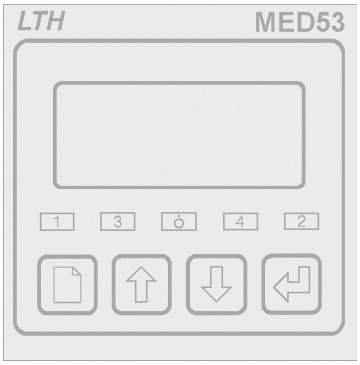
KLAY-INSTRUMENTS B.V.

Nijverheidsweg 5
Postbus 13
Tel. 0521-591550
Fax 0521-592046

7991 CZ DWINGELOO
7990 AA DWINGELOO
Nederland
E-mail: info@klay.nl

MED53

ELECTRODELESS CONDUCTIVITY MONITOR



OPERATION GUIDE

PREFACE

Product warranty

The MED53 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.

Copyright and trademarks

MED53 is a trademark of LTH Electronics Ltd

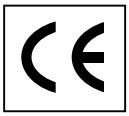
Eigth edition August 2005

Part number: 6135

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

Telephone : +44 (0)1582 593693
Fax : +44 (0)1582 598036
email : sales@lth.co.uk
Web : www.lth.co.uk

Manufacturing Standards



Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations set down by the European EMC Directive

Safety

This instrument has been designed to comply with the standards and regulations set down by the European Low Voltage Directive using BS EN 61010-1 : 1993

Quality

This instrument has been manufactured under the following quality standard : ISO 9001:2000. 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

INTRODUCTION

ABOUT THE MED53

The MED53 is a microprocessor controlled electrodeless conductivity measurement instrument with the facility to display in % concentration. The unit utilises a multifunction LCD to display readings and provide feedback to the operator. It is available with different options to provide fully configurable control and feedback with up to four control relays and two 0/4-20mA current output sources.

UNIT SPECIFICATION

Measurement Input	ECS20, ECS30 or ECS40 Series electrodeless conductivity sensor.
Cell Constant Adjustment	0 – 10.0 for other sensors than those shown above.
Range of Measurement	0 to 999.9 uS/cm, 9.999 mS/cm, 99.99 mS/cm, 999.9 mS/cm.
	0 to 16.00% NaOH
	0 to 30.00% NaCl
	0 to 15.00% HCl
	0 to 25.00% H_2SO_4
	0 to 25.00% H_3PO_4
	0 to 41.00 ppt Salinity
	0 to 99.9% Custom from 2 to 9 points can be entered.
Range Selection	Internal single or auto range, or external range selection via digital inputs.
Accuracy	±1%
Linearity	±0.1% of range
Repeatability	±0.1% of range
Operator Adjustment	Solution ±20% offset
	Conductivity ±10% slope
Connection Cable	Up to 100 metres 54E cable
Temperature Sensor	PT100 or PT1000 RTD input. Temperature sensor can be mounted in the sensor or separately.

Temperature Range	-50°C to +300°C. (-50 to +300°F), resolution 0.01°C
Temperature Accuracy	±0.2°C (When using a 4 wire PT1000).
Operator Adjustment (Temperature)	± 50.0°C, or ± 122°F.
Temperature Compensation Type	Automatic or manual 0 to 100°C, base 20 or 25°C (conductivity only), slope 0 to 9.9%/°C.
Off-Line Facility (for calibration and commissioning)	The relays are de-energised and the current output is held at the last on-line value.
Ambient Operating Temperature	-20°C to +50°C (-4°F to +122°F) for full specification.
Ambient Temperature Variation	±0.01% of range / °C (typical).
Display	Custom backlit LCD module. 4 digit + sign main display, 3x2 characters for units indication, and 16 characters for information and programming.
Current Outputs A and B (optional)	Select 0-20mA or 4-20mA, fully isolated to 2kV. (750 Ohm Max. load). Expandable up to 5% of any operating range (mS, %, °C) and offset anywhere in that range.
Operator Adjustment (Current)	+1mA zero and ±1mA span for remote monitor calibration.
Set points and Control Relays **Standard Set Point 1&2** **Optional Set Point 3**	Fully configurable set points (mS, % and °C) with volt free changeover contacts. Rated at 5A 30V DC / 5A 250VAC (non-inductive). Red LEDs indicate relay energised.
Operating Modes (Control Relays)	On/Off, Time Proportioning, Pulse Proportioning, and Band modes selectable for up to three relays. Adjustable delay timers up to 10:00 mm:ss in the On/Off mode. Hysteresis 0 to 9.9% in the On/Off mode. Adjustable dose alarm timer up to 90:00 mm:ss in all modes Adjustable cycle time, and proportional band in the proportional modes.

Alarm Relay Set Point 4 (optional)	Disabled or Fully configurable to energise on: any error, off-line, calibration, dose alarm, sensor error, Volt free changeover contacts rated at 5A 30V DC / 5A 250VAC (non-inductive). Red LED indicates relay energised.
Switches	Four tactile feedback push buttons
EMC : Immunity	BS EN 50082-2 1995
EMC : Emissions	BS EN 50081-1 1992
Safety	Designed and manufactured in accordance with BS EN 61010-1 1993
Power Supply	85 - 250V AC or DC, 10W max. Option 18 – 36 V AC or DC, 15W max
Panel Mount Housing	Flame retarding ABS plastic, rated to IP66 to the front when installed in a panel.
Weight	Less than 0.6kg
Dimensions	96mm x 96mm x 140mm (H x W x D), including connectors
Surface Mount Housing	Expanded polyurethane foam rated to IP66
Weight	Less than 1.5kg
Dimensions	305mm x 200mm x 82mm (H x W x D), excluding mounting brackets

This page intentionally blank.

ERRATA

{ See also “ADDENDA” on page 99 }

This page intentionally blank.

INSTALLATION

This chapter describes how to install and mount the panel-mounting and surface-mounting versions, 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 MED53 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 MED53 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 MED53 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 MXD53 series 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.

PANEL MOUNT UNITS

{ For surface or pipe mounted installation go to page 23. }

The panel-mounting version is designed to be flush mounted and sealed in a square cut-out in a panel, and is held in place with the two screw clamps provided.

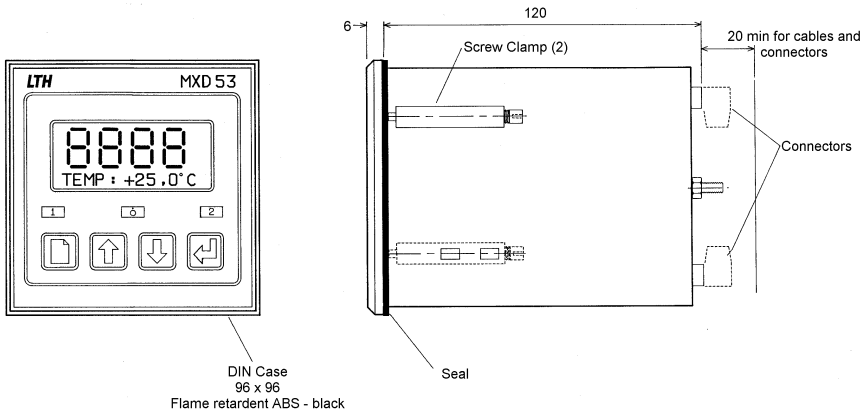


Figure 1 : Overall dimensions panel-mounting MED53

- The panel cut-out for mounting the unit should be 92 mm x 92 mm (+1.0 – 0.0).
- A sealing gasket is supplied with the MED53 to be fitted around the edge of the cut-out.
- Two screw clamps are supplied and are fitted from the back of the instrument.
- Take care to ensure the gasket is correctly positioned before tightening the clamps.
- A badly fitted gasket will not give a good seal to the specified IP rating.

