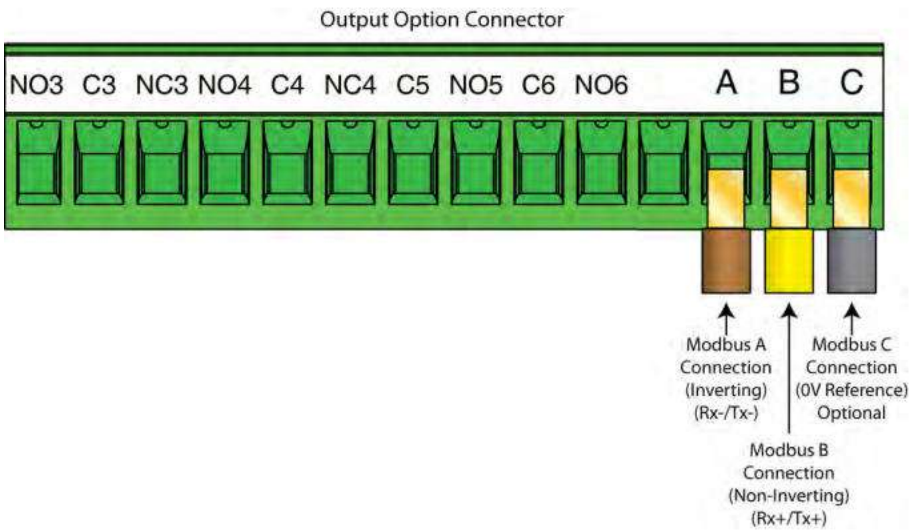
In the EIA/TIA-485 standard, two versions (cable type A and B) are specified for the bus line and can be used for all transmission rates. However, we recommend you use cable type A. The cable specification for cable type A is provided in the following table:

Cable Type A	
Characteristic Impedance	135 to 165Ω at a measuring frequency of 3 to 20Mhz
Cable Capacitance	<30pF/m
Core Cross-section	>AWG22
Cable Type	Twisted Pairs
Loop Resistance	≤100Ω/km
Signal damping	Max 9 dB over the entire cable cross-section
Shielding	Copper braided shielding or braided shielding and foil shielding

Note the following when designing the bus structure:

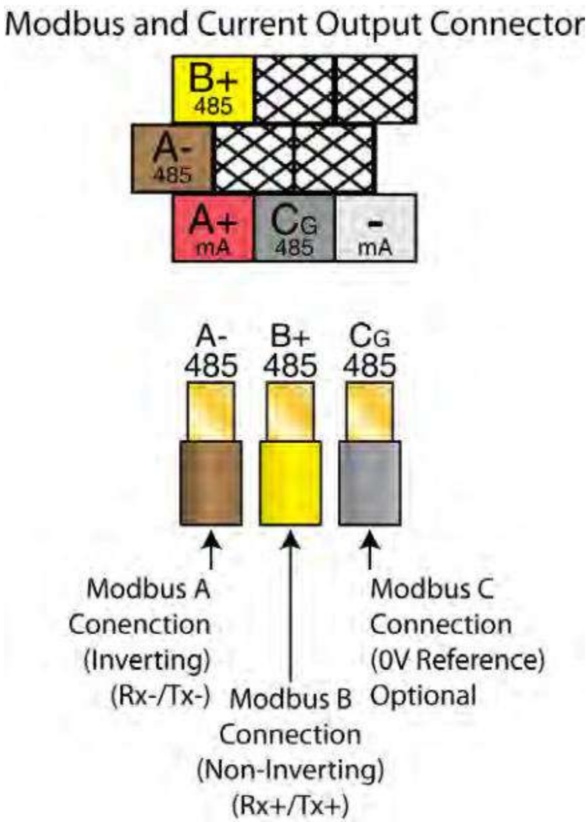
- Using cable type A and with a transmission rate of 9600 Baud, the maximum line length (segment length) of the MODBUS RS485 system is 10000 meters. The total length of the spurs may not exceed a maximum of 6.6 meters.
- A maximum of 32 devices are permitted per segment.
- Each segment is terminated at either end with a 120 Ω terminating resistor (not supplied).
- The bus length or the number of devices can be increased by introducing a repeater.

The MXD70 Series provides a Modbus interface via an Optional Output Card



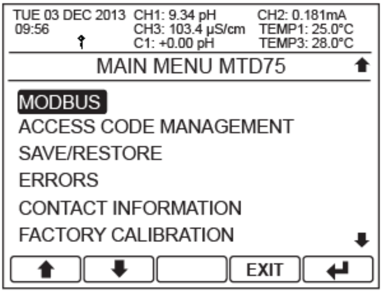
MXD73 Modbus RS485 Output Card Connection Details

Modbus Connections



MXD75 Modbus RS485 Output Card Connection Details

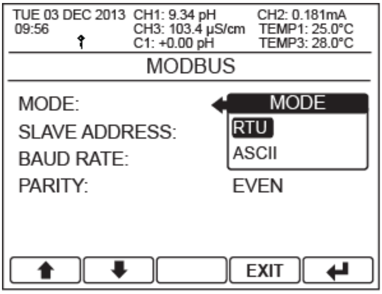
Modbus Setup



Main Menu

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

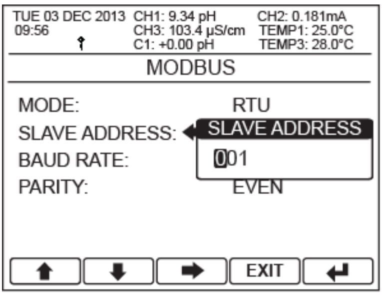
⬆/⬇	– Select Option
EXIT	– Return to Front Screen
↵	– Enter Option



Mode

Set the Modbus communication mode format to either RTU or ASCII.

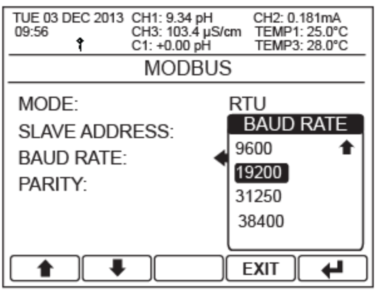
⬆/⬇	– Select Option
EXIT	– Cancel
↵	– Save Selection



Slave Address

Set the slave address used to address the instrument. Can be set from 1 to 247.

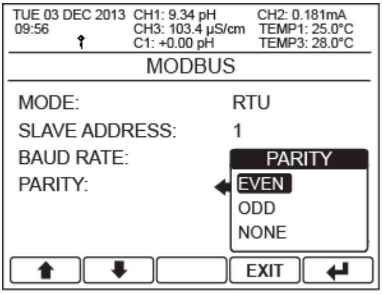
⬆/⬇	– Increase / Decrease Digit
➡	– Select Next Digit
EXIT	– Cancel
↵	– Save Value



Baud Rate

Set the communication Baud rate.
Available options: 300, 600, 1200, 2400, 4800, 9600, 19200, 31250 and 38400 bits per second.

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



Parity

Set the error parity bit.

⬆/⬇ – Select Option

EXIT – Cancel

↵ – Save Selection

Standard Value Tables

Commonly used values throughout the Modbus registers.

Table 1 – Supported ASCII Character Set (for use with labels):

Upper Case	A = 65	B = 66	C = 67	D = 68	E = 69	F = 70
	G = 71	H = 72	I = 73	J = 74	K = 75	L = 76
	M = 77	N = 78	O = 79	P = 80	Q = 81	R = 82
	S = 83	T = 84	U = 85	V = 86	W = 87	X = 88
	Y = 89	Z = 90				
Lower Case	a = 97	b = 98	c = 99	d = 100	e = 101	f = 102
	g = 103	h = 104	i = 105	j = 106	k = 107	l = 108
	m = 109	n = 110	o = 111	p = 112	q = 113	r = 114
	s = 115	t = 116	u = 117	v = 118	w = 119	x = 120
	y = 121	z = 122				
Numbers	0 = 48	1 = 49	2 = 50	3 = 51	4 = 52	5 = 53
	6 = 54	7 = 55	8 = 56	9 = 57		
Symbols	= 32	µ = 181	% = 37	(= 40	) = 41	+ = 43
	- = 45	. = 46	/ = 47	: = 58	= = 61	\ = 92
	^ = 94	Ω = 937	∑ = 8721	Π = 960	° = 176	± = 177
	^{2} = 178	^{3} = 179	β = 223			

Table 2 – Conventional Conductivity Ranges:

Conductivity	Resistivity	TDS
1014 = 0 - 9.999 µS/cm 1015 = 0 - 99.99 µS/cm 1016 = 0 - 999.9 µS/cm 1017 = 0 - 9.999 ms/cm 1018 = 0 - 99.99 ms/cm 1019 = 0 - 999.9 ms/cm	1020 = 0- 99.99MΩ/cm 1021 = 0- 9.999MΩ/cm 1022 = 0- 999.9kΩ/cm 1023 = 0- 99.99kΩ/cm	1024 = 0 - 9.999ppm 1025 = 0 - 99.99ppm 1026 = 0 - 999.9ppm 1027 = 0 - 9999ppm 1028 = 0 - 99.99ppt

Table 3 – Electrodeless Conductivity Ranges:

Conductivity	TDS	Solution
1016 = 0 - 999.9 µS/cm 1017 = 0 - 9.999 ms/cm 1018 = 0 - 99.99 ms/cm 1019 = 0 - 999.9 ms/cm	1026 = 0 - 999.9ppm 1027 = 0 - 9999ppm 1028 = 0 - 99.99ppt	1029 = %NaOH 1030 = %NaCL 1031 = %H2SO4 1032 = HCL 1033 = %H3PO4 1034 = %HNO 1035 = Salinity 1036 = Custom 1 1037 = Custom 2

Table 4 – Data Logging Live Trend / Calculation Variables:

Sensor/Type	Variable	Value: Channel 1	Value: Channel 2	Value: Channel 3
Auxiliary mA Input	Reading	1591	1629	1667
	Input Current	1592	1630	1668
Conventional Conductivity	Conductivity	1572	1610	1648
	Resistivity	1573	1611	1649
	TDS	1574	1612	1650
Dissolved Oxygen	Saturation (%)	1578	1616	1654
	Mg/l	1579	1617	1655
	Ppm	1580	1618	1656
	pO2	1581	1619	1657
	mmHg	1582	1620	1658
	Current	1583	1621	1659
	Probe (mV)	1584	1622	1660
	Pressure (Atm)	1585	1623	1661
	Pressure (Bar)	1586	1624	1662
	Pressure (kpa)	1587	1625	1663
	Pressure (mH20)	1588	1626	1664
	Pressure(psi)	1589	1627	1665
	Pressure(mmhg)	1590	1628	1666
Electrodeless Conductivity	Conductivity	1575	1613	1651
	TDS	1576	1614	1652
	Solution	1577	1615	1653
pH / Redox	pH	1570	1608	1646
	pH (mV)	1571	1609	1647
Suspended Solids / Turbidity	Suspended Solids	1593	1631	1669
	Ps	1594	1632	1670
Temperature	Temperature	1595	1633	1671
Current Output *	Current Output 1	1596	1634	1672
	Current Output 2	1597	1635	1673
	Current Output 3	1598	1636	1674
	Current Output 4	1599	1637	1675
	Current Output 5	1600	1638	1676
	Current Output 6	1601	1639	1677
Calculation*		**Calculation 1**	**Calculation 2**	
	Result	1684	1697	
	Current Output 1	1685	1698	
	Current Output 2	1686	1699	
	Current Output 3	1687	1700	
	Current Output 4	1688	1701	
	Current Output 5	1689	1702	
	Current Output 6	1690	1703	

*Not available for use with Calculation function X and Y variables.

Table 5 – Units

Sensor/Type	Units	Value
Auxiliary mA Input	Custom Units	1000
	mA	1001
Conventional Conductivity	µS/cm	300
	mS/cm	400
	kΩ/cm	100
	MΩ/cm	200
	ppm	500
	ppt	1028
Dissolved Oxygen	Saturation (%)	1099
	Concentration (ppm)	1100
	pO2	1101
	Mercury (mmHg)	1102
	Concentration (mg/l)	1103
	Pressure (Atm)	1110
	Pressure (Bar)	1111
	Pressure (kpa)	1112
	Pressure (mH20)	1113
	Pressure(psi)	1114
	Pressure(mmhg)	1115
	Probe Current (µA)	750
	Probe Current (nA)	760
Electrodeless Conducitvity	µS/cm	300
	mS/cm	400
	Custom 1 Units	600
	Custom 2 Units	700
	ppm	500
	ppt	1028
	%NaOH	1029
	%NaCl	1030
	%H2SO4	1031
	%HCl	1032
	%H3PO4	1033
	%HNO	1034
	ppt Salinity	1035
pH / Redox	pH	800
	mV	1066
Suspended Solids / Turbidity	NTU	1520
	FTU	1521
	mg/l	1522
	g/l	1523
	ppt	1524
	ppm	1525
	EBC	1526
	OD	1527
	%	1528
	PS	1529
Calculation	Ratio	1583
	%	1600

Tables

Table 6 – Menu Header / Front Screen Secondary Reading Options

		Value		
Sensor/Type	**Variable**	**Channel 1**	**Channel 2**	**Channel 3**
	Clear (do not show anything) Readingˆ Temperature Manual Temperature	1327 1328 1331 1334	1327 1329 1332 1335	1327 1330 1333 1336
Auxiliary mA Input	Current Input	1402	1403	1404
Conventional Conductivity	Conductivity Resistivity TDS	1340 1349 1352	1341 1350 1353	1342 1351 1354
Dissolved Oxygen	Saturation (%) Concentration (ppm) Oxygen (pO2) Mercury (mmHg) mg/l Current Pressure (Atm)* Pressure (Bar)* Pressure (kPa)* Pressure (mH20)* Pressure (psi)* Pressure (mmHg)*	1363 1366 1369 1372 1375 1378 1384 1387 1390 1393 1396 1399	1364 1367 1370 1373 1376 1379 1385 1388 1391 1394 1397 1400	1365 1368 1371 1374 1377 1380 1386 1389 1392 1395 1398 1401
Royce Do	Probe (mV)	1381	1382	1383
Electrodeless Conductivity	Conductivity	1340	1341	1342
pH / Redox	Electrode (mV) Temperature (°C)* Temperature (°F) * Temperature (K)*	1343 1408 1411 1414	1344 1409 1412 1415	1345 1410 1413 1416
Suspended Solids / Turbidity	Ps	1405	1406	1407
Current Output	Current Output 1 Current Output 2 Current Output 3 Current Output 4 Current Output 5 Current Output 6	1357 1358 1359 1360 1361 1362		
Calculation	Calculation 1 Result Calculation 2 Result	1355 1356		

*Only available for Front Screen Secondary Reading Configuration
ˆ Not available for Front Screen Secondary Reading Configuration

Modbus RS485 Registers

Base instrument configuration

Note. The availability of some of the registers depends upon the configuration of the unit.