Panel Mount Connections

Connections to the panel-mount version of the MED53 are made with up to four plug and socket terminal blocks, accessible to the rear of the unit. The vertically mounted connector [marked “Expansion Port”] is used for the optional relay channels.

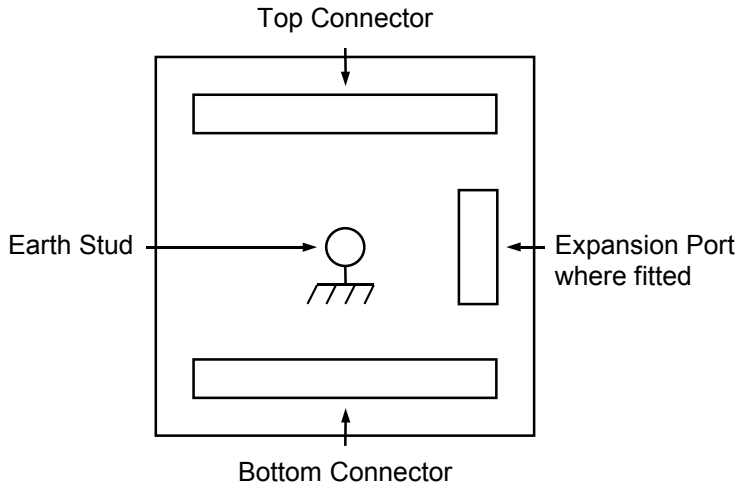


Figure 2 : Panel mount unit, rear view

The top connector houses the power input, relay and current output terminals. The bottom connector houses the sensor input, temperature input and digital inputs.

Top Connector

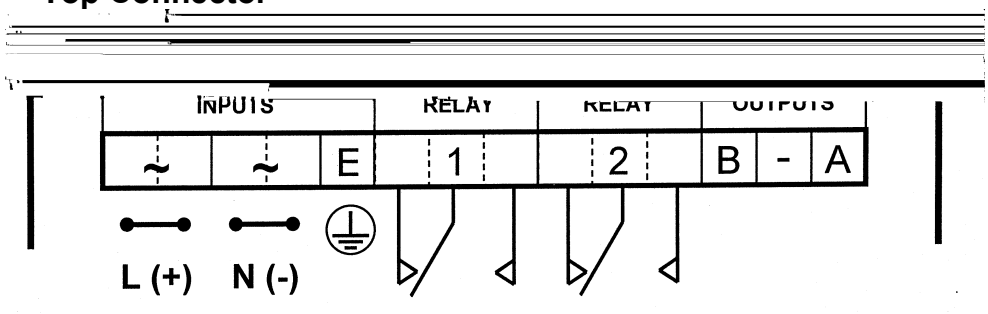


Figure 3 : Panel mount unit, top connector wiring

SUPPLY VOLTAGE CONNECTIONS

The MED53 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**.

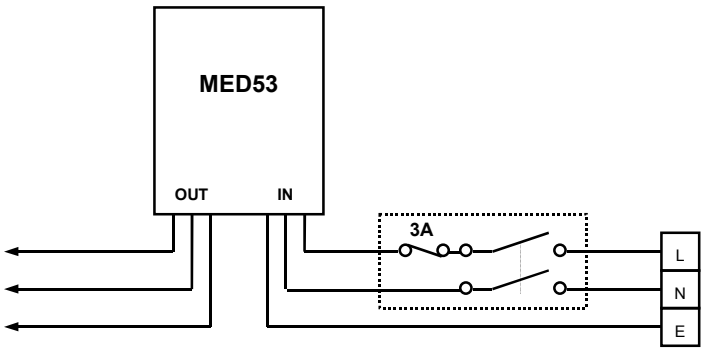


Figure 4 : Power supply "daisy chain" connection

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 (see page 16). **The incoming Earth connection must be connected to the "Earth" terminal.**

CURRENT OUTPUT CONNECTIONS

The MED53 can be supplied with up to 2 current outputs designated A and B. It is shipped with links across the relevant current output pins if the option is fitted. If a current output is required, remove the link and replace with a cable terminated by a load resistance not exceeding 1000Ω. 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. **When either of the outputs is open circuit, in a dual output unit, the other can be made to indicate a fault by transmitting a 0, 2 or 22mA signal as selected by the user. This will be accompanied by a flashing error message on the display (E41, see Appendix H, page 95).**

RELAY CONNECTIONS

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.**

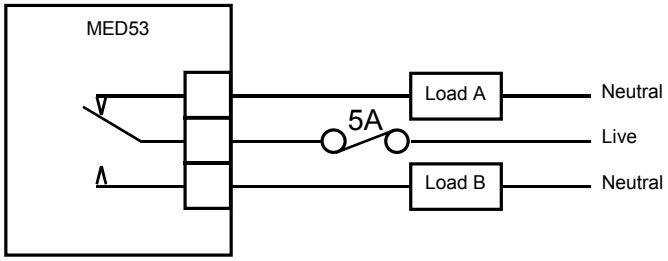


Figure 5 : Relay contact connection

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.

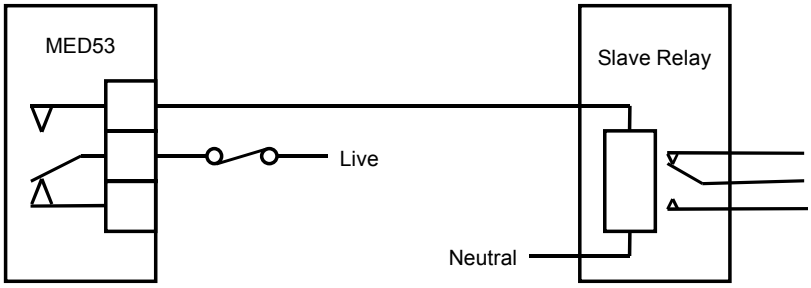


Figure 6 : Slave relay connection

For convenience, the power can be looped across from the supply connections.

RELAYS 3 & 4 CONNECTIONS

When fitted, the expansion port connector houses the additional relay output terminals. NB The relay contacts are volt free and should be wired in series with a supply and load { see Figure 5.}

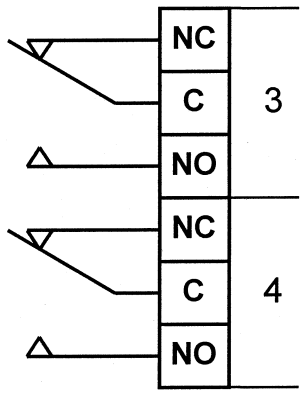


Figure 7 : Panel mount unit, Relays 3 & 4 wiring

Note:
NC = normally closed
NO = normally open
C = common

Bottom Connector

The bottom connector houses the Sensor input and Digital input connectors. The digital inputs are used for external ranging, they have two states, either open circuit or shorted to the common pin G. The temperature and sensor input connections depend on the cable and temperature sensor type.

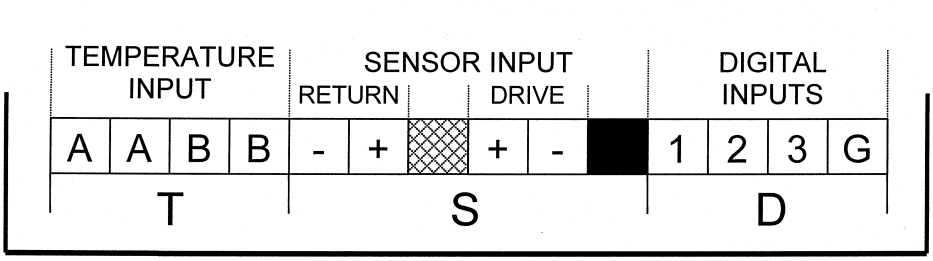


Figure 8 : Panel mount unit, bottom connector wiring

Two separate connectors are used separated by a blanking plug. A 9 way connector is provided for the sensor input and a 4 way connector for the digital inputs.

SENSOR INPUT CONNECTIONS

The following figures give the connection details of the most commonly used sensor/cable types. Do not use any other type of cable than those recommended by LTH 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 follows.

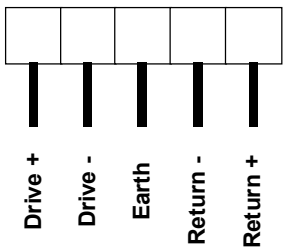


Figure 9 : Extension cable terminal arrangement

Cable Types

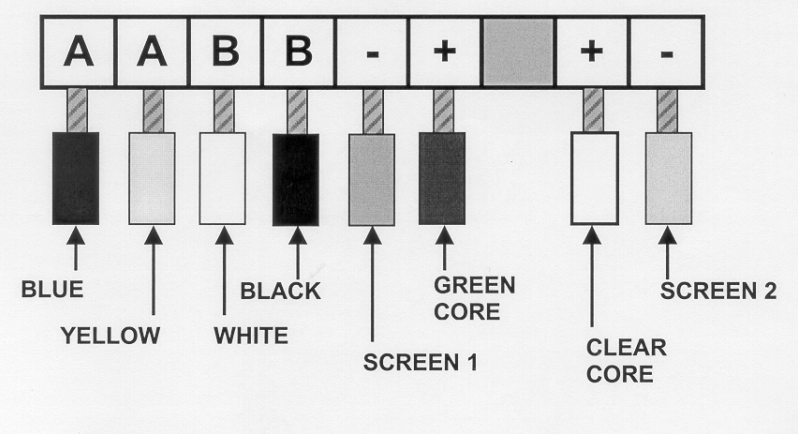


Figure 10 : 54E Cable

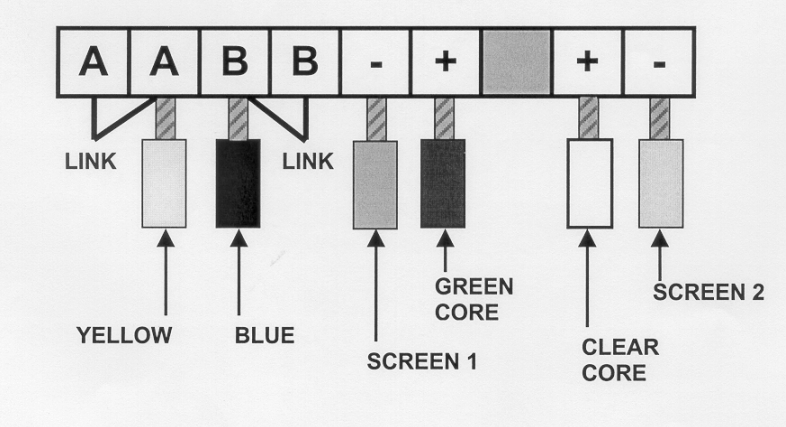


Figure 11 : 54H Cable

The outer screen should be connected to the Earth Stud.

Temperature Input Connections

The temperature input system is designed to measure resistive temperature sensors (see “Configuration” on page 69). These can be configured as 2 or 4 wire sensors, although for the specified accuracy it is necessary to use the 4 wire configuration for cable lengths over 5 metres. **N.B.** 54E type cable, commonly used on ECS30 and ECS40 sensors, utilises the 4 wire system with the cable paired as yellow/blue and white/black. The 54H cable, commonly used on ECS20 sensors, uses the two wire system with blue and yellow cores.

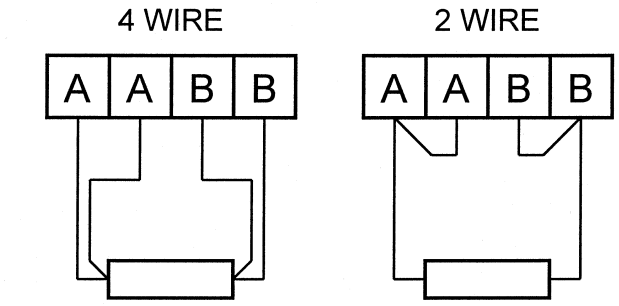


Figure 12 : Temperature Connections

DIGITAL INPUTS

The digital inputs are used to change the display ranging of the unit. This also affects both the Set Point range and the Current Output range. When the digital inputs are set for internal ranging the unit will revert to its internal range settings (see page 41). When "Autoranging" is selected, the Set Points and Current Output will revert to the internally set ranges (see Pages 48 & 54). On the following table the input combination assumes that "0" is an open contact and "1" is a contact shorted to the common pin G.

Digital Inputs			Conductivity Range Setting	Solution Range Setting
1	2	3		
0	0	0	Internal	Internal
0	0	1	999.9μS/cm	%NaOH
0	1	0	9.999mS/cm	%NaCl
0	1	1	99.99mS/cm	%H_2SO_4
1	0	0	999.9mS/cm	%HCl
1	0	1	Autoranging	%H_3PO_4
1	1	0	Autoranging	%HNO_3
1	1	1	Autoranging	Custom

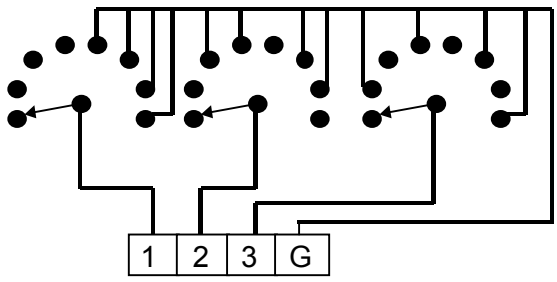


Figure 13 : Rotary switch connection

This page intentionally blank.

SURFACE MOUNT UNITS

The surface-mounting version is designed for fixing to a wall or other flat surface. Three 6.5 mm diameter holes are provided for this purpose. Note that fasteners are not provided.

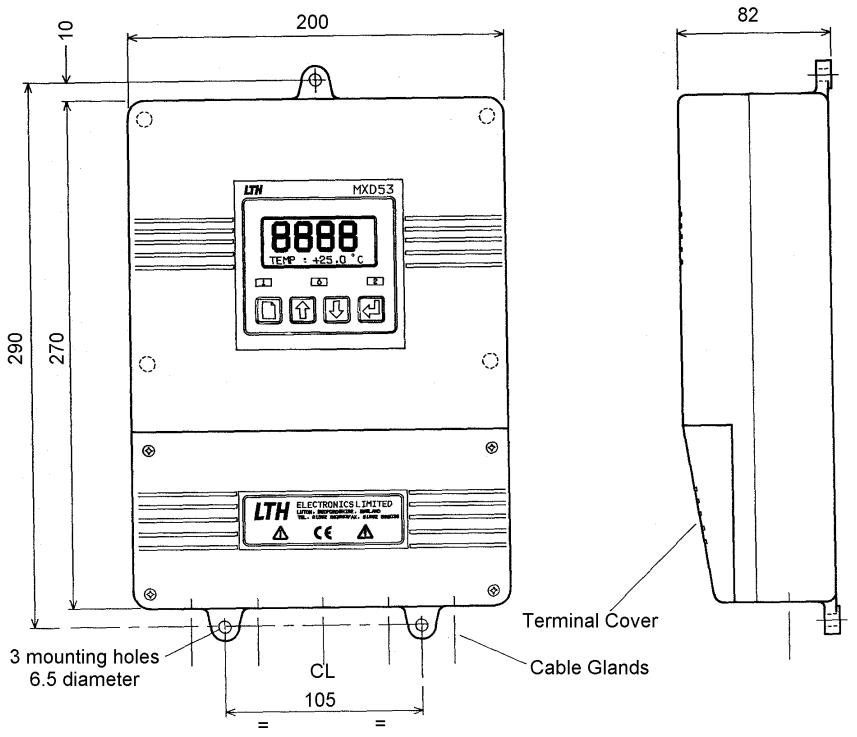


Figure 14 : ***Overall dimensions surface mounting MED53***

- LTH recommend using No. 10 x 1¼ inch round head screws or similar for mounting.
- Care must be taken when fitting the unit to uneven walls or surfaces. Do not over stress the three mounting lugs.
- Over tightening the mounting screws could also break the lugs.