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Instrument Information						
2000	Get		Company	INT	Company Name	
2001	Get Get		Instrument Type	INT	Type Of Instrument	1406 = Panel Mount 1407 = Surface Mount
2002	Get		Serial Number	LONG	Instrument Serial Number	
2004	Get		Software Version	FLOAT	The software version of the base instrument	0.00 to 99.99
Instrument Configuration						
2010	Get/Set		Language	INT	Instrument Language Settings	1000 = English 1001 = French 1002 = Spanish 1003 = Italian
2011	Get/Set		System Clock Hour	INT	System Clock – Hour element (HH:MM)	0 to 23 Hours
2012	Get/Set		System Clock Minute	INT	System Clock – Minute element (HH:MM)	0 to 59 Minutes
2013	Get/Set		System Clock Week Day	INT	System Clock – Day of the week	1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday
2014	Get/Set		System Clock Date	INT	System Clock – Date Element (DD:MM:YYYY)	1 to 31 Date
2015	Get/Set		System Clock Month	INT	System Clock – Month Element (DD:MM:YYYY)	1 to 12 Month
2016	Get/Set		System Clock Century	INT	System Clock – Century Element (DD:MM:YYYY)	0 to 3000
2017	Get/Set		Daylight Savings	INT	Daylight Savings Status	1076 = Yes 1077 = No
2018	Get/Set		Daylight Savings Start Occurrence	INT	The occurrence on which Daylight Savings should Start (i.e. last Sunday in March)	1 = First 2 = Second 3 = Third 4 = Fourth 5 = Last

Instrument Configuration Continued					
2019	Get/Set	Daylight Savings Start Day	INT	Day on which Daylight Savings should Start	1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday
2020	Get/Set	Daylight Savings Start Month	INT	Month in which Daylight Savings starts	1 = January 2 = February 3 = March 4 = April 5 = May 6 = June 7 = July 8 = August 9 = September 10 = October 11 = November 12 = December
2021	Get/Set	Daylight Savings Start Time Hours	INT	Hour Element Of Daylight Savings Start Time	0 to 23 Hours
2022	Get/Set	Daylight Savings Start Minutes	INT	Minute Element Of Daylight Savings Start Time	0 to 59 Minutes
2023	Get/Set	Daylight Savings Start Seconds	INT	Second Element Of Daylight Savings Start Time	0 to 59 Seconds
2024	Get/Set	Daylight Savings End Week	INT	Week In which Daylight Savings should End	1 = First Week 2 = Second Week 3 = Third Week 4 = Fourth week 5 = Fifth Week
2025	Get/Set	Daylight Savings End Day	INT	Day In which Daylight Savings should End	1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday

Instrument Configuration Continued					
2026	Get/Set	Daylight Savings End Month	INT	Month In which Daylight Savings should End	1 = January 2 = February 3 = March 4 = April 5 = May 6 = June 7 = July 8 = August 9 = September 10 = October 11 = November 12 = December
2027	Get/Set	Daylight Savings End Hours	INT	Hour Element Of Daylight Savings End Time	0 to 23 Hours
2028	Get/Set	Daylight Savings End Minutes	INT	Minute Element Of Daylight Savings End Time	0 to 59 Minutes
2029	Get/Set	Daylight Savings End Seconds	INT	Seconds Element Of Daylight Savings End Time	0 to 59 Seconds
2030	Get/Set	Contrast	INT	The currently set display contrast level	1 to 255 (Lighter to Darker)

Channel Sensors						
2040 2041 2042	Get	Channel 1 Channel 2 Channel 3	Sensor	INT	Current sensor installed in channel.	1119 = Sensor Not Set Up 1120 = Sensor Not Present 1121 = Conductivity 1122 = pH 1123 = Electrodeless 1124 = Suspended Solids 1125 = Dissolved Oxygen 1126 = Royce Do 1127 = Auxiliary

Output Card Information					
2050	Get	Output Card	INT	Type of Output Card installed	1409 = Output Card Not Setup 1410 = Output Card Not Present 1411 = 1 Current Output, 2 Relays 1412 = 3 Current Output, 0 Relays 1413 = 3 Current Output, 4 Relays 1414 = 5 Current Output, 2 Relays 1415 = 4 Current Output, 0 Relays 1416 = 0 Current Output, 2 Relays & Modbus
2051	Get	Serial Number	LONG	The Serial Number of the output card	0 to 9999999
2053	Get	Number Of Relays	INT	Number Of Relays on Output Card	0 to 4
2054	Get	Number Of Current Outputs	INT	Number Of Current Outputs on Output Card	0 to 5

DataLogging Information					
2060	Get	Datalogging Function	INT	Status Of DataLogging Function	1710 = Locked 1711 = Unlocked

Sensor Readings

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Auxiliary mA Input Readings						
2100 2400 2700	Get	Channel 1 Channel 2 Channel 3	Auxiliary Reading	FLOAT	Reading	Value depends upon channel range
2102 2402 2702	Get	Channel 1 Channel 2 Channel 3	First Custom Character	INT	1^{st} Character Of Custom Units	ASCII Character Refer to Table 1 for further information.
2103 2403 2703	Get	Channel 1 Channel 2 Channel 3	Second Custom Character	INT	2^{nd} Character Of Custom Units	
2104 2404 2704	Get	Channel 1 Channel 2 Channel 3	Third Custom Character	INT	3^{rd} Character Of Custom Units	
2105 2405 2705	Get	Channel 1 Channel 2 Channel 3	Fourth Custom Character	INT	4^{th} Character Of Custom Units	
2106 2406 2706	Get	Channel 1 Channel 2 Channel 3	Fifth Custom Character	INT	5^{th} Character Of Custom Units	
2107 2407 2407	Get	Channel 1 Channel 2 Channel 3	Sixth Custom Character	INT	6^{th} Character Of Custom Units	
2108 2408 2408	Get	Channel 1 Channel 2 Channel 3	mA Reading	FLOAT	Current Input Reading (in mA)	0 to 24.00

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Conventional Conductivity Readings						
2150 2450 2750	Get	Channel 1 Channel 2 Channel 3	Conductivity Reading	FLOAT	Conductivity Reading	Value depends upon channel range
2152 2452 2752	Get	Channel 1 Channel 2 Channel 3	Conductivity Units	INT	Conductivity Reading Units	300 = µs 400 = mS
2153 2453 2753	Get	Channel 1 Channel 2 Channel 3	Resistivity Reading*	FLOAT	Resistivity Reading *(only available when units set to resistivity)*	Value depends upon channel range
2155 2455 2755	Get	Channel 1 Channel 2 Channel 3	Resistivity Units*	INT	Resistivity Reading Units *(only available when units set to resistivity)*	100 = KΩ 200 = MΩ
2156 2456 2756	Get	Channel 1 Channel 2 Channel 3	TDS Reading*	FLOAT	TDS Reading *(only available when units set to TDS)*	Value depends upon channel range

Conventional Conductivity Readings Continued						
2158 2458 2758	Get	Channel 1 Channel 2 Channel 3	TDS Units*	INT	TDS Reading Units *(only available when units set to TDS)*	500 = ppm 1028 = ppt
2159 2459 2759	Get	Channel 1 Channel 2 Channel 3	Temperature Reading	FLOAT	Temperature Reading	-50°C to +150°C or -58°F to +320°F
2161 2461 2761	Get	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Reading Units	1040 = °C 1041 = °F

Dissolved Oxygen Readings						
2200 2500 2800	Get	Channel 1 Channel 2 Channel 3	% Sat Reading	FLOAT	Percent Saturation Reading	0 to 199.9%
2202 2502 2802	Get	Channel 1 Channel 2 Channel 3	ppm Reading	FLOAT	Concentration Reading	0 to 30.00 ppm
2204 2504 2804	Get	Channel 1 Channel 2 Channel 3	pO2 Reading	FLOAT	Partial Pressure of Oxygen Reading	0 to 9999 mBar pO2
2206 2506 2806	Get	Channel 1 Channel 2 Channel 3	mmHg Reading	FLOAT	Millimetres of Mercury Reading	0 to 999.9 mmHg
2208 2508 2808	Get	Channel 1 Channel 2 Channel 3	mg/l Reading	FLOAT	Milligrams per Litre Reading	0 to 30.00 mg/l
2210 2510 2810	Get	Channel 1 Channel 2 Channel 3	Probe Current Reading / Probe mV Reading*	FLOAT	Probe Current Reading/ Probe mV Reading* **Royce DO Only*	0 to 4000µA (galvanic) 0 to 500.0nA (polargraphic) 0 to 100.0mV*
2212 2512 2812	Get	Channel 1 Channel 2 Channel 3	Probe Current Reading Units / Probe mV Reading Units*	INT	Probe Current Reading units / Probe mV Reading Units* **Royce DO Only*	750 = Current (µA) 760 = Current (nA) 1105 = mV*
2213 2513 2813	Get	Channel 1 Channel 2 Channel 3	Temperature Reading	FLOAT	Temperature Reading	-50°C to +160°C -58°F to +320°F
2215 2515 2815	Get	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Reading Units	1040 = °C 1041 = °F
2216 2516 2816	Get	Channel 1 Channel 2 Channel 3	Pressure Reading	FLOAT	Pressure Reading	Atm: 0 to 99.99 Bar: 0 to 99.99 Kpa: 0 to 9999 mH20: 0 to 999.9 psi: 0 to 9999

Dissolved Oxygen Readings Continued						
2218 2518 2818	Get	Channel 1 Channel 2 Channel 3	Pressure Units	INT	Pressure Reading Units	1110 = Atm 1111 = Bar 1112 = Kpa 1113 = mH20 1114 = Psi 1115 = mmHg

Electrodeless Conductivity Readings						
2250 2550 2850	Get	Channel 1 Channel 2 Channel 3	Conductivity Reading	FLOAT	Electrodeless Conductivity Reading	Value depends upon channel range
2252 2552 2852	Get	Channel 1 Channel 2 Channel 3	Conductivity Units	INT	Electrodeless Conductivity Reading Units	300 = µs 400 = mS
2253 2553 2853	Get	Channel 1 Channel 2 Channel 3	TDS Reading*	FLOAT	TDS Reading *(*only available when units set to TDS)*	Value depends upon channel range
2255 2555 2855	Get	Channel 1 Channel 2 Channel 3	TDS Units*	INT	TDS Reading Units *(*only available when units set to TDS)*	500 = ppm 1028 = ppt
2256 2556 2856	Get	Channel 1 Channel 2 Channel 3	Solution Reading*	FLOAT	Solution Reading *(*only available when units set to solution)*	0 to 16.00% NaOH 0 to 30.00% NaCl 0 to 25.00 H2SO4 0 to 15.00% HCl 0 to 25.00% H3PO4 0 to 25.00 %HNO 0 to 41.00 ppt
2258 2558 2858	Get	Channel 1 Channel 2 Channel 3	Solution Units*	INT	Solution Reading Units *(*only available when unit set to solution)*	1029 = %NaOH 1030 = %NaCl 1031 = %H2SO4 1032 = %HCl 1033 = %H3PO4 1034 = %HNO 1035 = ppt 1036 = Custom Units
2259 2559 2859	Get	Channel 1 Channel 2 Channel 3	Custom Curve Units 1st Character	INT	Custom Curve Units 1st Custom Character	Refer To Table1
2260 2560 2860	Get	Channel 1 Channel 2 Channel 3	Custom Curve Units 2nd Character	INT	Custom Curve Units 2nd Custom Character	
2261 2561 2861	Get	Channel 1 Channel 2 Channel 3	Custom Curve Units 3rd Character	INT	Custom Curve Units 3rd Custom Character	
2262 2562 2862	Get	Channel 1 Channel 2 Channel 3	Custom Curve Units 4th Character	INT	Custom Curve Units 4th Custom Character	

Electrodeless Conducitvity Readings Continued						
2263 2563 2863	Get	Channel 1 Channel 2 Channel 3	Custom Curve Units 5th Character	INT	Custom Curve Units 5th Custom Character	Refer To Table1
2264 2564 2864	Get	Channel 1 Channel 2 Channel 3	Custom Curve Units 6th Character	INT	Custom Curve Units 6th Custom Character	
2265 2565 2865	Get	Channel 1 Channel 2 Channel 3	Temperature Reading	FLOAT	Temperature Reading	-50°C to +160°C -58°F to +320°F
2267 2567 2867	Get	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Reading Units	1040 = °C 1041 = °F

pH / Redox Readings						
2300 2600 2900	Get	Channel 1 Channel 2 Channel 3	pH Reading*	FLOAT	pH Reading *(*only available when units set to pH*)	0.00 to 14.00 pH
2302 2602 2902	Get	Channel 1 Channel 2 Channel 3	mV Reading	FLOAT	mV Reading	-1999 to +1999 mV
2304 2604 2904	Get	Channel 1 Channel 2 Channel 3	Temperature Reading	FLOAT	Temperature Reading	50.0°C to 160.0 °C or -58.0°F to 320.0 °F or 223.1K to 433.1K
2306 2606 2906	Get	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Reading Units	1040 = °C 1041 = °F 1042 = K

Suspended Solids / Turbidity Readings						
2350 2650 2950	Get	Channel 1 Channel 2 Channel 3	Suspended Solids/Turbidity Reading	FLOAT	Suspended Solids / Turbidity Reading	Value depends upon channel range
2352 2652 2952	Get	Channel 1 Channel 2 Channel 3	Suspended Solids/Turbidity Units	INT	Suspended Solids / Turbidity Reading Units	1520 = NTU 1521 = FTU 1522 = mg/l 1523 = g/l 1524 = Ppt 1525 = Ppm 1526 = EBC 1527 = OD 1528 = % 1529 = PS
2353 2653 2953	Get	Channel 1 Channel 2 Channel 3	PS Reading	FLOAT	Suspended Solids / Turbidity Probe Signal Reading	0 to 16000 or 0 to 32000

Calculation Readings						
3000 3005	Get	Calc 1 Calc 2	Calculation Result	FLOAT	Calculation Result	Depending upon Calculation Function
3002 3007	Get	Calc 1 Calc 2	Calculation Units	INT	Calculation Result Units	Refer to table 5

Setpoint / Relay Status

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Setpoint Status						
3100 3150 3200 3250 3300 3350	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint State	INT	Current State Of Setpoint	0 = Setpoint Not Active 1 = Setpoint Active 2 = Setpoint Initial Charge Active 3 = Setpoint Dose Alarm
3101 3151 3201 3251 3301 3351	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Cleaning Position	INT	Current Cleaning Position When setpoint source set to Cleaning	0 = Not Cleaning 1 = Clean Delay 2 = Cleaning 3 = Recovery
3102 3152 3202 3252 3302 3352	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Cleaning Type	INT	Current Type Of cleaning When setpoint source set to Cleaning	0 = Regular Cleaning 2 = Digital Input Cleaning 3 = Manual Cleaning
3103 3153 3203 3253 3303 3353	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Pulse Proportion Percentage	INT	Setpoint Pulse Proportion Percentage	0 to 100%
3104 3154 3204 3254 3304 3354	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Cleaning Hours	INT	Time remaining for the Setpoint Cleaning Interval, (Hours)	0 to 12
3105 3155 3205 3255 3305 3355	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Cleaning Minutes	INT	Time remaining for the Setpoint Cleaning Interval, (Minutes)	0 to 59
3106 3156 3206 3256 3306 3356	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Cleaning Seconds	INT	Time remaining for the Setpoint Cleaning Interval, (Seconds)	0 to 59

Setpoint Status Continued						
3107 3157 3207 3257 3307 3357	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Initial Charge Minutes	INT	Minutes remaining for the Setpoint Initial Charge	0 to 59
3108 3158 3208 3258 3308 3358	Get	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Setpoint Initial Charge Seconds	INT	Seconds remaining for the Setpoint Initial Charge	0 to 59

Current Output Readings

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Current Output Readings						
4000 4002 4004 4006 4008 4010	Get	Current 1 Current 2 Current 3 Current 4 Current 5 Current 6	Current Output	FLOAT	Current Output Reading (in mA)	0 to 20.00ma

Sensor Input Configuration

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Input Card Serial Number						
4500 5090 5680	Get	Card 1 Card 2 Card 3	Serial Number	LONG	The Serial Number of the input card	0 to 9999999

Auxiliary mA Input Configuration

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Auxiliary mA Input Configuration						
4510 5100 5690	Get/Set	Channel 1 Channel 2 Channel 3	Mode	INT	Input Mode Setting	1080 = Online 1081 = Offline
4511 5101 5691	Get/Set	Channel 1 Channel 2 Channel 3	First Units	INT	1st Character Of Units	Refer To Table 1
4512 5102 5692	Get/Set	Channel 1 Channel 2 Channel 3	Second Units	INT	2nd Character Of Units	
4513 5103 5693	Get/Set	Channel 1 Channel 2 Channel 3	Third Units	INT	3rd Character Of Units	
4514 5104 5694	Get/Set	Channel 1 Channel 2 Channel 3	Fourth Units	INT	4th Character Of Units	
4515 5105 5695	Get/Set	Channel 1 Channel 2 Channel 3	Fifth Units	INT	5th Character Of Units	
4516 5106 5696	Get	Channel 1 Channel 2 Channel 3	Sixth Units	INT	6th Character Of Units	
4517 5107 5697	Get/Set	Channel 1 Channel 2 Channel 3	Range	INT	Input Range	1501 = 9.999 1502 = 99.99 1503 = 999.9 1504 = 9999
4518 5108 5698	Get/Set	Channel 1 Channel 2 Channel 3	Loop Mode	INT	Input Loop Mode	1308 = Normal (mA Input) 1309 = Loop (24v Loop)
4519 5109 5699	Get/Set	Channel 1 Channel 2 Channel 3	Input Mode	INT	mA Input Mode	1134 = 4-20mA Output 1135 = 0-20mA Output
4520 5110 5700	Get/Set	Channel 1 Channel 2 Channel 3	0mA Input	FLOAT	0mA Input Value	Value depends upon channel range
4522 5112 5702	Get/Set	Channel 1 Channel 2 Channel 3	4mA Input	FLOAT	4mA Input Value	