PIPE MOUNTING

The handrail- & pipe-mounting version is designed for fixing to a vertical or horizontal handrail or pipe, of 25 - 60 mm outside diameter. The mounting kit comprises one plate, two channels, two clamps, four studs, 3 x M5 nuts, 3 x M5 plain washers, 3 x M5 shake proof washers, 12 x M4 nuts and 12 x M4 shake proof washers, as shown in the exploded view below.

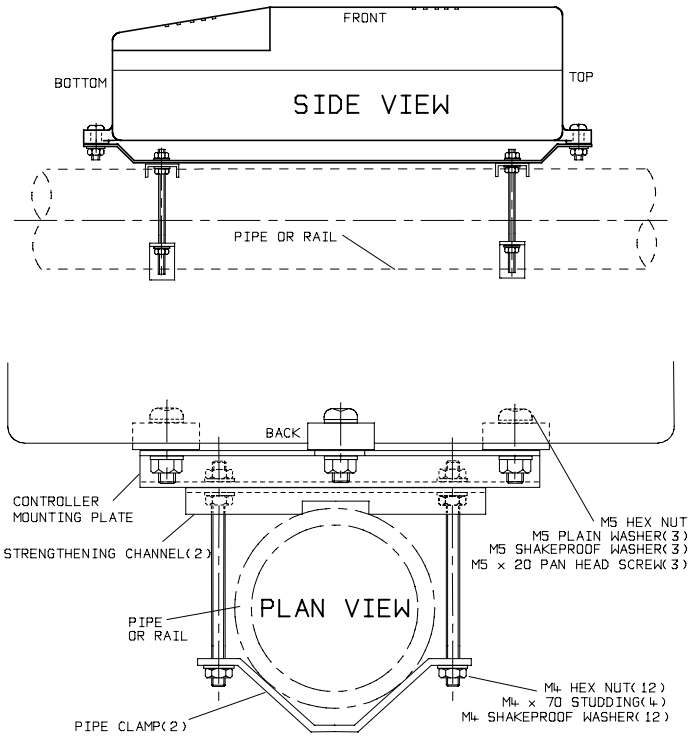


Figure 15 : ***MED53 handrail & pipe mounting brackets***

- The brackets can be fitted either vertically or horizontally.
- Position the channels to the rear of the mounting plate and secure with 8 x M4 nuts and 8 x M4 shake proof washers as shown.
- Position the mounting plate assembly onto the pipe/handrail ensuring that the single fixing hole for the controller is at the top.
- Secure the two pipe clamps with the 4 x M4 nuts and 4 x M4 shake proof washers.
- Attach the controller to the mounting plate with the 3 sets of M5 fixings supplied.

Surface Mount Terminals

Having ensured that the main power is isolated from the unit, remove the terminal cover by releasing the screws at each corner. (The terminal cover is the small cover at the bottom of the front panel [see Figure 14, page 23]). Once the cover has been removed the following terminal arrangement should be visible. Some terminals may not be fitted due to different supplied options.

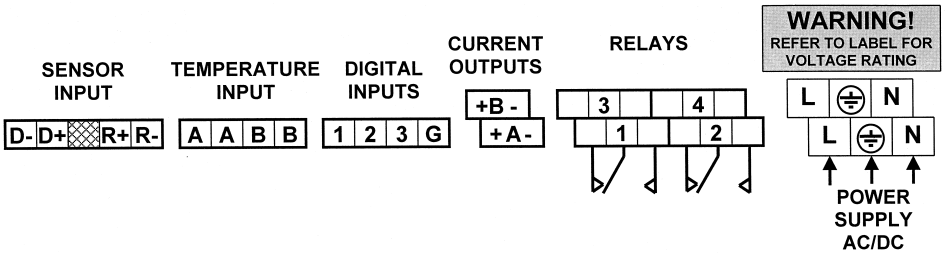


Figure 16 : Surface mount unit, terminal connections

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 MED53 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**.

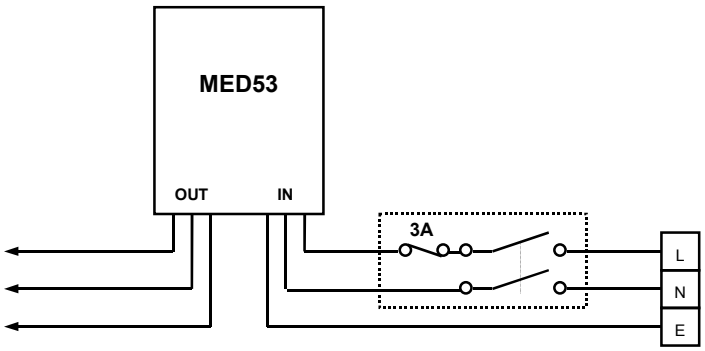


Figure 17 : Power supply "daisy chain" connection

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 (see page 27). **The incoming Earth connection must be connected to the "Earth" terminal.**

CURRENT OUTPUT CONNECTIONS

The MED53 can be supplied with up to 2 current outputs designated A and B. It is shipped with links across the relevant current output pins if the option is fitted. If a current output is required, remove the link and replace with a cable terminated by a load resistance not exceeding 1000Ω. 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. **When either of the outputs is open circuit, in a dual output unit, the other can be made to indicate a fault by transmitting a 0, 2 or 22mA signal as selected by the user. This will be accompanied by a flashing error message on the display (E41, see Appendix H, page 95).**

RELAY CONNECTIONS

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.**

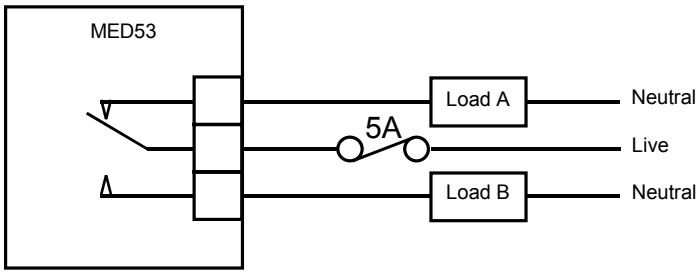


Figure 17 : Relay contact connection

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.

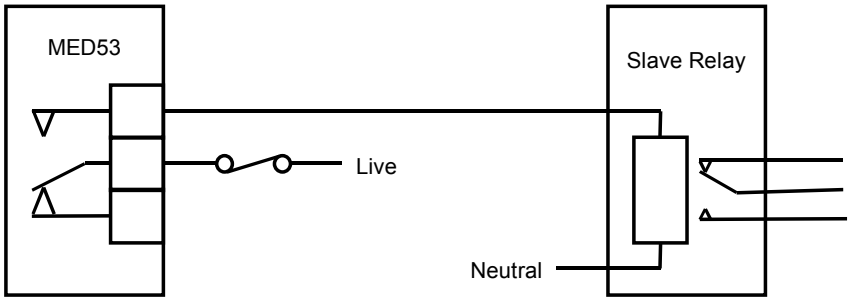


Figure 18 : Slave relay connection

For convenience, the power can be looped across from the supply connections.

SENSOR INPUT CONNECTIONS

The following figures give the connection details of the most commonly used sensor/cable types. Do not use any other type of cable than those recommended by LTH 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 follows.

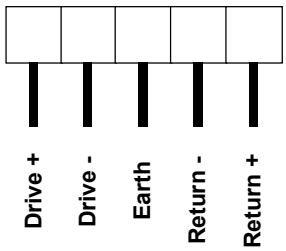


Figure 19 : Extension cable terminal arrangement

Cable Types

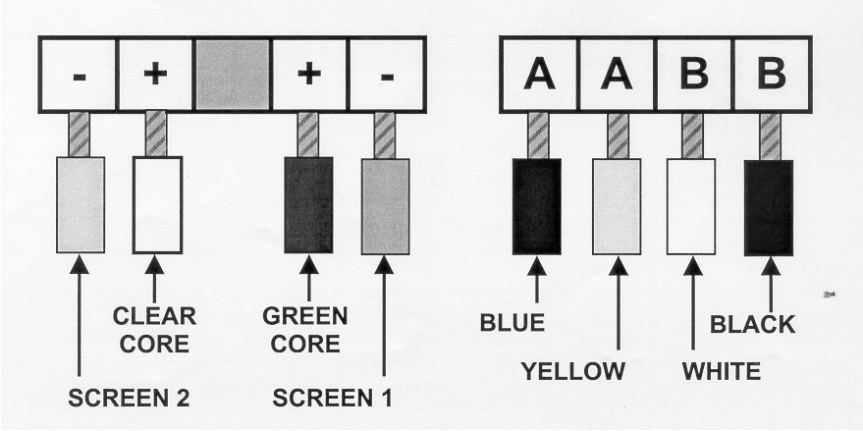


Figure 20 : 54E Cable

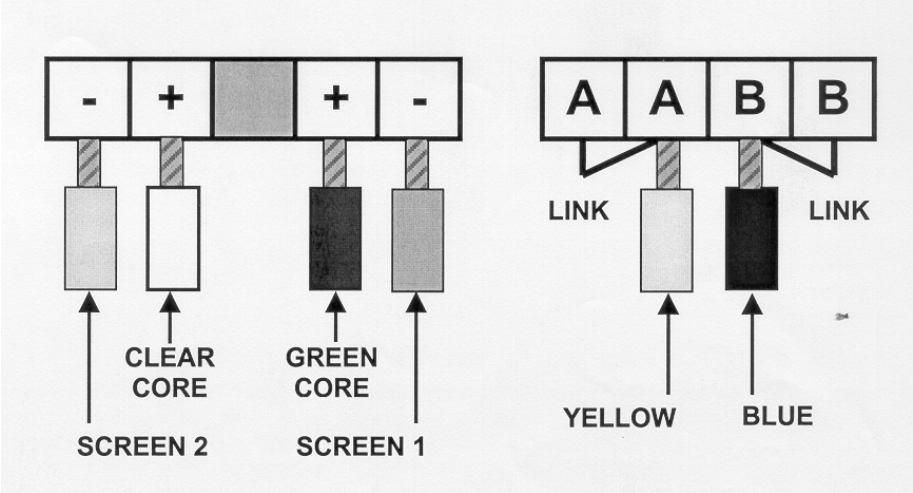


Figure 21 : 54H Cable

The outer screen should be connected to the Earth Stud mounted near the cable glands.

Temperature Input Connections

The temperature-input system is designed to measure resistive temperature sensors (see "Configuration" on page 69). These can be configured as 2 or 4 wire sensors, although for the specified accuracy it is necessary to use the 4 wire configuration for cable lengths greater than 5 metres. **N.B.** 54E type cable, commonly used on ECS30 sensors, utilises the 4 wire system with the cable paired as yellow/blue and white/black. The 54H cable, commonly used on ECS20 sensors, uses the two wire system with blue and yellow cores.

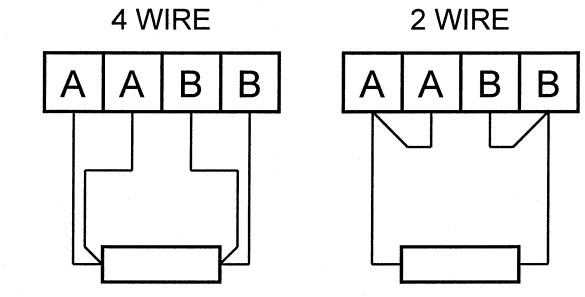


Figure 22 : Temperature Connections

DIGITAL INPUTS

The digital inputs are used to change the display ranging of the unit. This also affects both the Set Point range and the Current Output range. When the digital inputs are set for internal ranging the unit will revert to its internal range settings (see page 41). When “Autoranging” is selected, the Set Points and Current Output will revert to the internally set ranges (see Pages 48 & 54). On the following table the input combination assumes that “0” is an open contact and “1” is a contact shorted to the common pin G.

Digital Inputs			Conductivity Range Setting	Solution Range Setting
1	2	3		
0	0	0	Internal	Internal
0	0	1	999.9μS/cm	%NaOH
0	1	0	9.999mS/cm	%NaCl
0	1	1	99.99mS/cm	%H_2SO_4
1	0	0	999.9mS/cm	%HCl
1	0	1	Autoranging	%H_3PO_4
1	1	0	Autoranging	%HNO_3
1	1	1	Autoranging	Custom

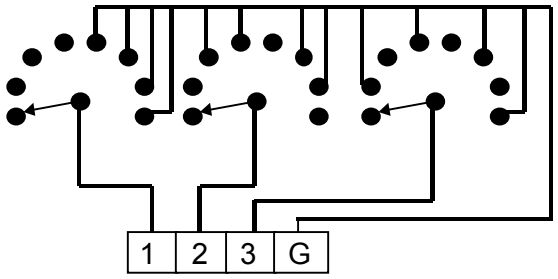
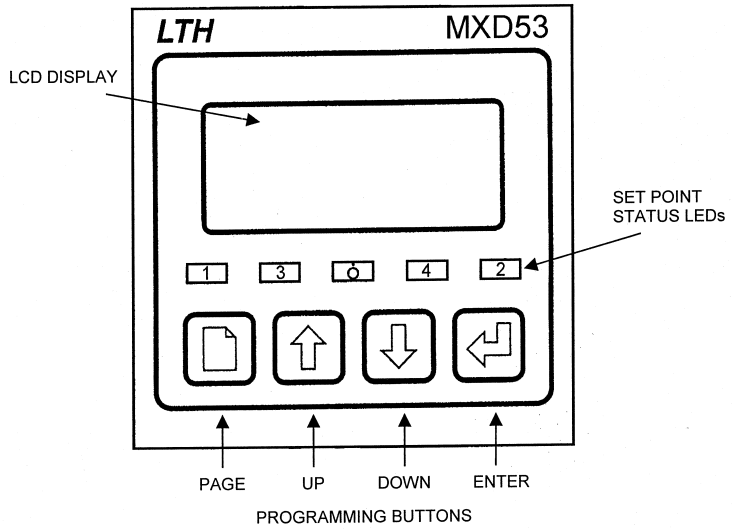


Figure 23 : Rotary switch connection

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 DEGRADE INSTRUMENT PERFORMANCE.