Auxiliary mA Input Configuration Continued						
4524 5114 5704	Get/Set	Channel 1 Channel 2 Channel 3	20mA Input	FLOAT	20mA Input Value	Value depends upon channel range
4526 5116 5706	Get/Set	Channel 1 Channel 2 Channel 3	Input Filter	INT	Input Filter	1050 = Filter Out 1051 = 10 Seconds 1052 = 20 Seconds 1053 = 40 Seconds 1054 = 1 Minutes 1055 = 3 Minutes 1056 = 5 Minutes
4527 5117 5707	Get/Set	Channel 1 Channel 2 Channel 3	First Label	INT	1st Character of Channel Description Label	Refer To Table 1
4528 5118 5708	Get/Set	Channel 1 Channel 2 Channel 3	Second Label	INT	2nd Character of Channel Description Label	
4529 5119 5709	Get/Set	Channel 1 Channel 2 Channel 3	Third Label	INT	3rd Character of Channel Description Label	
4530 5120 5710	Get/Set	Channel 1 Channel 2 Channel 3	Fourth Label	INT	4th Character of Channel Description Label	
4531 5121 5711	Get/Set	Channel 1 Channel 2 Channel 3	Fifth Label	INT	5th Character of Description Label	
4532 5122 5712	Get/Set	Channel 1 Channel 2 Channel 3	Sixth Label	INT	6th Character of Description Label	
4533 5123 5713	Get/Set	Channel 1 Channel 2 Channel 3	Seventh Label	INT	7th Character of Description Label	
4534 5124 5714	Get/Set	Channel 1 Channel 2 Channel 3	Eighth Label	INT	8th Character of Description Label	
4535 5125 5715	Get/Set	Channel 1 Channel 2 Channel 3	Ninth Label	INT	9th Character of Description Label	
4536 5126 5716	Get/Set	Channel 1 Channel 2 Channel 3	Tenth Label	INT	10th Character of Description Label	
4537 5127 5717	Get/Set	Channel 1 Channel 2 Channel 3	Eleventh Label	INT	11th Character of Description Label	
4538 5128 5718	Get/Set	Channel 1 Channel 2 Channel 3	Twelfth Label	INT	12th Character of Description Label	
4539 5129 5719	Get/Set	Channel 1 Channel 2 Channel 3	Thirteenth Label	INT	13th Character of Description Label	

Auxiliary mA Input Configuration Continued						
4540 5130 5720	Get/Set	Channel 1 Channel 2 Channel 3	Fourteenth Label	INT	14th Character of Description Label	Refer To Table 1
4541 5131 5721	Get/Set	Channel 1 Channel 2 Channel 3	Fifteenth Label	INT	15th Character of Description Label	
7700 7790 7880	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve A points	INT	Number of Custom Curve A points **(Not Available when input mode set to 4-20mA or 0-20mA)*	2 to 10
7701 7791 7881	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 1	FLOAT	Curve A mA Input Value Point 1 **(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7703 7793 7883	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary mA Input Point 1	FLOAT	Curve A Auxiliary mA Input Value Point 1 **(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7705 7795 7885	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Value Point 2	FLOAT	Curve A mA Input Value Point 2 **(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7707 7797 7887	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary mA Input Point 2	FLOAT	Curve A Auxiliary mA Input Value Point 2 **(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7709 7799 7889	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 3	FLOAT	Curve A mA Input Value Point 3 **(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7711 7801 7891	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary mA Input Value Point 3	FLOAT	Curve A Auxiliary mA Input Value Point 3 **(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7713 7803 7893	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Value Point 4	FLOAT	Curve A mA Input Value Point 4 **(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7715 7805 7895	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary mA Input Value Point 4	FLOAT	Curve A Auxiliary mA Input Value Point 4 **(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range

Auxiliary mA Input Configuration Continued						
7717 7807 7897	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Value Point 5	FLOAT	Curve A mA Input Value Point 5 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7719 7809 7899	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary Point 5	FLOAT	Curve A Auxiliary mA Input Value Point 5 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7721 7811 7901	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 6	FLOAT	Curve A mA Input Value Point 6 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7723 7813 7903	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary Point 6	FLOAT	Curve A Auxiliary mA Input Value Point 6 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7725 7815 7905	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 7	FLOAT	Curve A mA Input Value Point 7 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7727 7817 7907	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary Point 7	FLOAT	Curve A Auxiliary mA Input Value Point 7 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7729 7819 7909	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 8	FLOAT	Curve A mA Input Value Point 8 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7731 7821 7911	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary Point 8	FLOAT	Curve A Auxiliary mA Input Value Point 8 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7733 7823 7913	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 9	FLOAT	Curve A mA Input Value Point 9 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7735 7825 7915	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary Point 9	FLOAT	Curve A Auxiliary mA Input Value Point 9 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range

Auxiliary mA Input Configuration Continued						
7737 7827 7917	Get/Set	Channel 1 Channel 2 Channel 3	Curve A mA Input Point 10	FLOAT	Curve A mA Input Value Point 10 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7739 7829 7919	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Auxiliary Point 10	FLOAT	Curve A Auxiliary mA Input Value Point 10 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7741 7831 7921	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve B points	INT	Number of Custom Curve B points *(Not Available when input mode set to 4-20mA or 0-20mA)*	2 to 10
7742 7832 7922	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 1	FLOAT	Curve B mA Input Value Point 1 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7744 7834 7924	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary Point 1	FLOAT	Curve B Auxiliary mA Input Value Point 1 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7746 7836 7926	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 2	FLOAT	Curve B mA Input Value Point 2 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7748 7838 7928	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary Point 2	FLOAT	Curve B Auxiliary mA Input Value Point 2 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7750 7840 7930	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 3	FLOAT	Curve B mA Input Value Point 3 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7752 7842 7932	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary Point 3	FLOAT	Curve B Auxiliary mA Input Value Point 3 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7754 7844 7934	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 4	FLOAT	Curve B mA Input Value Point 4 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma

Auxiliary mA Input Configuration Continued						
7756 7846 7936	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 4	FLOAT	Curve B Auxiliary mA Input Value Point 4 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7758 7848 7938	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 5	FLOAT	Curve B mA Input Value Point 5 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7760 7850 7940	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 5	FLOAT	Curve B Auxiliary mA Input Value Point 5 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7762 7852 7942	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 6	FLOAT	Curve B mA Input Value Point 6 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7764 7854 7944	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 6	FLOAT	Curve B Auxiliary mA Input Value Point 6 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7766 7856 7946	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 7	FLOAT	Curve B mA Input Value Point 7 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7768 7858 7948	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 7	FLOAT	Curve B Auxiliary mA Input Value Point 7 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7770 7860 7950	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 8	FLOAT	Curve B mA Input Value Point 8 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7772 7862 7952	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 8	FLOAT	Curve B Auxiliary mA Input Value Point 8 *(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7774 7864 7954	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 9	FLOAT	Curve B mA Input Value Point 9 *(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma

Auxiliary mA Input Configuration Continued						
7776 7866 7956	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 9	FLOAT	Curve B Auxiliary mA Input Value Point 9 **(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range
7778 7868 7958	Get/Set	Channel 1 Channel 2 Channel 3	Curve B mA Input Point 10	FLOAT	Curve B mA Input Value Point 10 **(Not Available when input mode set to 4-20mA or 0-20mA)*	0 to 20.00ma
7780 7870 7960	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Auxiliary mA Input Point 10	FLOAT	Curve B Auxiliary mA Input Value Point 10 **(Not Available when input mode set to 4-20mA or 0-20mA)*	Value depends upon channel range

Conventional Conductivity Input Configuration

Conventional Conductivity Configuration						
4580 5170 5770	Get/Set	Channel 1 Channel 2 Channel 3	Mode	INT	Input Mode Setting	1080 = Online 1081 = Offline
4581 5171 5771	Get/Set	Channel 1 Channel 2 Channel 3	Units	INT	Units	1005 = Siemens (S/cm) 1006 = Resistivity (Ω/cm) 1007 = TDS (ppm)
4582 5172 5772	Get/Set	Channel 1 Channel 2 Channel 3	Cell Constant	FLOAT	Cell Constant Value	Siemens (0.00500 to 15.00000) Resistivity (0.00500 to 1.50000) TDS (0.00500 to 15.00000)
4584 5174 5774	Get/Set	Channel 1 Channel 2 Channel 3	Range*	INT	Input Range **(Valid ranges depend upon Units and Cell Constant see Conductivity Manual for more information.)*	1013 = Auto 1014 = 0 - 9.999 µS/cm 1015 = 0 -99.99 µS/cm 1016 = 0 - 999.9 µS/cm 1017 = 0 - 9.999 mS/cm 1018 = 0 - 99.99 mS/cm 1019 = 0 - 999.9 mS/cm 1020 = 0-99.99MΩ/cm 1021 = 0-9.999MΩ/cm 1022 = 0-999.9KΩ/cm 1023 = 0-99.99KΩ/cm 1024 = 0 - 9.999 ppm 1025 = 0 -99.99 ppm 1026 = 0 - 999.9 ppm 1027 = 0 -9999 ppm 1028 = 0 - 99.99 ppt
4585 5175 5775	Get/Set	Channel 1 Channel 2 Channel 3	TDS Factor*	FLOAT	TDS Factor Value **(only available when units set to TDS)*	0.50 to 0.90
4587 5177 5777	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Sensor Type	INT	Temperature Sensor Type	1069 = PT1000 1070 = PT100 1075 = Disabled
4588 5178 5778	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Units	1040 = °C 1041 = °F
4589 5179 5779	Get/Set	Channel 1 Channel 2 Channel 3	Compensation	INT	Temperature Compensation Mode	1042 = In 1043 = Out
4590 5180 5780	Get/Set	Channel 1 Channel 2 Channel 3	Compensation Base*	INT	Temperature Compensation Base **(only available when temperature compensation set to in)*	1044 = +20°C 1045 = +25°C

Conductivity Configuration Continued						
4591 5181 5781	Get/Set	Channel 1 Channel 2 Channel 3	Compensation Slope*	FLOAT	Temperature Compensation Slope Value *(only available when temperature compensation set to in)*	0 to 9.99%°C
4593 5183 5783	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Mode*	INT	Manual Temperature Mode *(only available when temperature compensation set to in and temperature sensor type not set to disabled)*	1046 = Auto 1047 = Manual
4594 5184 5784	Get/Set	Channel 1 Channel 2 Channel 3	Compensation Input*	FLOAT	Manual Temperature Compensation Input Value *(only available when temperature compensation mode set to manual)*	-20.0 °C to 150.0 °C -4.0°F to 302.0°F
4596 5186 5786	Get/Set	Channel 1 Channel 2 Channel 3	Cable Compensation	FLOAT	Cable Length Compensation Value	0 to 999 Meters
4598 5188 5788	Get/Set	Channel 1 Channel 2 Channel 3	Input Filter	INT	Input Filter (Averaging)	1050 = Filter Out 1051 = 10 Seconds 1052 = 20 Seconds 1053 = 40 Seconds 1054 = 1 Minutes 1055 = 3 Minutes 1056 = 5 Minutes

Dissolved Oxygen Input Configuration

Dissolved Oxygen Configuration						
4650 5240 5840	Get/Set	Channel 1 Channel 2 Channel 3	Mode	INT	Input Mode Setting	1080 = Online 1081 = Offline
4651 5241 5841	Get/Set	Channel 1 Channel 2 Channel 3	Units	INT	Units	1099 = Saturation (%) 1100 = Concentration (ppm) 1101 = pO2 1102 = Mercury (mmHg) 1103 = Concentration (mg/l) 1104 = Current (A)
4652 5242 5842	Get/Set	Channel 1 Channel 2 Channel 3	Probe	INT	Probe Type	1431 = LTH OE15 1432 = BJC Process Probe 1433 = Hamilton 1434 = Royce Do *(Only available when using a Royce DO input Card)* 1435 = Custom Probe
4653 5243 5843	Get/Set	Channel 1 Channel 2 Channel 3	Sensor Type*	INT	Sensor Type **(Only available when Probe Type set to Custom Probe)*	1229 = Galvanic 1230 = Polargraphic
4654 5244 5844	Get/Set	Channel 1 Channel 2 Channel 3	Bias Voltage*	FLOAT	Bias Voltage Value **(Only available when using a Polargraphic sensor)*	-1.000 to 1.000
4656 5246 5846	Get/Set	Channel 1 Channel 2 Channel 3	Membrane Correction Factor	FLOAT	Probe Membrane Correction Factor Value	0 to 9999
4658 5248 5848	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Sensor Type	INT	Temperature Input Sensor	1069 = Pt1000 1070 = Pt100 1072 = LTH 1K 1073 = BJ22K 1074 = Royce 2K252 *(Only available when using a Royce DO input Card)* 1075 = Disabled
4659 5249 5849	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Units	1040 = °C 1041 = °F

Registers

Dissolved Oxygen Configuration Continued						
4660 5250 5850	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Compensation Mode	INT	Temperature Compensation	1046 = Auto 1047 = Manual
4661 5251 5851	Get/Set	Channel 1 Channel 2 Channel 3	Manual Temperature Input*	FLOAT	Manual Temperature Compensation Input Value *(Only available when Temperature Compensation set to manual)*	-20.0 °C to 150.0 °C -4.0°F to 302.0°F
4663 5253 5853	Get/Set	Channel 1 Channel 2 Channel 3	Input Salinity	FLOAT	Input Salinity Compensation Value	0 to 40.00
4665 5255 5855	Get/Set	Channel 1 Channel 2 Channel 3	Pressure Compensation Mode	INT	Pressure Compensation Mode	1107 = Manual 1108 = Auto
4666 5256 5856	Get/Set	Channel 1 Channel 2 Channel 3	Pressure Mode*	INT	Pressure Mode *(Only available when Pressure Compensation Mode set to auto)*	1308 = mA Input 1309 = 24v Loop
4667 5257 5857	Get/Set	Channel 1 Channel 2 Channel 3	Pressure Units	INT	Pressure Units	1110 = Atm 1111 = Bar 1112 = Kpa 1113 = mH20 1114 = Psi 1115 = mmHg
4668 5258 5858	Get/Set	Channel 1 Channel 2 Channel 3	4ma Pressure Setting*	FLOAT	Pressure 4ma Input Value *(Only available when pressure compensation mode set to auto)*	Atm: 0 to 99.99 Bar: 0 to 99.99 Kpa: 0 to 9999 mH20: 0 to 999.9 Psi: 0 to 999.9 mmHg: 0 to 9999
4670 5260 5860	Get/Set	Channel 1 Channel 2 Channel 3	20ma Pressure Setting*	FLOAT	Pressure 20ma Input Value *(Only available when pressure compensation mode set to auto)*	
4672 5262 5862	Get/Set	Channel 1 Channel 2 Channel 3	Pressure Damping*	INT	Pressure Damping *(Only available when pressure compensation mode set to auto)*	1429 = Disabled 1430 = Enabled
4673 5263 5863	Get/Set	Channel 1 Channel 2 Channel 3	Pressure Damping Limit A*	FLOAT	Pressure Damping Limit A Value *(Only available when pressure damping set to enable)*	Atm: 0 to 99.99 Bar: 0 to 99.99 Kpa: 0 to 9999 mH20: 0 to 999.9 Psi: 0 to 999.9 mmHg: 0 to 9999

Dissolved Oxygen Configuration Continued						
4675 5265 5865	Get/Set	Channel 1 Channel 2 Channel 3	Pressure Damping Limit B*	FLOAT	Pressure Damping Limit B Value *(Only available when pressure damping set to enable)*	Atm: 0 to 99.99 Bar: 0 to 99.99 Kpa: 0 to 9999 mH20: 0 to 999.9 Psi: 0 to 999.9 mmHg: 0 to 9999
4677 5267 5867	Get/Set	Channel 1 Channel 2 Channel 3	Input Pressure*	FLOAT	Fixed Input Pressure Value *(Only available when pressure compensation mode set to manual)*	Atm: 0 to 99.99 Bar: 0 to 99.99 Kpa: 0 to 9999 mH20: 0 to 999.9 Psi: 0 to 999.9 mmHg: 0 to 9999
4679 5269 5869	Get/Set	Channel 1 Channel 2 Channel 3	Input Filter	INT	Dissolved Oxygen Input Filter	1050 = Filter Out 1051 = 10 Seconds 1052 = 20 Seconds 1053 = 40 Seconds 1054 = 1 Minutes 1055 = 3 Minutes 1056 = 5 Minutes