When shipped the MED53 is configured to the default conductivity set-up (see page 79). In this state the instrument can perform all of the necessary function for a basic conductivity monitoring instrument.



THE FRONT PANEL

The MED53 uses a versatile dot matrix character LCD to display all of the settings and readings. The seven segment digits at the top of the display indicate the primary measured value during normal operation. The six character display to the right of these indicates the units of measurement when a value is being displayed. The sixteen characters on the bottom of the display are used to indicate secondary readings or states, and to display scrolling error messages.

Along with the LCD display, the front panel also incorporates three LEDs. The four outer LEDs (labelled 1,2,3 & 4) indicate the set point status, i.e. when the LED is

illuminated the indicated relay is active. The centre LED indicates when the unit is "Off-line".

THE MENU SYSTEM

When the instrument is switched on it will default to the main display menu. The user interface to the MED53 is arranged as a menu structure, a summary of which is printed as a fold out sheet at the back of this guide. Movement around this menu structure is achieved using the "PAGE", "UP" and "DOWN" keys at the bottom of the front panel. The functions within each menu are explained in detail in the following sections of this guide.

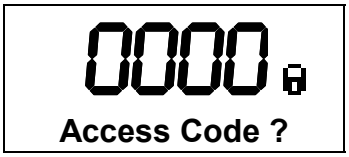
ERROR MESSAGES

If the internal diagnostics have detected an error condition, the appropriate error message will flash on the bottom row of the display. A reference to these error messages can be found on page 95. Pressing the "ENTER" key when an error message is flashing will scroll a more detailed description of the error along the bottom line. Pressing "ENTER" again will return the unit to the flashing display. The error messages can be disabled within the "***Configuration***" menu (see page 69). If the error messages are disabled, the display will flash a bell symbol on the far right of the bottom row when an error is detected. It is possible to configure set point 4 as an error relay to provide external signalling of error conditions.

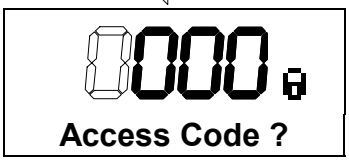
ACCESS ENTRY

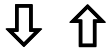
To protect the instrument setup from unauthorised or accidental tampering, an access code must be entered. The "***Access Entry***" menu will appear when the "PAGE" key is first pressed from the main display menu. A character on the upper right of the display will indicate whether access is permitted. The character will be a key for permitted access and a padlock for denied access. By default the access code will appear as 0000, however to unlock the instrument the correct code will need to be entered.

Enter the access code as follows (**N.B.** “Outlined” text represents flashing digits/characters on the display).

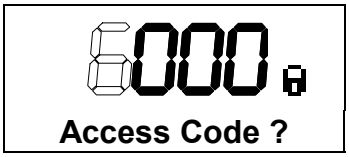


Press “ENTER” to begin editing the access code.

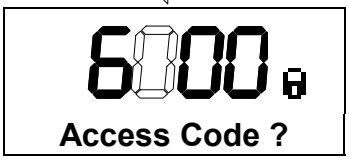




Use the “UP” and “DOWN” keys to change the first digit



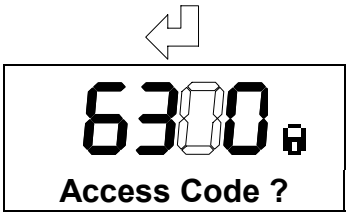
Press “ENTER” to select the next digit



Use the “UP” and “DOWN” keys to change the second digit

Press “ENTER” to select the next digit

Continued on next page .....



Use the “UP” and “DOWN” keys to change the third digit

Press “ENTER” to select the next digit

Use the “UP” and “DOWN” keys to change the last digit

Press “ENTER” to store the new code

If the new code is correct the Padlock symbol will now change to a Key symbol.

{ Note 6375 is only an example of an access code the correct code will need to be entered to unlock the instrument.}

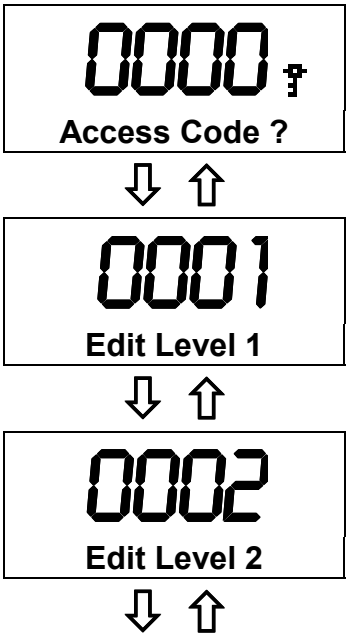
When the key symbol is displayed the operator may then move through the menu structure using the “PAGE”, “UP” and “DOWN” keys. Pressing the “PAGE” key will advance the unit on to the next menu header, using the “UP” and “DOWN” keys the operator can then select the items within that menu.
Pressing the “PAGE” key from within a menu will return the unit to the menu’s header, subsequent presses of the “PAGE” key will advance to the next menu. When the last menu is reached the unit will return to the normal display mode.

Using the “PAGE” and “ENTER” keys simultaneously will allow the unit to move backwards through the menus.

N.B. When in the menu structure, if none of the buttons are pressed within 2 minutes, the unit will timeout and return to the main display. The Access Code display will be reset to 0000, 30 seconds after returning to the main display.

There are two levels of access to the menu structure (refer to the menu structure printed inside the back cover). The first level allows access to the basic setup operations. The more complex level two menus will only appear when the level two access code has been entered.

The default access codes are 0001 for level one and 0002 for level 2
Once the access code has been entered correctly the operator can use the “UP” and “DOWN” keys to select and modify the access codes.



Access Code Entry

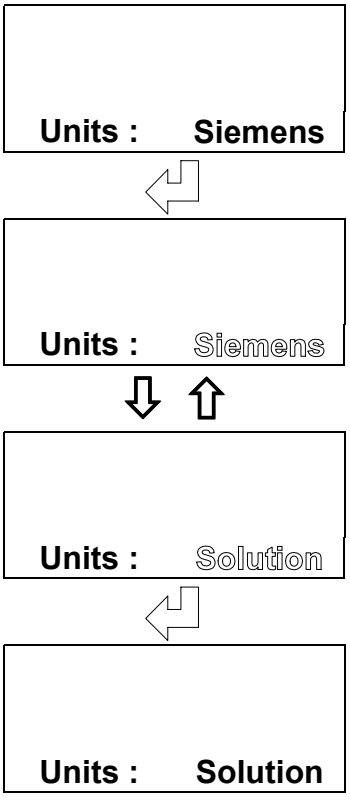
Level 1 Code Edit
(Only available once level 1 code has been entered)

Level 2 Code Edit
(Only available once level 2 code has been entered)

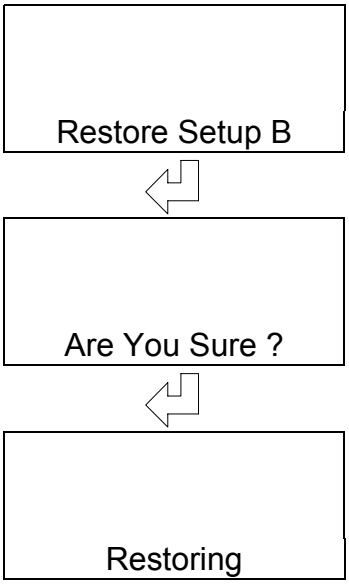
PROGRAMMING

Editing of discrete values (such as Set Point Level or Fixed Temperature Input) is performed in the same way as described above for the access code entry. Changing states (such as Units or Set Point Mode) is achieved in a similar fashion.

E.g. Using the "***Units***" menu function (in "***Parameters***"). Press the "ENTER" key to start the text flashing. Press the "UP" and "DOWN" keys to cycle through the displayed states, then press "ENTER" to select the required state.



For functions such as Resets and Restoring Setups, press the ”ENTER” key to initiate the function, the system will then ask for confirmation. Press “ENTER” to continue or “UP” or ”DOWN” to cancel the function.



Select the required function and press the “ENTER” key.

To continue press the “ENTER” key again
To abort the “Restore”, press any other key

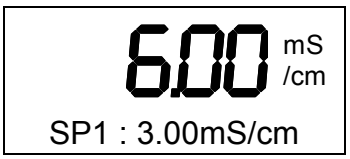
When the setup has been restored, the system will return to the main display.

The following sections of this guide describe in more detail each of the menus and their functions.

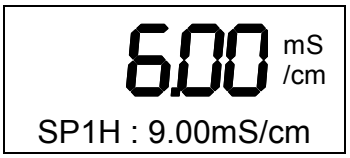
This page intentionally blank.

MAIN DISPLAY

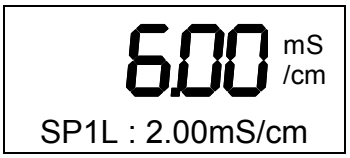
The normal mode of operation is to displays the sensor reading on the top row and the secondary reading on the bottom row. Using the “UP” and “DOWN” keys the user can cycle through the secondary parameters (those available depend upon the instrument options and configuration).



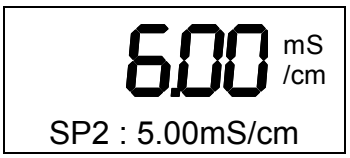
Sensor + Set Point 1
(When SP1 Trigger = High or Low)



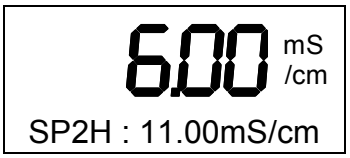
Sensor + Set Point 1 High
(When SP1 Trigger = Band or Latch)



Sensor + Set Point 1 Low
(When SP1 Trigger = Band or Latch)

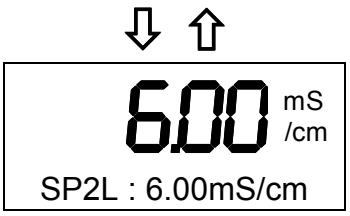


Sensor + Set Point 2
(When SP2 Trigger = High or Low)



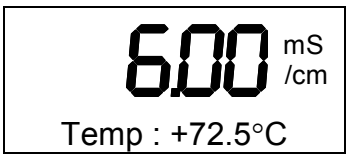
Sensor + Set Point 2 High
(When SP2 Trigger = Band or Latch)

Continued on next page .....

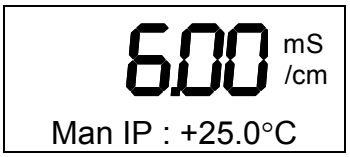


Sensor + Set Point 2 Low
(When SP2 Trigger = Band or Latch)

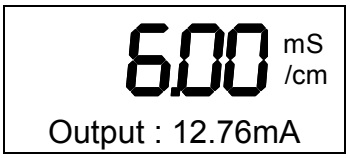
Set Point 3 will appear here if fitted.



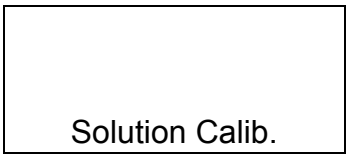
Sensor + Temperature Input
(When Compensation = Auto)



Sensor + Fixed Temperature
(When Compensation = Manual)



Sensor + Current Output
(When Current output fitted)

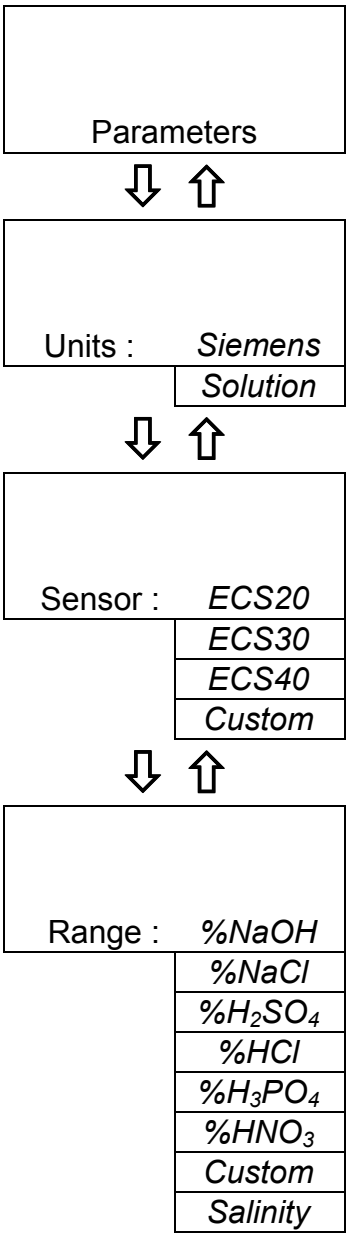


Solution Calibration (When calibration access is enabled in the calibration menu. See page 59)

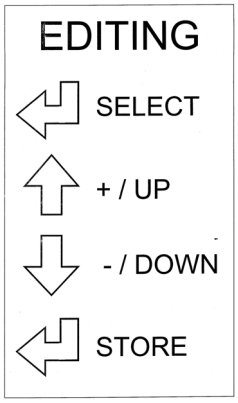
The default secondary parameter can be set by selecting the parameter and pressing the “ENTER” key (provided that no error messages are present). This is the parameter that is displayed on the bottom line, when the unit is switched on, or as a result of a timeout back to the normal display mode.

PARAMETERS

The “Parameters” menu contains the basic configurations for the sensor inputs



Parameters Menu Header

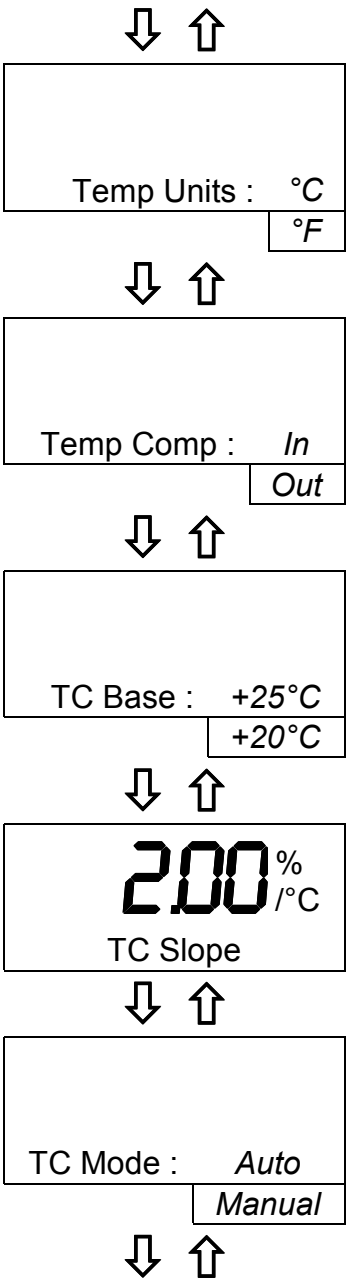


Sensor Units

Sensor Type,
Select Custom if the type of sensor you have is not shown and enter the Cell Constant value in the calibrate menu. (see page 57)

When the units are “Solution”, the ranges appear as shown. When the units are “Siemens” the five Conductivity ranges appear on the top Row as :

- 999.9µS/cm
- 9.999mS/cm
- 99.99mS/cm
- 999.9mS/cm
- Auto



Temperature Units

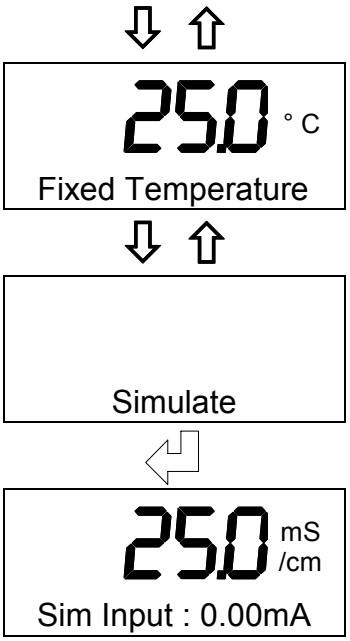
Temperature Compensation, not available when units set to Solution (automatically set to In).