Electrodeless Conductivity Input Configuration

<table>
<tr><th colspan="7">Electrodeless Conductivity Configuration</th></tr>
<tr><td>4730
5320
5920</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Mode</td><td>INT</td><td>Input Mode Setting</td><td>1080 = Online
1081 = Offline</td></tr>
<tr><td>4731
5321
5921</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Units</td><td>INT</td><td>Units</td><td>1005 = Siemens
1007 = TDS (ppm)
1008 = Solution</td></tr>
<tr><td>4732
5322
5922</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Sensor Type</td><td>INT</td><td>Electrodeless Sensor Type</td><td>1180 = ECS20
1181 = ECS40
1182 = ECS48
1183 = Custom</td></tr>
<tr><td>4733
5323
5923</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Cell Constant*</td><td>FLOAT</td><td>Electrodeless Cell Constant Value
*(only available when Electrodeless Cell set Custom)</td><td>1.00 to 15.00</td></tr>
<tr><td>4735
5325
5925</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Range</td><td>INT</td><td>Range
*(Valid ranges depend upon selected units, see Electrodeless Conductivity manual for more information)</td><td>1013 = Auto
1016 = 0-999.9 µs/cm
1017 = 0-9.999 ms/cm
1018 = 0-99.99 ms/cm
1019 = 0-999.9 ms/cm
1026 = 0-999.9 ppm
1027 = 0-9999 ppm
1028 = 0-99.99 ppt
1029 = %NaOH
1030 = %NaCL
1031 = %H2SO4
1032 = %HCL
1033 = %H3PO4
1034 = %HNO
1035 = Salinity
1036 = Custom 1
1037 = Custom 2</td></tr>
<tr><td>4736
5326
5926</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Custom Curve 1 Conductivity Range</td><td>INT</td><td>Custom Solution Curve 1 Conductivity Operating Range</td><td>1567 = 0-9.999 µS/cm
1568 = 0-99.99 ms/cm
1569 = 0-999.9 ms/cm
1570 = 0-9999 ms/cm</td></tr>
<tr><td>4737
5327
5927</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Custom Curve 1 Points</td><td>INT</td><td>Number of Points for Custom Solution Curve 1</td><td>1 to 9</td></tr>
<tr><td>4738
5328
5928</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Custom Curve 1 First Units</td><td>INT</td><td>1st Character of Custom Curve 1 Units</td><td rowspan="2">Refer To Table 1</td></tr>
<tr><td>4739
5329
5929</td><td>Get/Set</td><td>Channel 1
Channel 2
Channel 3</td><td>Custom Curve 1 Second Units</td><td>INT</td><td>2nd Character of Custom Curve 1 Units</td></tr>
</table>

Registers

Electrodeless Conductivity Configuration Continued						
4740 5330 5930	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Third Units	INT	3rd Character of Custom Curve 1 Units	Refer To Table 1
4741 5331 5931	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Fourth Units	INT	4th Character of Custom Curve 1 Units	
4742 5332 5932	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Fifth Units	INT	5th Character of Custom Curve 1 Units	
4743 5333 5933	Get	Channel 1 Channel 2 Channel 3	Custom Curve 1 Sixth Units	INT	6th Character of Custom Curve 1 Units	
4744 5334 5934	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Range	INT	Custom Solution Curve 1 Solution Operating Range	1567 = 0-9.999 1568 = 0-99.99 1569 = 0-999.9 1570 = 0-9999
4745 5335 5935	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 1	FLOAT	Custom Curve 1 Conductivity Point 1 Value	Value Dependant on Custom Curve 1 Conductivity Range
4747 5337 5937	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 1	FLOAT	Electrodeless Custom Input 1 Solution Point 1 Value	Value Dependant on Custom Curve 1 Solution Range
4749 5339 5939	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 2	FLOAT	Custom Curve 1 Conductivity Point 2 Value	Value Dependant on Custom Curve 1 Conductivity Range
4751 5341 5941	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 2	FLOAT	Electrodeless Custom Curve 1 Solution Point 2 Value	Value Dependant on Custom Curve 1 Solution Range
4753 5343 5943	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 3	FLOAT	Custom Curve 1 Conductivity Point 3 Value	Value Dependant on Custom Curve 1 Conductivity Range
4755 5345 5945	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 3	FLOAT	Electrodeless Custom Curve 1 Solution Point 3 Value	Value Dependant on Custom Curve 1 Solution Range
4757 5347 5947	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 4	FLOAT	Custom Curve 1 Conductivity Point 4 Value	Value Dependant on Custom Curve 1 Conductivity Range
4759 5349 5949	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 4	FLOAT	Electrodeless Custom Curve 1 Solution Point 4 Value	Value Dependant on Custom Curve 1 Solution Range
4761 5351 5951	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 5	FLOAT	Custom Curve 1 Conductivity Point 5 Value	Value Dependant on Custom Curve 1 Conductivity Range
4763 5353 5953	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 5	FLOAT	Electrodeless Custom Curve 1 Solution Point 5 Value	Value Dependant on Custom Curve 1 Solution Range

Electrodeless Conductivity Configuration Continued						
4765 5355 5955	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 6	FLOAT	Custom Curve 1 Conductivity Point 6 Value	Value Dependant on Custom Curve 1 Conductivity Range
4767 5357 5957	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 6	FLOAT	Electrodeless Custom Curve 1 Solution Point 6 Value	Value Dependant on Custom Curve 1 Solution Range
4769 5359 5959	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 7	FLOAT	Custom Curve 1 Conductivity Point 7 Value	Value Dependant on Custom Curve 1 Conductivity Range
4771 5361 5961	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 7	FLOAT	Electrodeless Custom Curve 1 Solution Point 7 Value	Value Dependant on Custom Curve 1 Solution Range
4773 5363 5963	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 8	FLOAT	Custom Curve 1 Conductivity Point 8 Value	Value Dependant on Custom Curve 1 Conductivity Range
4775 5365 5965	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 8	FLOAT	Electrodeless Custom Curve 1 Solution Point 8 Value	Value Dependant on Custom Curve 1 Solution Range
4777 5367 5967	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Conductivity Point 9	FLOAT	Custom Curve 1 Conductivity Point 9 Value	Value Dependant on Custom Curve 1 Conductivity Range
4779 5369 5969	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 1 Solution Point 9	FLOAT	Electrodeless Custom Curve 1 Solution Point 9 Value	Value Dependant on Custom Curve 1 Solution Range
4781 5371 5971	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Range	INT	Custom Solution Curve 2 Conductivity Operating Range	1567 = 0-9.999 µS/cm 1568 = 0-99.99 ms/cm 1569 = 0-999.9 ms/cm 1570 = 0-9999 ms/cm
4782 5372 5972	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Points	INT	Number of Points for Custom Solution Curve 2	1 to 9
4783 5373 5973	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 First Units	INT	1st Character of Custom Curve 2 Units	Refer To Table 1
4784 5374 5974	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Second Units	INT	2nd Character of Custom Curve 2 Units	
4785 5375 5975	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Third Units	INT	3rd Character of Custom Curve 2 Units	
4786 5376 5976	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Fourth Units	INT	4th Character of Custom Curve 2 Units	
4787 5377 5977	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Fifth Units	INT	5th Character of Custom Curve 2 Units	
4788 5378 5978	Get	Channel 1 Channel 2 Channel 3	Custom Curve 2 Sixth Units	INT	6th Character of Custom Curve 2 Units	

Electrodeless Conductivity Configuration Continued						
4789 5379 5979	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Range	INT	Custom Solution Curve 2 Solution Operating Range	1567 = 0-9.999 1568 = 0-99.99 1569 = 0-999.9 1570 = 0-9999
4790 5380 5980	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 1	FLOAT	Custom Curve 2 Conductivity Point 1 Value	Value Dependant on Custom Curve 2 Conductivity Range
4792 5382 5982	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 1	FLOAT	Electrodeless Custom Curve 2 Solution Point 1 Value	Value Dependant on Custom Curve 2 Solution Range
4794 5384 5984	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 2	FLOAT	Custom Curve 2 Conductivity Point 2 Value	Value Dependant on Custom Curve 2 Conductivity Range
4796 5386 5986	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 2	FLOAT	Electrodeless Custom Curve 2 Solution Point 2 Value	Value Dependant on Custom Curve 2 Solution Range
4798 5388 5988	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 3	FLOAT	Custom Curve 2 Conductivity Point 3 Value	Value Dependant on Custom Curve 2 Conductivity Range
4800 5390 5990	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 3	FLOAT	Electrodeless Custom Curve 2 Solution Point 3 Value	Value Dependant on Custom Curve 2 Solution Range
4802 5392 5992	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 4	FLOAT	Custom Curve 2 Conductivity Point 4 Value	Value Dependant on Custom Curve 2 Conductivity Range
4804 5394 5994	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 4	FLOAT	Electrodeless Custom Curve 2 Solution Point 4 Value	Value Dependant on Custom Curve 2 Solution Range
4806 5396 5996	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 5	FLOAT	Custom Curve 2 Conductivity Point 5 Value	Value Dependant on Custom Curve 2 Conductivity Range
4808 5398 5998	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 5	FLOAT	Electrodeless Custom Curve 2 Solution Point 5 Value	Value Dependant on Custom Curve 2 Solution Range
4810 5400 6000	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 6	FLOAT	Custom Curve 2 Conductivity Point 6 Value	Value Dependant on Custom Curve 2 Conductivity Range
4812 5402 6002	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 6	FLOAT	Electrodeless Custom Curve 2 Solution Point 6 Value	Value Dependant on Custom Curve 2 Solution Range
4814 5404 6004	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 7	FLOAT	Custom Curve 2 Conductivity Point 7 Value	Value Dependant on Custom Curve 2 Conductivity Range
4816 5406 6006	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 7	FLOAT	Electrodeless Custom Curve 2 Solution Point 7 Value	Value Dependant on Custom Curve 2 Solution Range

Electrodeless Configuration Continued						
4818 5408 6008	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 8	FLOAT	Custom Curve 2 Conductivity Point 8 Value	Value Dependant on Custom Curve 2 Conductivity Range
4820 5410 6010	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 8	FLOAT	Electrodeless Custom Curve 2 Solution Point 8 Value	Value Dependant on Custom Curve 2 Solution Range
4822 5412 6012	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Conductivity Point 9	FLOAT	Custom Curve 2 Conductivity Point 9 Value	Value Dependant on Custom Curve 2 Conductivity Range
4824 5414 6014	Get/Set	Channel 1 Channel 2 Channel 3	Custom Curve 2 Solution Point 9	FLOAT	Electrodeless Custom Curve 2 Solution Point 9 Value	Value Dependant on Custom Curve 2 Solution Range
4826 5416 6016	Get/Set	Channel 1 Channel 2 Channel 3	TDS Factor	FLOAT	TDS Factor Value ** (Only available when Units set to TDS)*	0.50 to 0.90
4828 5418 6018	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Input Sensor	INT	Temperature Input Sensor	1069 = PT1000 1075 = Sensor Disabled
4829 5419 6019	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Units	1040 = °C 1041 = °F
4830 5420 6020	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Compensation	INT	Temperature Compensation	1042 = In 1043 = Out
4831 5421 6021	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Compensation Base*	INT	Temperature Compensation Base **(Only available when Temperature Compensation set to In)*	1044 = +20°C 1045 = +25°C
4832 5422 6022	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Compensation Slope	FLOAT	Temperature Compensation Slope Value **(Only available when Temperature Compensation set to In)*	0 to 9.99%°C
4834 5424 6024	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Compensation Mode	INT	Temperature Compensation Mode **(only available when temperature compensation set to in and temperature sensor type not set to disabled)*	1046 = Auto 1047 = Manual
4835 5425 6025	Get/Set	Channel 1 Channel 2 Channel 3	Manual Temperature Input*	FLOAT	-4.0°F to 302.0°F **(only available when Temperature Compensation set to In and Temperature Compensation Mode set to Manual)*	-20.0 °C to 150.0 °C

Registers

Electrodeless Conductivity Configuration Continued						
4837 5427 6027	Get/Set	Channel 1 Channel 2 Channel 3	Input Filter	INT	Electrodeless Input Filter	1050 = Filter Out 1051 = 10 Seconds 1052 = 20 Seconds 1053 = 40 Seconds 1054 = 1 Minutes 1055 = 3 Minutes 1056 = 5 Minutes

pH / Redox Input Configuration

pH / Redox Configuration						
4890 5480 6080	Get/Set	Channel 1 Channel 2 Channel 3	Mode	INT	Input Mode Setting	1080 = Online 1081 = Offline
4891 5481 6081	Get/Set	Channel 1 Channel 2 Channel 3	Units	INT	Units	1065 = pH (XX.XX) 1066 = Redox(mV) 1067 = Temperature 1068 = pH (XX.XXX)
4892 5482 6082	Get/Set	Channel 1 Channel 2 Channel 3	Probe Type*	INT	Probe Type **(Only available if Units set to pH)*	1067 = Glass 1068 = Antimony
4893 5483 6083	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Sensor	INT	Temperature Input Sensor	1069 = Pt1000 1070 = Pt100 1075 = Disabled *(Unavailable when Units set to Temperature)*
4894 5484 6084	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Units	INT	Temperature Units	1040 = °C 1041 = °F 1042 = K *(Unavailable when Units not set to Temperature)*
4895 5485 6085	Get/Set	Channel 1 Channel 2 Channel 3	Temperature Compensation Mode*	INT	Temperature Compensation Mode **(Only available when pH units chosen)*	1046 = Auto 1047 = Manual
4896 5486 6086	Get/Set	Channel 1 Channel 2 Channel 3	Manual Temperature Input*	FLOAT	Manual Temperature Input Value **(Only Available when Units set to pH and Temperature Compensation Mode is set to Manual)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
4898 5488 6088	Get/Set	Channel 1 Channel 2 Channel 3	Input Filter	INT	Input Filter (Averaging)	1050 = Filter Out 1051 = 10 Seconds 1052 = 20 Seconds 1053 = 40 Seconds 1054 = 1 Minute 1055 = 3 Minute 1056 = 5 Minute

Suspended Solids / Turbidity Input Configuration

Suspended Solids / Turbidity Configuration						
4950 5540 6140	Get/Set	Channel 1 Channel 2 Channel 3	Mode	INT	Input Mode Setting	1080 = Online 1081 = Offline
4951 5541 6141	Get/Set	Channel 1 Channel 2 Channel 3	Units	INT	Units	1520 = NTU 1521 = FTU 1522 = mg/l 1523 = g/l 1524 = ppt 1525 = ppm 1526 = EBC 1527 = OD 1528 = % 1529 = PS
4952 5542 6142	Get/Set	Channel 1 Channel 2 Channel 3	Range	INT	Range *(Not Available when Units Set to PS)*	1536 = 0-9.999 1537 = 0-99.99 1538 = 0-999.9 1539 = 0-9999 1539 = 0-10.00 * 1540 = 0-100.0* **Only available for units %*
4953 5543 6143	Get/Set	Channel 1 Channel 2 Channel 3	Linearisation Source*	INT	Linearisation Curve Source **(Not Available when Units Set to PS)*	1550 = Curve A 1551 = Curve B
4954 5544 6144	Get/Set	Channel 1 Channel 2 Channel 3	Curve A points*	INT	Curve A Number of Points **(Not Available when Units Set to PS)*	2 to 10
4955 5545 6145	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 1*	FLOAT	Curve A Point 1 Value **(Not Available when Units Set to PS)*	Value Dependant On Range
4957 5547 6147	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 1*	FLOAT	Curve A Sensor Point 1 Value **(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4959 5549 6149	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 2*	FLOAT	Curve A Point 2 Value **(Not Available when Units Set to PS)*	Value Dependant On Range
4961 5551 6151	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 2*	FLOAT	Curve A Sensor Point 2 Value **(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)

Suspended Solids / Turbidity Configuration Continued						
4963 5553 6153	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 3*	FLOAT	Curve A Point 3 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4965 5555 6155	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 3*	FLOAT	Curve A Sensor Point 3 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4967 5557 6157	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 4*	FLOAT	Curve A Point 4 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4969 5559 6159	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 4*	FLOAT	Curve A Sensor Point 4 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4971 5561 6161	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 5*	FLOAT	Curve A Point 5 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4973 5563 6163	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 5*	FLOAT	Curve A Sensor Point 5 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4975 5565 6165	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 6*	FLOAT	Curve A Point 6 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4977 5567 6167	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 6*	FLOAT	Curve A Sensor Point 6 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4979 5569 6169	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 7*	FLOAT	Curve A Point 7 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4981 5571 6171	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 7*	FLOAT	Curve A Sensor Point 7 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4983 5573 6173	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 8*	FLOAT	Curve A Point 8 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4985 5575 6175	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 8*	FLOAT	Curve A Sensor Point 8 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)

Suspended Solids / Turbidity Configuration Continued						
4987 5577 6177	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 9*	FLOAT	Curve A Point 9 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4989 5579 6179	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 9*	FLOAT	Curve A Sensor Point 9 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4991 5581 6181	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Point 10*	FLOAT	Curve A Point 10 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4993 5583 6183	Get/Set	Channel 1 Channel 2 Channel 3	Curve A Sensor Point 10*	FLOAT	Curve A Sensor Point 10 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
4995 5585 6185	Get/Set	Channel 1 Channel 2 Channel 3	Curve B points*	INT	Curve B Number of Points *(Not Available when Units Set to PS)*	2 to 10
4996 5586 6186	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 1*	FLOAT	Curve B Point 1 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
4998 5588 6188	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 1*	FLOAT	Curve B Sensor Point 1 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5000 5590 6190	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 2*	FLOAT	Curve B Point 2 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5002 5592 6192	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 2*	FLOAT	Curve B Sensor Point 2 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5004 5594 6194	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 3*	FLOAT	Curve B Point 3 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5006 5596 6196	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 3*	FLOAT	Curve B Sensor Point 3 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5008 5598 6198	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 4*	FLOAT	Curve B Point 4 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5010 5600 6200	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 4*	FLOAT	Curve B Sensor Point 4 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)

Suspended Solids / Turbidity Configuration Continued						
5012 5602 6202	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 5*	FLOAT	Curve B Point 5 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5014 5604 6204	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 5*	FLOAT	Curve B Sensor Point 5 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5016 5606 6206	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 6*	FLOAT	Curve B Point 6 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5018 5608 6208	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 6*	FLOAT	Curve B Sensor Point 6 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5020 5610 6210	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 7*	FLOAT	Curve B Point 7 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5022 5612 6212	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 7*	FLOAT	Curve B Sensor Point 7 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5024 5614 6214	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 8*	FLOAT	Curve B Point 8 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5026 5616 6216	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 8*	FLOAT	Curve B Sensor Point 8 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5028 5618 6218	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 9*	FLOAT	Curve B Point 9 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5030 5620 6220	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 9*	FLOAT	Curve B Sensor Point 9 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5032 5622 6222	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Point 10*	FLOAT	Curve B Point 10 Value *(Not Available when Units Set to PS)*	Value Dependant On Range
5034 5624 6224	Get/Set	Channel 1 Channel 2 Channel 3	Curve B Sensor Point 10*	FLOAT	Curve B Sensor Point 10 Value *(Not Available when Units Set to PS)*	0 to 16000 0 to 32000 (turbidity)
5036 5626 6226	Get/Set	Channel 1 Channel 2 Channel 3	Input Filter	INT	Suspended Solids Input Filter	1555 = Filter Out 1556 = 1 Second 1557 = 2 Seconds 1558 = 4 Seconds 1559 = 8 Seconds 1560 = 16 Seconds 1561 = 32 Seconds

Calculation Configuration

Calculation Configuration						
6280 6300	Get/Set	Calc 1 Calc 2	Mode	INT	Calculation On or Off	1305 = Off 1306 = On
6281 6301	Get/Set	Calc 1 Calc 2	Variable X	INT	Calculation Variable X	Refer To Table 4 * *Available options depends on Sensors installed in Instrument*
6282 6302	Get/Set	Calc 1 Calc 2	Variable Y	INT	Calculation Variable Y	
6283 6303	Get/Set	Calc 1 Calc 2	Function	INT	Calculation Function	1580 = Difference (X-Y) 1581 = Difference (Y-X) 1582 = Average 1583 = Ratio 1584 = Passage 1585 = Rejection

Sensor Calibration

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values

Auxiliary mA Input Calibration

Auxiliary mA Input Calibration						
6500 6880 7260	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Access	INT	Front screen Calibration Access	1076 = Yes 1077 = No
6501 6881 7261	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Reminder	INT	Calibration Reminder	1076 = Yes 1077 = No
6502 6882 7262	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Interval*	FLOAT	Calibration Interval Value **(Only available when Calibration Reminder set to yes)*	0 to 999 Days
6504 6884 7264	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Date*	INT	Calibration Alarm Date Value **(Only available when Calibration Reminder set to yes)*	1 to 31 Day
6505 6885 7265	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Month*	INT	Calibration Alarm Month Value **(Only available when Calibration Reminder set to yes)*	1 to 12 Month
6506 6886 7266	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Year*	INT	Calibration Alarm Year Value **(Only available when Calibration Reminder set to yes)*	0 to 2099 Year
6507 6887 7267	Get	Channel 1 Channel 2 Channel 3	Solution Offset	FLOAT	Sensor Solution Offset Value	Value Dependant On Auxiliary mA Input Range

Conventional Conductivity Input Calibration

Conventional Conductivity Input Calibration						
6550 6930 7310	Get/Set	Channel 1 Channel 2 Channel 3	Cal Access	INT	Front Screen Calibration Access	1076 = Yes 1077 = No
6551 6931 7311	Get/Set	Channel 1 Channel 2 Channel 3	Cal Manual Temperature Input*	FLOAT	Calibration Manual Temperature Input **(Only available when Temperature compensation Mode is set to Manual)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6553 6933 7313	Get	Channel 1 Channel 2 Channel 3	Reading Slope	FLOAT	Sensor Slope Value	90 to 110%
6555 6935 7315	Get	Channel 1 Channel 2 Channel 3	Temperature Offset*	FLOAT	Temperature Offset Value **(Not available when Temperature Sensor is set to Disabled)*	-25°C to +25°C -13.0°F to 77.0°F
6557 6937 7317	Get/Set	Channel 1 Channel 2 Channel 3	Calibration reminder	INT	Calibration Reminder	1076 = Yes 1077 = No
6558 6938 7318	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Interval*	FLOAT	Calibration Interval Value **(Only available when Calibration Reminder set to yes)*	0 to 999 Days
6560 6940 7320	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Date*	INT	Calibration Alarm Date Value **(Only available when Calibration Reminder set to yes)*	1 to 31 Day
6561 6941 7321	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Month*	INT	Calibration Alarm Month Value **(Only available when Calibration Reminder set to yes)*	1 to 12 Month
6562 6942 7322	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Year*	INT	Conductivity Calibration Alarm Year Value **(Only available when Calibration Reminder set to yes)*	Max 2099 Year

Dissolved Oxygen Input Calibration

Dissolved Oxygen Input Calibration						
6600 6980 7360	Get/Set	Channel 1 Channel 2 Channel 3	Cal Manual Temperature Input*	FLOAT	Calibration Manual Temperature Input **(Only available when Temp Compensation Mode is set to Manual)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6602 6982 7362	Get/Set	Channel 1 Channel 2 Channel 3	Cal Units	INT	Calibration Units	1099 = %sat 1100 = Ppm 1101 = pO2 1102 = Mmhg 1103 = Mg/litre
6603 6983 7363	Get/Set	Channel 1 Channel 2 Channel 3	Manual Pressure Input*	FLOAT	Manual Pressure Input **(Only available when Pressure Compensation is set to Manual)*	Atm: 0 to 99.99 Bar: 0 to 99.99 Kpa: 0 to 9999 mH20: 0 to 999.9 Psi: 0 to 999.9 mmHg: 0 to 9999
6605 6985 7365	Get/Set	Channel 1 Channel 2 Channel 3	Span Level	FLOAT	Span Calibration Point	%sat: 0 to 999.99 Ppm: 0 to 20 pO2 : 0 to 999.99 Mmhg : 0 to 999.99 Mg/litre : 0 to 20
6607 6987 7367	Get/Set	Channel 1 Channel 2 Channel 3	Auto Span	INT	Enable Auto span Calibration	1076 = Yes 1077 = No
6608 6988 7368	Get	Channel 1 Channel 2 Channel 3	Temperature Offset*	FLOAT	Temperature Offset Value **(Not available when Temperature Sensor is set to Disabled)*	-25°C to +25°C -13.0°F to 77.0°F
6610 6990 7370	Get	Channel 1 Channel 2 Channel 3	Sensor Condition	INT	Sensor Condition	0 = Good 1 = Fault 2 = Span High 3 = Refill
6611 6991 7371	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Access	INT	Front screen Calibration Access	1076 = Yes 1077 = No
6612 6992 7372	Get/Set	Channel 1 Channel 2 Channel 3	Calibration reminder	INT	Calibration Reminder	1076 = Yes 1077 = No
6613 6993 7373	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Interval*	FLOAT	Calibration Interval **(Only available when Calibration Reminder set to yes)*	0 to 999 Days
6615 6995 7375	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Date*	INT	Calibration Alarm Date Value **(Only available when Calibration Reminder set to yes)*	1 to 31 Day

Dissolved Oxygen Input Calibration Continued						
6616 6996 7376	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Month*	INT	Calibration Alarm Month Value **(Only available when Calibration Reminder set to yes)*	1 to 12 Month
6617 6997 7377	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Year*	INT	Dissolved Oxygen Calibration Alarm Year Value **(Only available when Calibration Reminder set to yes)*	Max 2099 Year

Electrodeless Conductivity Input Calibration

Electrodeless Conductivity Input Calibration						
6650 7030 7410	Get/Set	Channel 1 Channel 2 Channel 3	Cal Manual Temperature Input*	FLOAT	Calibration Manual Temperature Input *(Only available when Temperature compensation Mode is set to Manual)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6652 7032 7412	Get	Channel 1 Channel 2 Channel 3	Reading Slope	FLOAT	Sensor Slope Value	80% to 120%
6654 7034 7414	Get	Channel 1 Channel 2 Channel 3	Temperature Offset*	FLOAT	Temperature Offset Value *(Not available when Temperature Sensor is set to Disabled)*	25°C to +25°C -13.0°F to 77.0°F
6656 7036 7416	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Access	INT	Front screen Calibration Access	1076 = Yes 1077 = No
6657 7037 7417	Get/Set	Channel 1 Channel 2 Channel 3	Calibration reminder	INT	Calibration Reminder	1076 = Yes 1077 = No
6658 7038 7418	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Interval*	FLOAT	Calibration Interval Value *(Only available when Calibration Reminder set to yes)*	0 to 999 Days
6660 7040 7420	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Date*	INT	Calibration Alarm Date Value *(Only available when Calibration Reminder set to yes)*	1 to 31 Day
6661 7041 7421	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Month*	INT	Calibration Alarm Month Value *(Only available when Calibration Reminder set to yes)*	1 to 12 Month
6662 7042 7422	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Year*	INT	Calibration Alarm Year Value *(Only available when Calibration Reminder set to yes)*	Max 2099 Year

pH / Redox Input Calibration

pH / Redox Input Calibration						
6700 7080 7460	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Mode	INT	Calibration Principle	1438 = Auto 1439 = Manual
6701 7081 7461	Get/Set	Channel 1 Channel 2 Channel 3	Manual Temperature Input*	FLOAT	Manual Temperature Input *(Only available when Temperature compensation Mode is set to Manual)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6703 7083 7463	Get	Channel 1 Channel 2 Channel 3	pH Offset*	FLOAT	pH Reading Offset Value *(Only available when Units is set to pH)*	3 to 11 pH -4 to +4 pH for Antimony
6705 7085 7465	Get	Channel 1 Channel 2 Channel 3	pH Slope*	FLOAT	pH Slope Value *(Only available when Units is set to pH)*	60 to 120%
6707 7087 7467	Get	Channel 1 Channel 2 Channel 3	Redox Offset*	FLOAT	Redox Offset Value *(Only available when Units is set to Redox)*	-400mV to +400mV
6709 7089 7469	Get	Channel 1 Channel 2 Channel 3	Temperature Offset	FLOAT	Temperature Offset Value *(Not available when Temperature Sensor is set to Disabled)*	-25°C to +25°C -13.0°F to 77.0°F
6711 7091 7471	Get	Channel 1 Channel 2 Channel 3	Sensor condition	INT	Sensor Condition	0 = Good 1 = Fault 2 = Span High 3 = Refill
6712 7092 7472	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Access	INT	Front Screen Calibration access	1076 = Yes 1077 = No
6713 7093 7473	Get/Set	Channel 1 Channel 2 Channel 3	Calibration reminder	INT	Calibration Reminder	1076 = Yes 1077 = No
6714 7094 7474	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Interval*	FLOAT	Calibration Interval Value *(Only available when Calibration Reminder set to yes)*	0 to 999 Days
6716 7096 7476	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Date*	INT	Calibration Alarm Date Value *(Only available when Calibration Reminder set to yes)*	1 to 31 Day
6717 7097 7477	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Month*	INT	Calibration Alarm Month Value *(Only available when Calibration Reminder set to yes)*	1 to 12 Month

pH / Redox Input Calibration Continued						
6718 7098 7478	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Year*	INT	Calibration Alarm Year *(Only available when Calibration Reminder set to yes)*	Max 2099 Year
6719 7099 7479	Get/Set	Channel 1 Channel 2 Channel 3	Custom Input Points*	INT	Number of Custom Input Buffer Points *(Only available when Units is set to pH)*	1 to 13 buffer points
6720 7100 7480	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 1*	FLOAT	Custom Buffer A Point 1 *(Only available when Units is set to pH)*	0 to 14.00 pH
6722 7102 7482	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 1*	FLOAT	Custom Buffer B Point 1 *(Only available when Units is set to pH)*	0 to 14.00 pH
6724 7104 7484	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 1*	FLOAT	Custom Buffer Point 1 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6726 7106 7486	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 2*	FLOAT	Custom Buffer A Point 2 *(Only available when Units is set to pH)*	0 to 14.00 pH
6728 7108 7488	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 2*	FLOAT	Custom Buffer B Point 2 *(Only available when Units is set to pH)*	0 to 14.00 pH
6730 7110 7490	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 2*	FLOAT	Custom Buffer Point 2 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6732 7112 7492	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 3*	FLOAT	Custom Buffer A Point 3 *(Only available when Units is set to pH)*	0 to 14.00 pH
6734 7114 7494	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 3*	FLOAT	Custom Buffer B Point 3 *(Only available when Units is set to pH)*	0 to 14.00 pH
6736 7116 7496	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 3*	FLOAT	Custom Buffer Point 3 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6738 7118 7498	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 4*	FLOAT	Custom Buffer A Point 4 *(Only available when Units is set to pH)*	0 to 14.00 pH
6740 7120 7500	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 4*	FLOAT	Custom Buffer B Point 4 *(Only available when Units is set to pH)*	0 to 14.00 pH
6742 7122 7502	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 4*	FLOAT	Custom Buffer Point 4 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F

pH / Redox Input Calibration Continued						
6744 7124 7504	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 5*	FLOAT	Custom Buffer A Point 5 *(Only available when Units is set to pH)*	0 to 14.00 pH
6746 7126 7506	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 5*	FLOAT	Custom Buffer B Point 5 *(Only available when Units is set to pH)*	0 to 14.00 pH
6748 7128 7508	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 5*	FLOAT	Custom Buffer Point 5 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6750 7130 7510	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 6*	FLOAT	Custom Buffer A Point 6 *(Only available when Units is set to pH)*	0 to 14.00 pH
6752 7132 7512	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 6*	FLOAT	Custom Buffer B Point 6 *(Only available when Units is set to pH)*	0 to 14.00 pH
6754 7134 7514	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 6*	FLOAT	Custom Buffer Point 6 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6756 7136 7516	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 7*	FLOAT	Custom Buffer A Point 7 *(Only available when Units is set to pH)*	0 to 14.00 pH
6758 7138 7518	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 7*	FLOAT	Custom Buffer B Point 7 *(Only available when Units is set to pH)*	0 to 14.00 pH
6760 7140 7520	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 7*	FLOAT	Custom Buffer Point 7 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6762 7142 7522	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 8*	FLOAT	Custom Buffer A Point 8 *(Only available when Units is set to pH)*	0 to 14.00 pH
6764 7144 7524	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 8*	FLOAT	Custom Buffer B Point 8 *(Only available when Units is set to pH)*	0 to 14.00 pH
6766 7146 7526	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 8*	FLOAT	Custom Buffer Point 8 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6768 7148 7528	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 9*	FLOAT	Custom Buffer A Point 9 *(Only available when Units is set to pH)*	0 to 14.00 pH
6770 7150 7530	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 9*	FLOAT	Custom Buffer B Point 9 *(Only available when Units is set to pH)*	0 to 14.00 pH
6772 7152 7532	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 9*	FLOAT	Custom Buffer Point 9 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F

pH / Redox Input Calibration Continued						
6774 7154 7534	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 10*	FLOAT	Custom Buffer A Point 10 *(Only available when Units is set to pH)*	0 to 14.00 pH
6776 7156 7536	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 10*	FLOAT	Custom Buffer B Point 10 *(Only available when Units is set to pH)*	0 to 14.00 pH
6778 7158 7538	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 10*	FLOAT	Custom Buffer Point 10 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6780 7160 7540	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 11*	FLOAT	Custom Buffer A Point 11 *(Only available when Units is set to pH)*	0 to 14.00 pH
6782 7162 7542	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 11*	FLOAT	Custom Buffer B Point 11 *(Only available when Units is set to pH)*	0 to 14.00 pH
6784 7164 7544	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 11*	FLOAT	Custom Buffer Point 11 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6786 7166 7546	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 12*	FLOAT	Custom Buffer A Point 12 *(Only available when Units is set to pH)*	0 to 14.00 pH
6788 7168 7548	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 12*	FLOAT	Custom Buffer B Point 12 *(Only available when Units is set to pH)*	0 to 14.00 pH
6790 7170 7550	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 12*	FLOAT	Custom Buffer Point 12 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F
6792 7172 7552	Get/Set	Channel 1 Channel 2 Channel 3	Buffer A point 13*	FLOAT	Custom Buffer A Point 13 *(Only available when Units is set to pH)*	0 to 14.00 pH
6794 7174 7554	Get/Set	Channel 1 Channel 2 Channel 3	Buffer B point 13*	FLOAT	Custom Buffer B Point 13 *(Only available when Units is set to pH)*	0 to 14.00 pH
6796 7176 7556	Get/Set	Channel 1 Channel 2 Channel 3	Temperature point 13*	FLOAT	Custom Buffer Point 13 Temperature *(Only available when Units is set to pH)*	-20.0°C to 150.0°C -4.0°F to 302.0°F

pH / Redox Input Calibration Continued						
6798 7178 7558	Get/Set	Channel 1 Channel 2 Channel 3	Nominal pH Buffer 1	FLOAT	Custom Nominal pH Buffer 1	0.00 to 14.00 pH
6800 7180 7560	Get/Set	Channel 1 Channel 2 Channel 3	Nominal pH Buffer 2	FLOAT	Custom Nominal pH Buffer 2	0.00 to 14.00 pH

Suspended Solids / Turbidity Input Calibration

Suspended Solids / Turbidity Input Calibration						
6830 7210 7590	Get	Channel 1 Channel 2 Channel 3	Offset Zero	FLOAT	Zero Offset Value	
6832 7212 7592	Get	Channel 1 Channel 2 Channel 3	Offset Span	FLOAT	Span Offset Value	
6834 7214 7594	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Access	INT	Front screen Calibration Access	1076 = Yes 1077 = No
6835 7215 7595	Get/Set	Channel 1 Channel 2 Channel 3	Calibration reminder	INT	Calibration Reminder	1076 = Yes 1077 = No
6836 7216 7596	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Interval*	FLOAT	Calibration Interval Value *(Only available when Calibration Reminder set to yes)*	0 to 999 Days
6838 7218 7598	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Date*	INT	Calibration Alarm Date Value *(Only available when Calibration Reminder set to yes)*	1 to 31 Day
6839 7219 7599	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Month*	INT	Calibration Alarm Month Value *(Only available when Calibration Reminder set to yes)*	1 to 12 Month
6840 7220 7600	Get/Set	Channel 1 Channel 2 Channel 3	Calibration Alarm Year*	INT	Calibration Alarm Year Value *(Only available when Calibration Reminder set to yes)*	Max 2099 Year

Setpoint Configuration

Register #	Access Rule	Setpoint	Name	Data Format	Description of Attribute	Semantics of Values
Setpoint Configuration						
8000 8080 8160 8240 8320 8410	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Channel	INT	Assigned Input Channel	1159 = Disabled 1160 = Channel 1 1161 = Channel 2 1162 = Channel 3 1163 = Unit Alarm 1164 = Calculation 1 1165 = Calculation 2
8001 8081 8161 8241 8321 8411	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Source	INT	Input Source	1166 = Sensor 1167 = Temperature 1168 = Pressure 1169 = Alarm 1170 = Cleaning
8002 8082 8162 8242 8322 8412	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Range*	INT	Range *(Only available when the range of Assigned Input Channel is set to Auto)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
8003 8083 8163 8243 8323 8413	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Trigger	INT	Trigger	1173 = High 1174 = Low 1175 = Band 1176 = Latch High 1177 = Latch Low 1178 = USP* 1179 = USP Pre-Trigger* **(only available for Conductivity)*
8004 8084 8164 8244 8324 8414	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Usp Pre-Trigger*	FLOAT	USP Pre-Trigger Value **(Only available for Conductivity)*	0.000µS/cm to 9.999µS/cm
8006 8086 8166 8246 8326 8416	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	High Value*	FLOAT	Trigger High Value **(Not available when Trigger is set to Low)*	Value depends on input channel assigned to

Setpoint Configuration Continued						
8008 8088 8168 8248 8328 8418	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Low Value*	FLOAT	Trigger Low Value *(Not available when Trigger is set to High)*	Value depends on input channel assigned to
8010 8090 8170 8250 8330 8420	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Units	INT	Trigger Value Units	Refer to Table 5
8011 8091 8171 8251 8331 8421	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Mode*	INT	Mode *(Only available when Trigger is set to High or Low)*	1156 = On/Off 1157 = Pulse Proportional 1158 = Time Proportional
8012 8092 8172 8252 8332 8422	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cycle Time*	INT	Minutes element for Setpoint Cycle Time *(Only available when Mode is set to Time Proportional)*	0 to 59 Minutes
8013 8093 8173 8253 8333 8423	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cycle Time*	INT	Seconds element for Setpoint Cycle Time *(Only available when Mode is set to Time Proportional)*	0 to 59 Seconds
8014 8094 8174 8254 8334 8424	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Prop Band*	FLOAT	Proportion Band Size Value *(Not available when Mode is set to On/Off)*	Value depends on input channel assigned to
8016 8096 8176 8256 8336 8426	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Delay Time Minutes*	INT	Minutes element for Setpoint Delay Time *(Only available when Mode is set to On/Off)*	0 to 59 Minutes
8017 8097 8177 8257 8337 8427	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Delay Time Seconds*	INT	Seconds element for Setpoint Delay Time *(Only available when Mode is set to On/Off)*	0 to 59 Seconds

Setpoint Configuration Continued						
8018 8098 8178 8258 8338 8428	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Hysteresis*	FLOAT	Setpoint Hysteresis Value *(Only available when Mode is set to On/Off)*	0 to 99.99%
8025 8105 8185 8265 8345 8435	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Dose Alarm	INT	Dose Alarm	1076 = Yes 1077 = No
8026 8106 8186 8266 8346 8436	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Alarm Time – Minutes*	INT	Minutes element for Dose Alarm Time *(Only available when Dose Alarm set to yes)*	0 to 59 Minutes
8027 8107 8187 8267 8347 8437	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Dose Alarm Time – Seconds*	INT	Seconds element for Dose Alarm Time *(Only available when Dose Alarm set to yes)*	0 to 59 Seconds
8028 8108 8188 8268 8348 8438	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Initial Charge*	INT	Initial Charge *(Only available when Dose Alarm set to yes)*	1076 = Yes 1077 = No
8029 8109 8189 8269 8349 8439	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Charge Time – Minutes*	INT	Minutes element for Initial Charge Time *(Only available when Initial Charge set to yes)*	0 to 59 Minutes
8030 8110 8190 8270 8350 8440	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Charge Time – Seconds*	INT	Seconds element for Initial Charge Time *(Only available when Initial Charge set to yes)*	0 to 59 Seconds
8031 8111 8191 8271 8351 8441	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Charge Access	INT	Initial Charge Front Screen Access *(Only available when Initial Charge set to yes)*	1076 = Yes 1077 = No

Setpoint Configuration Continued						
8035 8115 8195 8275 8355 8445	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Channel Alarm Condition*	INT	Alarm mode *(Only Available when Input Source is set to Alarm)*	1137 = Disabled 1138 = Sensor Error 1139 = Dose Alarm 1140 = Calibration 1141 = Offline 1142 = Any Error 1143 = Cleaning 1144 = Calibration Due 1145 = Gain Error
8040 8120 8200 8280 8360 8450	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Duration – Minutes*	INT	Minutes element for Cleaning Duration *(Only Available when Input Source is set to Cleaning)*	0 to 10 Minutes
8041 8121 8201 8281 8361 8451	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Duration – Seconds*	INT	Seconds element for Setpoint Cleaning Duration *(Only Available when Input Source is set to Cleaning)*	0 to 59 Seconds (Min 5 Seconds when minutes is 0)
8042 8122 8202 8282 8362 8452	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Interval – Hours*	INT	Hours element for Cleaning Interval Time *(Only Available when Input Source is set to Cleaning)*	0 to 23 hours
8043 8123 8203 8283 8363 8453	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Interval – Minutes*	INT	Minutes element for Cleaning Interval Time *(Only Available when Input Source is set to Cleaning)*	0 to 59 minutes (Min 1 Minutes when hours is 0)
8044 8124 8204 8284 8364 8454	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Mode*	INT	Setpoint Cleaning Mode *(Only Available when Input Source is set to Cleaning)*	1080 = Online 1081 = Offline
8045 8125 8205 8285 8365 8455	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Recovery – Minutes*	INT	Minutes element for Setpoint Cleaning Recovery Time *(Only available when Cleaning Mode set to Offline)*	0 to 10 minutes

Setpoint Configuration Continued						
8046 8126 8206 8286 8366 8456	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Recovery – Seconds	INT	Seconds element for Cleaning Recovery Time *(Only available when Cleaning Mode set to Offline)*	0 to 59 minutes
8047 8127 8207 8287 8367 8457	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Cleaning Delay	INT	Cleaning Delay	1076 = Yes 1077 = No
8050 8130 8210 8290 8370 8460	Get/Set	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	Unit Alarm Condition*	INT	Alarm Mode **(Only Available when Channel is set to Unit Alarm)*	1137 = Disabled 1138 = Sensor Error 1139 = Dose Alarm 1140 = Calibration 1141 = Offline 1142 = Any Error 1143 = Cleaning 1144 = Calibration Due 1145 = Gain error 1146 = Power Failure

Current Output Configuration

Register #	Access Rule	Current Output	Name	Data Format	Description of Attribute	Semantics of Values
Current Output Configuration						
9100 9150 9200 9250 9300 9350	Get/Set	Output A Output B Output C Output D Output E Output F	Channel	INT	Assigned Input Channel	1159 = Disabled 1160 = Channel 1 1161 = Channel 2 1162 = Channel 3 1163 = Unit Alarm 1164 = Calculation 1 1165 = Calculation 2
9101 9151 9201 9251 9301 9351	Get/Set	Output A Output B Output C Output D Output E Output F	Source	INT	Input Source	1166 = Sensor 1167 = Temperature 1168 = Pressure
9102 9152 9202 9252 9302 9352	Get/Set	Output A Output B Output C Output D Output E Output F	Output	INT	Output Mode	1134 = 4-20mA 1135 = 0-20mA
9103 9153 9203 9253 9303 9353	Get/Set	Output A Output B Output C Output D Output E Output F	Range*	INT	Range **(Only available when the range of Assigned Input Channel is set to Auto)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
9104 9154 9204 9254 9304 9354	Get/Set	Output A Output B Output C Output D Output E Output F	On Error Action	INT	On Error Action	1130 = No Action 1131 = Drive To 0mA 1132 = Drive To 22mA 1133 = Hold Level 1134 = Drive to 4mA
9105 9155 9205 9255 9305 9355	Get/Set	Output A Output B Output C Output D Output E Output F	Output Zero	FLOAT	Zero Equivalent Value	Value depends on input channel assigned to
9107 9157 9207 9257 9307 9357	Get/Set	Output A Output B Output C Output D Output E Output F	Output Span	FLOAT	Current Output Span Equivalent Value	Value depends on input channel assigned to

Current Output Configuration Continued						
9109 9159 9209 9259 9309 9359	Get	Output A Output B Output C Output D Output E Output F	Units	INT	Current Output Value Units	Refer to Table 5

Digital Input Configuration

Register #	Access Rule	Current Output	Name	Data Format	Description of Attribute	Semantics of Values
Digital Input Configuration						
9500 9520 9540 9560 9580 9600 9620 9640	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Channel	INT	Assigned Input Channel	1159 = Disabled 1160 = Channel 1 1161 = Channel 2 1162 = Channel 3 1163 = Whole Unit
9501 9521 9541 9561 9581 9601 9621 9641	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Function	INT	Function	1280 = Offline 1281 = Cleaning 1282 = Range Changing 1283 = Switch Setup 1284 = Interlock 1285 = Flow Switch Input 1286 = Tank Level Switch 1287 = Calibration 1288 = Initial Charge 1289 = CIP
9502 9522 9542 9562 9582 9602 9622 9642	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Store*	INT	Switch Setup Store **(Only available when Function is set to Switch Setup)*	1300 = Store A 1301 = Store B
9503 9523 9543 9563 9583 9603 9623 9643	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Polarity	INT	Digital Input Operating Polarity	1298 = Normally Open 1299 = Normally Closed
9504 9524 9544 9564 9584 9604 9624 9644	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Range*	INT	Digital Input Switched Range **(Only available when Function is set to Range Changing)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals

Digital Input Configuration Continued						
9505 9525 9545 9565 9585 9605 9625 9645	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Current Output Level	INT	Digital Input Offline Current Output Drive Level **(Not available when Function is set to Switch Setup or Range Changing)*	1130 = No Action 1131 = Drive To 0mA 1132 = Drive To 22mA 1133 = Hold Level 1134 = Drive to 4mA
9506 9526 9546 9566 9586 9606 9626 9646	Get/Set	Digital IP 1 Digital IP 2 Digital IP 3 Digital IP 4 Digital IP 5 Digital IP 6 Digital IP 7 Digital IP 8	Setpoint*	INT	Digital Input Setpoint **(Only available when Function is set to Cleaning or Initial Charge)*	1147 = Setpoint None 1148 = Setpoint 1 1149 = Setpoint 2 1150 = Setpoint 3 1151 = Setpoint 4 1152 = Setpoint 5 1153 = Setpoint 6

Display Configuration

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Front Screen Configuration						
9700 9850 10000	Get/Set	Channel 1 Channel 2 Channel 3	Channel Shown	INT	Channel Shown	1402 = Channel 1 Yes 1405 = Channel 1 No 1403 = Channel 2 Yes 1405 = Channel 2 No 1404 = Channel 3 Yes 1405 = Channel 3 No
9701 9851 10001	Get/Set	Channel 1 Channel 2 Channel 3	Character 1	INT	Label 1st Character	Refer To Table 1 (excluding symbols)
9702 9852 10002	Get/Set	Channel 1 Channel 2 Channel 3	Character 2	INT	Label 2nd Character	
9703 9853 10003	Get/Set	Channel 1 Channel 2 Channel 3	Character 3	INT	Label 3rd Character	
9704 9854 10004	Get/Set	Channel 1 Channel 2 Channel 3	Character 4	INT	Label 4th Character	
9705 9855 10005	Get/Set	Channel 1 Channel 2 Channel 3	Character 5	INT	Label 5th Character	
9706 9856 10006	Get/Set	Channel 1 Channel 2 Channel 3	Character 6	INT	Label 6th Character	
9707 9857 10007	Get/Set	Channel 1 Channel 2 Channel 3	Character 7	INT	Label 7th Character	
9708 9858 10008	Get	Channel 1 Channel 2 Channel 3	Character 8	INT	Label 8th Character	
Auxiliary mA Inout Front Screen Secondary Reading Configuration						
9720 9870 10020	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 1	INT	Secondary reading 1	Refer To Table 6
9721 9871 10021	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 2	INT	Secondary reading 2	

Conventional Conductivity Front Screen Secondary Reading Configuration						
9730 9880 10030	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 1	INT	Secondary reading 1	Refer To Table 6
9731 9881 10031	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 2	INT	Secondary reading 2	

Dissolved Oxygen Front Screen Secondary Reading Configuration						
9740 9890 10040	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 1	INT	Secondary reading 1	Refer To Table 6
9741 9891 10041	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 2	INT	Secondary reading 2	Refer To Table 6

Electrodeless Front Screen Secondary Reading Configuration						
9750 9900 10050	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 1	INT	Secondary reading 1	Refer To Table 6
9751 9901 10051	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 2	INT	Secondary reading 2	

pH Front Screen Secondary Reading Configuration						
9760 9910 10060	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 1	INT	Secondary reading 1	Refer To Table 6
9761 9911 10061	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 2	INT	Secondary reading 2	

Suspended Solids Front Screen Secondary Reading Configuration						
9770 9920 10070	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 1	INT	Secondary reading 1	Refer To Table 6
9771 9921 10071	Get/Set	Channel 1 Channel 2 Channel 3	Secondary reading 2	INT	Secondary reading 2	

Front Screen Calculation Configuration						
10150 10220	Get/Set	Calc 1 Calc 2	Calculation Shown	INT	Calculation Shown	1076 = Yes 1077 = No
10151 10221	Get/Set	Calc 1 Calc 2	Character 1	INT	Label First Character	Refer To Table1 (excluding symbols)
10152 10222	Get/Set	Calc 1 Calc 2	Character 2	INT	Label Second Character	
10153 10223	Get/Set	Calc 1 Calc 2	Character 3	INT	Label Third Character	
10154 10224	Get/Set	Calc 1 Calc 2	Character 4	INT	Label Fourth Character	
10155 10225	Get/Set	Calc 1 Calc 2	Character 5	INT	Label Fifth Character	
10156 10226	Get/Set	Calc 1 Calc 2	Character 6	INT	Label Sixth Character	Refer To Table1 (excluding symbols)
10157 10227	Get/Set	Calc 1 Calc 2	Character 7	INT	Label Seventh Character	
10158 10228	Get	Calc 1 Calc 2	Character 8	INT	Label Eighth Character	

Calculation Front Screen Secondary Reading Configuration						
10170 10240	Get/Set	Calc 1 Calc 2	Secondary reading 1	INT	Front Screen Secondary reading 1	1356 = Clear 1357 = Current Output A 1358 = Current Output B 1359 = Current Output C 1360 = Current Output D 1361 = Current Output E 1362 = Current Output F
10171 10241	Get/Set	Calc 1 Calc 2	Secondary reading 2	INT	Front Screen Secondary reading 2	

Current Output Front Screen Configuration						
10300 10301	Get/Set	Trend 1 Trend 2	Current Output Front Screen	INT	Current Output Front Screen Configuration **(Not available when more than one channel or calculation is currently being shown)*	1213 = Disabled 1214 = Current Output A 1215 = Current Output B 1216 = Current Output C 1217 = Current Output D 1218 = Current Output E 1219 = Current Output F

Menu Header Configuration						
10400 10401 10402 10403 10404 10405	Get/Set	Header 1 Header 2 Header 3 Header 4 Header 5 Header 6	Menu Header	INT	Menu Header configuration	Refer To Table 6

Data Logging Configuration

Register #	Access Rule	Name	Data Format	Description of Attribute	Semantics of Values
SD Card Data logging Configuration					
10500	Get	Status	INT	Data logging Status	1076 = Logging Data 1077 = Not Logging Data
10501	Get/Set	Interval Hours	INT	Data logging Interval (Hours)	0 to 23 Hours
10502	Get/Set	Interval Minutes	INT	Data logging Interval (Minutes)	0 to 59 Minutes
10503	Get/Set	Interval Seconds	INT	Data logging Interval (Seconds)	0 to 59 Seconds
10504	Get/Set	Data log Channel 1	INT	Channel 1 Log	1695 = Enabled 1696 = Disabled
10505	Get/Set	Data log Range 1*	INT	Channel 1 Range **(Only available when the range of the Input Channel is set to Auto)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10506	Get/Set	Data log Channel 2	INT	Channel 2 Log	1695 = Enabled 1696 = Disabled
10507	Get/Set	Data log Range 2*	INT	Channel 2 Range **(Only available when the range of the Input Channel is set to Auto)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10508	Get/Set	Data log Channel 3	INT	Channel 3 Log	1695 = Enabled 1696 = Disabled
10509	Get/Set	Data log Range 3	INT	Channel 3 Range **(Only available when the range of the Input Channel is set to Auto)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10510	Get/Set	Data logging Calculation 1	INT	Calculation 1 Log	1695 = Enabled 1696 = Disabled
10511	Get/Set	Calculation 1 Range*	INT	Calculation 1 Range **(Only available when the channels associated with the calculation been set to Auto Range)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10512	Get/Set	Data logging Calculation 1	INT	Calculation 2 Log	1695 = Enabled 1696 = Disabled
10513	Get/Set	Calculation 2 Range*	INT	Calculation 2 Range **(Only available when the channels associated with the calculation been set to Auto Range)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10514	Get/Set	Loop Recording	INT	Loop recording	1076 = Enabled 1077 = Disabled

Registers

Data logging Live Trend Configuration						
10520 10545 10570	Get/Set	Trend 1 Trend 2 Trend 3	Traces	INT	Traces Configuration	1690 = None 1691 = 1 Trace 1692 = 2 Traces
10521 10546 10571	Get/Set	Trend 1 Trend 2 Trend 3	Interval Hours	INT	Trend Interval Minutes	0 to 23 Hours
10522 10547 10572	Get/Set	Trend 1 Trend 2 Trend 3	Interval Minutes	INT	Trend Interval Minutes	0 to 59 Minutes
10523 10548 10573	Get/Set	Trend 1 Trend 2 Trend 3	Interval Seconds	INT	Trend Interval Seconds	0 to 59 Seconds
10524 10549 10574	Get/Set	Trend 1 Trend 2 Trend 3	Primary Variable	INT	Trace 1 (Left hand axis)	Refer to Table 4
10525 10550 10575	Get/Set	Trend 1 Trend 2 Trend 3	Primary Range	INT	Trace 1 Range *(Only available when the associated variable has been set to Auto Range)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10526 10551 10576	Get/Set	Trend 1 Trend 2 Trend 3	Primary Start Number	FLOAT	Trace 1 Minimum Value	Value Dependant on Primary Variable
10528 10553 10578	Get/Set	Trend 1 Trend 2 Trend 3	Primary End Number	FLOAT	Trace 1 Maximum Value	
10530 10555 10580	Get/Set	Trend 1 Trend 2 Trend 3	Secondary Variable	INT	Trace 2 (Right hand axis)	Refer to Table 4
10531 10556 10581	Get/Set	Trend 1 Trend 2 Trend 3	Secondary Range	INT	Trace 2 Range *(Only available when the associated variable has been set to Auto Range)*	Refer To Tables 2 and 3 and Sensor Configuration Manuals
10532 10557 10583	Get/Set	Trend 1 Trend 2 Trend 3	Secondary Start Number	FLOAT	Trace 2 Minimum Value	Value Dependant on Secondary Variable
10534 10559 10585	Get/Set	Trend 1 Trend 2 Trend 3	Secondary End Number	FLOAT	Trace 2 Maximum Value	

Service Configuration

Register #	Access Rule	Channel	Name	Data Format	Description of Attribute	Semantics of Values
Service Reminder						
10700 10701 10702	Get	Channel 1 Channel 2 Channel 3	Service reminder	INT	Service Reminder	1076 = Yes 1077 = No
Auxiliary mA Input Service Alarm Configuration						
10710 10780 10850	Get	Channel 1 Channel 2 Channel 3	Service Interval*	FLOAT	Service Interval Value **(Only available when Service Reminder set to yes)*	0 to 999 Days
10712 10782 10852	Get	Channel 1 Channel 2 Channel 3	Service Alarm Date*	INT	Service Alarm Date Value **(Only available when Service Reminder set to yes)*	1 to 31 Day
10713 10783 10853	Get	Channel 1 Channel 2 Channel 3	Service Alarm Month*	INT	Service Alarm Month Value **(Only available when Service Reminder set to yes)*	1 to 12 Month
10714 10784 10854	Get	Channel 1 Channel 2 Channel 3	Service Alarm Year*	INT	Service Alarm Year Value **(Only available when Service Reminder set to yes)*	0 to 2099 Year
Conventional Conductivity Service Alarm Configuration						
10720 10790 10860	Get	Channel 1 Channel 2 Channel 3	Service Interval*	FLOAT	Service Interval Value **(Only available when Service Reminder set to yes)*	0 to 999 Days
10722 10792 10862	Get	Channel 1 Channel 2 Channel 3	Service Alarm Date*	INT	Service Alarm Date Value **(Only available when Service Reminder set to yes)*	1 to 31 Day
10723 10793 10863	Get	Channel 1 Channel 2 Channel 3	Service Alarm Month*	INT	Service Alarm Month Value **(Only available when Service Reminder set to yes)*	1 to 12 Month
10724 10794 10864	Get	Channel 1 Channel 2 Channel 3	Service Alarm Year*	INT	Service Alarm Year Value **(Only available when Service Reminder set to yes)*	Max 2099 Year

Dissolved Oxygen Service Alarm Configuration						
10730 10800 10870	Get	Channel 1 Channel 2 Channel 3	Service Interval*	FLOAT	Service Interval Value *(Only available when Service Reminder set to yes)*	0 to 999 Days
10732 10802 10872	Get	Channel 1 Channel 2 Channel 3	Service Alarm Date*	INT	Service Alarm Date Value *(Only available when Service Reminder set to yes)*	1 to 31 Day
10733 10803 10873	Get	Channel 1 Channel 2 Channel 3	Service Alarm Month*	INT	Service Alarm Month Value *(Only available when Service Reminder set to yes)*	1 to 12 Month
10734 10804 10874	Get	Channel 1 Channel 2 Channel 3	Service Alarm Year*	INT	Service Alarm Year Value *(Only available when Service Reminder set to yes)*	Max 2099 Year

Electrodeless Conductivity Service Alarm Configuration						
10740 10810 10880	Get	Channel 1 Channel 2 Channel 3	Service Interval*	FLOAT	Service Interval Value *(Only available when Service Reminder set to yes)*	0 to 999 Days
10742 10812 10882	Get	Channel 1 Channel 2 Channel 3	Service Alarm Date*	INT	Service Alarm Date Value *(Only available when Service Reminder set to yes)*	1 to 31 Day
10743 10813 10883	Get	Channel 1 Channel 2 Channel 3	Service Alarm Month*	INT	Service Alarm Month Value *(Only available when Service Reminder set to yes)*	1 to 12 Month
10744 10814 10884	Get	Channel 1 Channel 2 Channel 3	Service Alarm Year*	INT	Service Alarm Year Value *(Only available when Service Reminder set to yes)*	Max 2099 Year

pH / Redox Input Service Alarm Configuration						
10750 10820 10890	Get	Channel 1 Channel 2 Channel 3	Service Interval*	FLOAT	Service Interval Value *(Only available when Service Reminder set to yes)*	0 to 999 Days
10752 10822 10892	Get	Channel 1 Channel 2 Channel 3	Service Alarm Date*	INT	Service Alarm Date Value *(Only available when Service Reminder set to yes)*	1 to 31 Day
10753 10823 10893	Get	Channel 1 Channel 2 Channel 3	Service Alarm Month*	INT	Service Alarm Month Value *(Only available when Service Reminder set to yes)*	1 to 12 Month
10754 10824 10894	Get	Channel 1 Channel 2 Channel 3	Service Alarm Year*	INT	Service Alarm Year Value *(Only available when Service Reminder set to yes)*	Max 2099 Year

Suspended Solids / Turbidity Service Alarm Configuration						
10760 10830 10900	Get	Channel 1 Channel 2 Channel 3	Service Interval*	FLOAT	Service Interval Value *(Only available when Service Reminder set to yes)*	0 to 999 Days
10762 10831 10902	Get	Channel 1 Channel 2 Channel 3	Service Alarm Date*	INT	Service Alarm Date Value *(Only available when Service Reminder set to yes)*	1 to 31 Day
10763 10833 10903	Get	Channel 1 Channel 2 Channel 3	Service Alarm Month*	INT	Service Alarm Month Value *(Only available when Service Reminder set to yes)*	1 to 12 Month
10764 10834 10904	Get	Channel 1 Channel 2 Channel 3	Service Alarm Year*	INT	Service Alarm Year Value *(Only available when Service Reminder set to yes)*	Max 2099 Year

Modbus RS485 Coils

Note. The availability of some of the coils depends upon the configuration of the instrument.

Type#	Function	Channel#	Coil#	Write Value#
Calibration Resets				
Auxiliary mA Input	Reset Sensor Calibration	Channel 1 Channel 2 Channel 3	100 165 230	0 = N/A 1 = Activate
	Reset Solution Calibration	Channel 1 Channel 2 Channel 3	101 166 231	
	Reset Entire Calibration	Channel 1 Channel 2 Channel 3	102 167 232	
Conventional Conductivity	Reset Sensor Calibration	Channel 1 Channel 2 Channel 3	110 175 240	
	Reset Temperature Calibration	Channel 1 Channel 2 Channel 3	111 176 241	
	Reset Entire calibration	Channel 1 Channel 2 Channel 3	112 177 242	
Dissolved Oxygen	Reset Sensor Calibration	Channel 1 Channel 2 Channel 3	120 185 250	
	Reset Temperature Calibration	Channel 1 Channel 2 Channel 3	121 186 251	
	Reset Pressure Calibration	Channel 1 Channel 2 Channel 3	122 187 252	
	Reset Entire Calibration	Channel 1 Channel 2 Channel 3	123 188 253	
Electrodeless Conductivity	Reset Sensor Calibration	Channel 1 Channel 2 Channel 3	130 195 260	
	Reset Solution Calibration	Channel 1 Channel 2 Channel 3	131 196 261	
	Reset Temperature Calibration	Channel 1 Channel 2 Channel 3	132 197 262	
	Reset Entire Calibration	Channel 1 Channel 2 Channel 3	133 198 263	

Calibration Resets Continued				
pH / Redox	Reset Sensor Calibration	Channel 1 Channel 2 Channel 3	140 205 270	0 = N/A 1 = Activate
	Reset Temperature Calibration	Channel 1 Channel 2 Channel 3	141 206 271	
	Reset Entire Calibration	Channel 1 Channel 2 Channel 3	142 207 272	
	Reset pH Custom Buffer	Channel 1 Channel 2 Channel 3	143 208 273	
Suspended Solids / Turbidity	Reset Entire Calibration	Channel 1 Channel 2 Channel 3	150 215 280	

Unit Calibration Reset				
Unit	Reset Entire Unit Calibration		295	0 = N/A 1 = Activate

Current Output Resets				
Current Output	Reset 4-20mA Output	Output A Output B Output C Output D Output E Output F	310 311 312 313 314 315	0 = N/A 1 = Activate
	Reset All 4-20mA Outputs		316	

Save Setup				
Channel	Save Setup To Slot A	Channel 1 Channel 2 Channel 3	325 330 335	0 = N/A 1 = Activate
	Save Setup To Slot B	Channel 1 Channel 2 Channel 3	326 331 336	
Unit	Save Entire Unit To Slot A		340	
	Save Entire Unit To Slot B		341	

Restore Setup				
Channel	Restore Setup From Slot A	Channel 1 Channel 2 Channel 3	350 335 360	0 = N/A 1 = Activate
	Restore Setup From Slot B	Channel 1 Channel 2 Channel 3	351 336 361	
Unit	Restore Entire Unit From Slot A		365	
	Restore Entire Unit From Slot B		366	

Delete Setup				
Channel	Delete Setup In Slot A	Channel 1 Channel 2 Channel 3	375 380 385	0 = N/A 1 = Activate
	Delete Setup In Slot B	Channel 1 Channel 2 Channel 3	376 381 386	
Unit	Delete Entire Unit Setup In Slot A		390	
	Delete Entire Unit Setup In Slot B		391	

Reset Setup				
Channel	Reset Setup	Channel 1 Channel 2 Channel 3	395 396 397	0 = N/A 1 = Activate
Unit	Reset Whole Unit		405	

Defer Calibration Alarm Date				
Channel	Defer Channel Calibration Alarm Date	Channel 1 Channel 2 Channel 3	415 416 417	0 = N/A 1 = Activate

Defer Channel Service Alarm Date				
Channel	Defer Channel Service Alarm Date	Channel 1 Channel 2 Channel 3	425 426 427	0 = N/A 1 = Activate

Setpoint Start/Stop Options				
Setpoint	Setpoint Initial Charge	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	435 440 445 450 455 460	0 = N/A 1 = Activate
	Setpoint Manual Clean	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	436 441 446 451 456 461	

Setpoint Acknowledgments				
Setpoint	Acknowledge Setpoint Dose Alarm	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	437 442 447 452 457 462	0 = N/A 1 = Activate

Reset Custom Ranges				
Auxiliary mA Input	Reset Auxiliary mA Input Custom Curve A	Channel 1 Channel 2 Channel 3	465 480 495	0 = N/A 1 = Activate
	Reset Auxiliary mA Input Custom Curve B	Channel 1 Channel 2 Channel 3	466 481 496	
Elect Cond	Reset Electrodeless Custom 1 Range	Channel 1 Channel 2 Channel 3	470 485 500	
	Reset Electrodeless Custom 2 Range	Channel 1 Channel 2 Channel 3	471 486 501	
Suspended Solids	Reset Suspended Solids Custom 1 Range	Channel 1 Channel 2 Channel 3	475 490 505	
	Reset Suspended Solids Custom 2 Range	Channel 1 Channel 2 Channel 3	476 491 506	

Data logging				
Unit	Start/Stop SD Card Data logging		515	0 = Stop 1 = Start

Save Live Trend Data				
Unit	Save Live Trend Data To SD Card	Trend 1 Trend 2 Trend 3	520 521 522	0 = N/A 1 = Activate

Suspended Solids / Turbidity - CIP				
Suspended Solids / Turbidity	Turn On/Off Suspended Solids Sensor Clean In Place (CIP) Mode	Channel 1 Channel 2 Channel 3	525 526 527	0 = Turn Off 1 = Turn On

Modbus RS485 Discretes

Note. The availability of some of the discrete depends upon the configuration of the instrument

Discrete #	Channel	Name	Semantics of Values

Digital Input Status

Digital Inputs			
500 501 502 503 504 505 506 507	Digital Input 1 Digital Input 2 Digital Input 3 Digital Input 4 Digital Input 5 Digital Input 6 Digital Input 7 Digital Input 8	Digital Input State	0 = Inactive 1 = Active

Sensor Status

Auxiliary mA Input			
540 645 755	Channel 1 Channel 2 Channel 3	Digital Input Switch Setup State	0 = Switch Setup Inactive 1 = Switch Setup Active
541 646 756	Channel 1 Channel 2 Channel 3	Sensor simulation State	0 = Sensor Not Simulating 1 = Sensor Simulating
542 647 757	Channel 1 Channel 2 Channel 3	Sensor Calibration State	0 = Sensor Not Calibrating 1 = Sensor Calibrating

Conventional Conductivity			
555 660 770	Channel 1 Channel 2 Channel 3	Digital Input Switch Setup State	0 = Switch Setup Inactive 1 = Switch Setup Active
556 661 771	Channel 1 Channel 2 Channel 3	Sensor simulation State	0 = Sensor Not Simulating 1 = Sensor Simulating
557 662 772	Channel 1 Channel 2 Channel 3	Temperature simulation State	0 = Temperature Not Simulating 1 = Temperature Simulating
558 663 773	Channel 1 Channel 2 Channel 3	Sensor Calibration State	0 = Sensor Not Calibrating 1 = Sensor Calibrating
559 664 774	Channel 1 Channel 2 Channel 3	Temperature Calibration State	0 = Temperature Not Calibrating 1 = Temperature Calibrating
560 665 775	Channel 1 Channel 2 Channel 3	Ranging State	0 = Sensor Not Ranging 1 = Sensor Ranging

Dissolved Oxygen			
575 680 790	Channel 1 Channel 2 Channel 3	Digital Input Switch Setup State	0 = Switch Setup Inactive 1 = Switch Setup Active
576 681 791	Channel 1 Channel 2 Channel 3	Sensor simulation State	0 = Sensor Not Simulating 1 = Sensor Simulating
577 682 792	Channel 1 Channel 2 Channel 3	Pressure simulation State	0 = Pressure Not Simulating 1 = Pressure Simulating
578 683 793	Channel 1 Channel 2 Channel 3	Temperature simulation State	0 = Temperature Not Simulating 1 = Temperature Simulating
579 684 794	Channel 1 Channel 2 Channel 3	Sensor Calibration State	0 = Sensor Not Calibrating 1 = Sensor Calibrating
580 685 795	Channel 1 Channel 2 Channel 3	Temperature Calibration State	0 = Temperature Not Calibrating 1 = Temperature Calibrating

Electrodeless Conductivity			
595 700 810	Channel 1 Channel 2 Channel 3	Input Switch Setup State	0 = Switch Setup Inactive 1 = Switch Setup Active
596 701 811	Channel 1 Channel 2 Channel 3	Sensor simulation State	0 = Sensor Not Simulating 1 = Sensor Simulating
597 702 812	Channel 1 Channel 2 Channel 3	Temperature simulation State	0 = Temperature Not Simulating 1 = Temperature Simulating
598 703 813	Channel 1 Channel 2 Channel 3	Sensor Calibration State	0 = Sensor Not Calibrating 1 = Sensor Calibrating
599 704 814	Channel 1 Channel 2 Channel 3	Temperature Calibration State	0 = Temperature Not Calibrating 1 = Temperature Calibrating
600 705 815	Channel 1 Channel 2 Channel 3	Ranging State	0 = Sensor Not Ranging 1 = Sensor Ranging

pH / Redox			
615 720 830	Channel 1 Channel 2 Channel 3	Digital Input Switch Setup State	0 = Switch Setup Inactive 1 = Switch Setup Active
616 721 831	Channel 1 Channel 2 Channel 3	Sensor simulation State	0 = Sensor Not Simulating 1 = Sensor Simulating
617 722 832	Channel 1 Channel 2 Channel 3	Temperature simulation State	0 = Temperature Not Simulating 1 = Temperature Simulating
618 723 833	Channel 1 Channel 2 Channel 3	Sensor Calibration State	0 = Sensor Not Calibrating 1 = Sensor Calibrating
619 724 834	Channel 1 Channel 2 Channel 3	Temperature Calibration State	0 = Temperature Not Calibrating 1 = Temperature Calibrating

Suspended Solids / Turbidity			
630 740 845	Channel 1 Channel 2 Channel 3	Digital Input Switch Setup State	0 = Switch setup Inactive 1 = Switch setup Active
631 741 846	Channel 1 Channel 2 Channel 3	Sensor simulation State	0 = Sensor Not Simulating 1 = Sensor Simulating
632 742 847	Channel 1 Channel 2 Channel 3	Sensor Calibration State	0 = Sensor Not Calibrating 1 = Sensor Calibrating

Current Output			
870 880 890 900 910 920	Current Output A Current Output B Current Output C Current Output D Current Output E Current Output F	Calibration State	0 = Current Output Not Calibrating 1 = Current Output Calibrating
871 881 891 901 911 921	Current Output A Current Output B Current Output C Current Output D Current Output E Current Output F	Simulation State	0 = Current Output Not Simulating 1 = Current Output Simulating

Instrument Error Status

Discrete #	Channel /type	Error Code	Name	Semantics of Values

Internal Errors

Internal Errors				
1001		E001	Processor RAM Read/Write Error	0 = Inactive
1002		E002	External RAM Read/Write Error	1 = Active
1003		E003	Internal Setup Checksum Error	
1004		E004	Output Card Setup Checksum Error	
1005		E005	Internal Outputs Setup Checksum Error	
1007		E007	Unit Setup Checksum Error	
1008		E008	Unit Store A Checksum Error	
1009		E009	Unit Store B Checksum Error	
1010		E010	Maths Error	
1011		E011	Maths Error	
1012		E012	Maths Error	
1013		E013	Maths Error	
1014		E014	Contrast Chip Error	
1015		E015	Unit SD Card Checksum Error	
1016		E016	SD Card Full	

Input Channel Errors

Input Channel Errors				
1030 1080 1130	Channel 1 Channel 2 Channel 3	E030 E080 E130	Input Card Checksum Error	0 = Inactive 1 = Active
1031 1081 1131	Channel 1 Channel 2 Channel 3	E031 E081 E131	Setup Checksum Error	
1032 1082 1132	Channel 1 Channel 2 Channel 3	E032 E082 E132	Store A Checksum Error	
1033 1083 1133	Channel 1 Channel 2 Channel 3	E033 E083 E133	Store B Checksum Error	
1034 1084 1134	Channel 1 Channel 2 Channel 3	E034 E084 E134	Factory Cal Checksum Error	
1035 1085 1135	Channel 1 Channel 2 Channel 3	E035 E085 E135	User Cal Checksum Error	
1036 1086 1136	Channel 1 Channel 2 Channel 3	E036 E086 E136	Sensor Cal Out of Spec	
1037 1087 1137	Channel 1 Channel 2 Channel 3	E037 E087 E137	Sensor Zero Cal Out of Spec	

Input Channel Errors Continued				
1038 1088 1138	Channel 1 Channel 2 Channel 3	E038 E088 E138	Sensor Span Cal Out of Spec	0 = Inactive 1 = Active
1039 1089 1139	Channel 1 Channel 2 Channel 3	E039 E089 E139	No Signal	
1040 1090 1140	Channel 1 Channel 2 Channel 3	E040 E090 E140	Signal Overload	
1041 1091 1141	Channel 1 Channel 2 Channel 3	E041 E091 E141	Partial Depletion	
1042 1092 1142	Channel 1 Channel 2 Channel 3	E042 E092 E142	Full Depletion	
1043 1093 1143	Channel 1 Channel 2 Channel 3	E043 E093 E143	Sensor User Offset At Limit	
1044 1094 1144	Channel 1 Channel 2 Channel 3	E044 E094 E144	Sensor User Slope At Limit	
1045 1095 1145	Channel 1 Channel 2 Channel 3	E045 E095 E145	Sensor User Slope Below Spec	
1046 1096 1146	Channel 1 Channel 2 Channel 3	E046 E096 E146	Sensor User Slope Above Spec	
1047 1097 1147	Channel 1 Channel 2 Channel 3	E047 E097 E147	Sensor Open Circuit	
1048 1098 1148	Channel 1 Channel 2 Channel 3	E048 E098 E148	Sensor Short Circuit	
1049 1099 1149	Channel 1 Channel 2 Channel 3	E049 E099 E149	Sensor Positive Saturation	
1050 1100 1150	Channel 1 Channel 2 Channel 3	E050 E100 E150	Sensor Negative Saturation	
1051 1101 1151	Channel 1 Channel 2 Channel 3	E051 E101 E151	Sensor Input Over Range	
1052 1102 1152	Channel 1 Channel 2 Channel 3	E052 E102 E152	Sensor Input Under Range	
1053 1103 1153	Channel 1 Channel 2 Channel 3	E053 E103 E153	Temperature Sensor Fault	

Input Channel Errors Continued				
1054 1104 1154	Channel 1 Channel 2 Channel 3	E054 E104 E154	Temperature Input Over Range	0 = Inactive 1 = Active
1055 1105 1155	Channel 1 Channel 2 Channel 3	E055 E105 E155	Temperature Input Under Range	
1056 1106 1156	Channel 1 Channel 2 Channel 3	E056 E106 E156	Temperature Compensation Outside Limits	
1057 1107 1157	Channel 1 Channel 2 Channel 3	E057 E107 E157	Polar graphic Zero Calibration At Limit	
1058 1108 1158	Channel 1 Channel 2 Channel 3	E058 E108 E158	Polar graphic Span Calibration At Limit	
1059 1109 1159	Channel 1 Channel 2 Channel 3	E059 E109 E159	Galvanic Zero Calibration At Limit	
1060 1110 1160	Channel 1 Channel 2 Channel 3	E060 E110 E160	Galvanic Span Calibration At Limit	
1061 1111 1161	Channel 1 Channel 2 Channel 3	E061 E111 E161	Pressure Sensor Over Range	
1062 1112 1162	Channel 1 Channel 2 Channel 3	E062 E112 E162	Pressure Sensor Under Range	
1063 1113 1163	Channel 1 Channel 2 Channel 3	E063 E113 E163	Pressure Above 20mA	
1064 1114 1164	Channel 1 Channel 2 Channel 3	E064 E114 E164	Pressure Below 4mA	
1065 1115 1165	Channel 1 Channel 2 Channel 3	E065 E115 E165	Aux mA Input Above 20mA	
1066 1116 1166	Channel 1 Channel 2 Channel 3	E066 E116 E166	Aux mA Input Below 4mA	
1067 1117 1167	Channel 1 Channel 2 Channel 3	E067 E117 E167	Sensor 0mV Calibration Out Of Spec	
1068 1118 1168	Channel 1 Channel 2 Channel 3	E068 E118 E168	Calibration Due	
1069 1119 1169	Channel 1 Channel 2 Channel 3	E069 E119 E169	Planned Service Due	

Input Channel Errors Continued				
1070 1120 1170	Channel 1 Channel 2 Channel 3	E070 E120 E170	SD Card Checksum Error	0 = Inactive 1 = Active
1071 1121 1171	Channel 1 Channel 2 Channel 3	E071 E121 E171	Gain Error	
1072 1122 1172	Channel 1 Channel 2 Channel 3	E072 E122 E172	Invalid Linearisation Curve	
1073 1123 1173	Channel 1 Channel 2 Channel 3	E073 E123 E173	Linearisation Over Range	
1074 1124 1174	Channel 1 Channel 2 Channel 3	E074 E124 E174	Linearisation Under Range	
1075 1125 1175	Channel 1 Channel 2 Channel 3	E075 E125 E175	Curve Low Limit	
1076 1126 1176	Channel 1 Channel 2 Channel 3	E076 E126 E176	Curve High Limit	
1077 1127 1177	Channel 1 Channel 2 Channel 3	E077 E127 E177	Custom Error	

Setpoint Errors

Setpoint Errors				
1180 1190 1200 1210 1220 1230	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	E180 E190 E200 E210 E220 E230	Dose Alarm Error	0 = Inactive 1 = Active
1185 1195 1205 1215 1225 1235	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	E185 E195 E205 E215 E225 E235	Store A Checksum Error	
1186 1196 1206 1216 1226 1236	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	E186 E196 E206 E216 E226 E236	Store A Checksum Error	
1187 1197 1207 1217 1227 1237	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	E187 E197 E207 E217 E227 E237	Setup Checksum Error	
1188 1198 1208 1218 1228 1238	Setpoint 1 Setpoint 2 Setpoint 3 Setpoint 4 Setpoint 5 Setpoint 6	E188 E198 E208 E218 E228 E238	SD Card Checksum Error	

Current Output Errors

Current Output Errors				
1240	Current Op A	E240	4-20mA Output Hardware Fault	0 = Inactive
1250	Current Op B	E250		1 = Active
1260	Current Op C	E260		
1270	Current Op D	E270		
1280	Current Op E	E280		
1290	Current Op F	E290		
1241	Current Op A	E241	Sensor Input Below 4-20mA Output Zero	
1251	Current Op B	E251		
1261	Current Op C	E261		
1271	Current Op D	E271		
1281	Current Op E	E281		
1291	Current Op F	E291		
1242	Current Op A	E242	Sensor Input Above 4-20mA Output Span	
1252	Current Op B	E252		
1262	Current Op C	E262		
1272	Current Op D	E272		
1282	Current Op E	E282		
1292	Current Op F	E292		
1243	Current Op A	E243	Sensor Input Below 4-20mA Output Span	
1253	Current Op B	E253		
1263	Current Op C	E263		
1273	Current Op D	E273		
1283	Current Op E	E283		
1293	Current Op F	E293		
1244	Current Op A	E244	Sensor Input Above 4-20mA Output Zero	
1254	Current Op B	E254		
1264	Current Op C	E264		
1274	Current Op D	E274		
1284	Current Op E	E284		
1294	Current Op F	E294		
1245	Current Op A	E245	Store A Checksum Error	
1255	Current Op B	E255		
1265	Current Op C	E265		
1275	Current Op D	E275		
1285	Current Op E	E285		
1295	Current Op F	E295		
1246	Current Op A	E246	Store B Checksum Error	
1256	Current Op B	E256		
1266	Current Op C	E266		
1276	Current Op D	E276		
1286	Current Op E	E286		
1296	Current Op F	E296		
1247	Current Op A	E247	Setup Checksum Error	
1257	Current Op B	E257		
1267	Current Op C	E267		
1277	Current Op D	E277		
1287	Current Op E	E287		
1297	Current Op F	E297		

Digital Input Errors

Digital Input Errors				
1301	Digital IP 1	E301	Store A Checksum Error	0 = Inactive
1306	Digital IP 2	E306		1 = Active
1311	Digital IP 3	E311		
1316	Digital IP 4	E316		
1321	Digital IP 5	E321		
1326	Digital IP 6	E326		
1331	Digital IP 7	E331		
1336	Digital IP 8	E336		
1302	Digital IP 1	E302	Store B Checksum Error	
1307	Digital IP 2	E307		
1312	Digital IP 3	E312		
1317	Digital IP 4	E317		
1322	Digital IP 5	E322		
1327	Digital IP 6	E327		
1332	Digital IP 7	E332		
1337	Digital IP 8	E337		
1303	Digital IP 1	E303	Setup Checksum Error	
1308	Digital IP 2	E308		
1313	Digital IP 3	E313		
1318	Digital IP 4	E318		
1323	Digital IP 5	E323		
1328	Digital IP 6	E328		
1333	Digital IP 7	E333		
1338	Digital IP 8	E338		
1304	Digital IP 1	E304	SD Card Checksum Error	
1309	Digital IP 2	E309		
1314	Digital IP 3	E314		
1319	Digital IP 4	E319		
1324	Digital IP 5	E324		
1329	Digital IP 6	E329		
1334	Digital IP 7	E334		
1339	Digital IP 8	E339		

Communication Errors

Communication Errors				
1340	Channel 1	E340	Communications Failure	0 = Inactive
1342	Channel 2	E342		1 = Active
1344	Channel 3	E344		
1341	Channel 1	E341	Communications Error	
1343	Channel 2	E343		
1345	Channel 3	E345		
1346		E346	Output Communication Failure	
1347		E347	Output Communication Error	
1348		E348	Output Card Communication Failure	
1349		E349	Output Card Communication Error	

Data Logging Errors

Data logging Errors				
1350		E350	Data logging Setup Checksum Error	0 = Inactive 1 = Active
1351		E351	Data logging Store A Checksum Error	
1352		E352	Data logging Store B Checksum Error	
1353		E353	Data logging SD Card Checksum Error	

Calculation Errors

Calculation Errors				
1400 1410	Calc 1 Calc 2	E400 E410	Calculation Over Range	0 = Inactive 1 = Active
1401 1411	Calc 1 Calc 2	E401 E411	Calculation Under Range	
1402 1412	Calc 1 Calc 2	E402 E412	Calculation Setup Checksum	
1403 1413	Calc 1 Calc 2	E403 E413	Calculation Store A Checksum	
1404 1414	Calc 1 Calc 2	E404 E414	Calculation Store B Checksum	
1405 1415	Calc 1 Calc 2	E405 E415	Calculation SD Card Checksum	

Modbus Errors

Modbus Errors				
1420		E420	Modbus Setup Checksum Error	0 = Inactive 1 = Active
1421		E421	Modbus Store A Checksum Error	
1422		E422	Modbus Store B Checksum Error	
1423		E423	Modbus SD Card Checksum Error	