Temperature Compensation Base
Reference for TC slope application
Shows in °F when units are °F.
Not available when units set to Solution (automatically set to 25°C).

Temperature Compensation Slope
Shows slope in %/°F when units are °F. (See Calculating Slope on page 89

Temperature Compensation Mode
Auto = from measured input
Manual = from fixed entry (see below)

Continued on next page .....



Temperature input for manual compensation. Only present when temperature compensation is manual.

Press “ENTER” to Select the Input Simulation Mode
(Not available when Range = “Auto”)

Simulate sensor input, display current output.

UNITS

The MED53 can be setup to display conductivity in Siemens/cm or solution concentration as “%wt/vol”. This is achieved by setting the units. The rest of the menu structure responds by enabling and disabling the appropriate menu items. When “Siemens” are selected, the instrument displays the input conductivity. All appropriate set points etc have their units changed automatically.

When “Solution” is selected the MED53 will automatically apply the correct conversion and temperature compensation and display the concentration as “%” with an indication of the solution type selected (see range selection). All of the set point units etc. will then be changed to “%”.

SENSOR TYPE

The MED53 can use either the ECS20, ECS30 or ECS40 series Electrodeless conductivity sensors. This enables the user to enter sensor type so the system can apply the correct nominal cell constant. If your sensor type is not shown select Custom and enter the correct cell constant in the Calibrate menu.

RANGE

The range options that are displayed will depend upon the units selected. If Solution is selected an option for Custom range is available. This allows the operator to enter their own Conductivity/Concentration lookup table (see page 70.).

TEMPERATURE INPUT

The MED53 has an accurate four wire temperature measurement. With this, the user can apply automatic temperature compensation to the sensor measurement. The operator can display all temperatures in either °C or °F with the ***Temp. Units*** function. All temperature related displays will use the units selected in this menu. **N.B.** The system will convert all temperature related variables when the units are changed, however it may be wise to ensure that changing the units has not altered the Temperature Compensation settings.

Temperature compensation is enabled by setting the ***Temp Comp*** menu item to "In". The user can then select two modes of compensation by the ***TC Mode*** menu item. If a temperature sensor is not connected, then it should be ***Disabled*** in the ***Configuration*** Menu on page 69. In this mode the instrument can be set with the TC ***Out*** which will provide a non-compensated measurement, or with the TC ***In*** and the ***Manual*** temperature set to the average solution temperature. When the manual mode is selected, the user can enter the fixed process temperature under the ***Fixed Temp*** Menu. (When automatic mode is selected, the ***Fixed Temp.*** menu is not present).

Note : When the unit detects a fault in the temperature sensor it will use the ***Fixed Temp*** setting as a default for compensation and indicate an error on the display**.**

If Solution measurement is selected the appropriate slope is applied automatically, unless Custom range is selected in which case the correct Slope for that solution must be entered. All Solution measurements are compensated to a Base of 25°C.

The Slope and Base for the Temperature Compensation can be easily modified by selecting the appropriate menu items.

SIMULATED INPUT

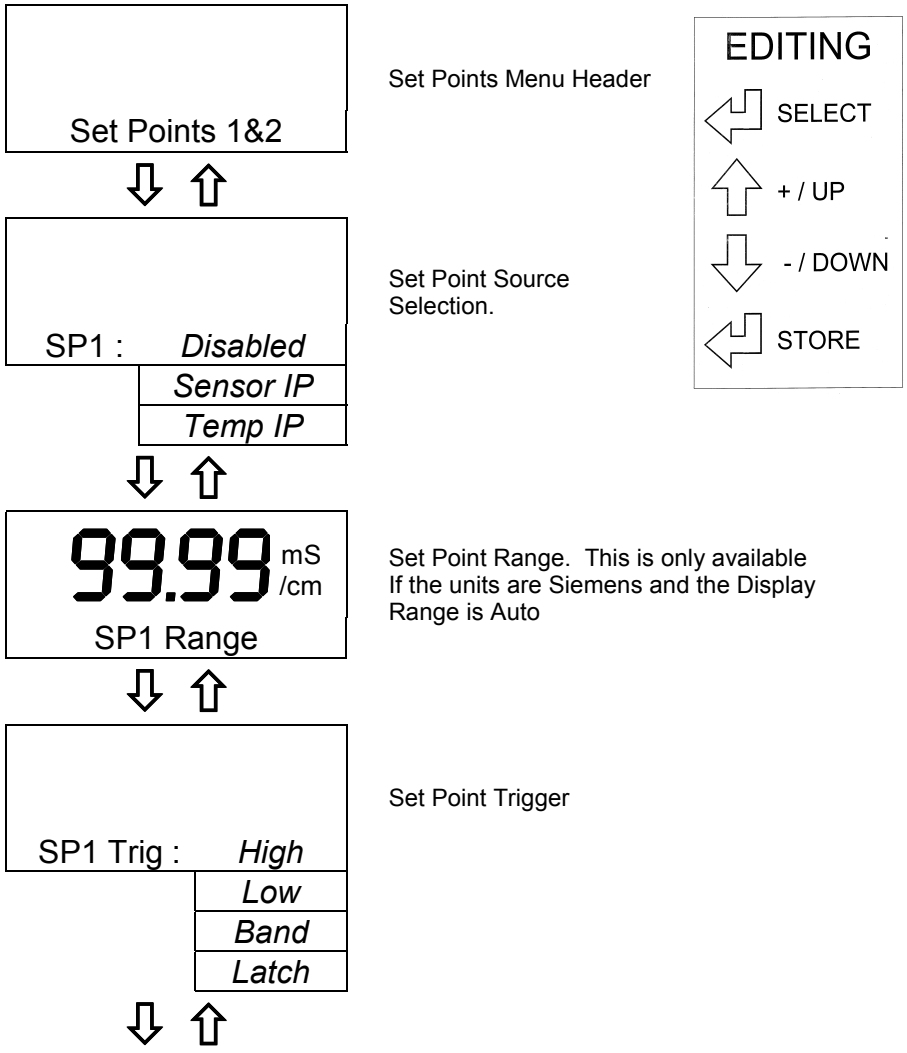
The facility exists within the MED53 to simulate the input sensor levels to test the set point and current output operation. This function allows the user to cycle up and down through the sensor range using the "UP" and "DOWN" keys and display the current output level, with the relays responding accordingly.

Selecting the ***Simulate*** menu item from the ***Parameters*** menu, press the "ENTER" key. This unit will now display the simulation menu. Pressing the "UP" and "DOWN" keys will cycle the displayed value between its minimum and maximum levels in steps of approximately 1% of its input range. The relays and current output will respond as if the displayed value were an actual input, thus allowing the user to debug the set point and current output configurations.

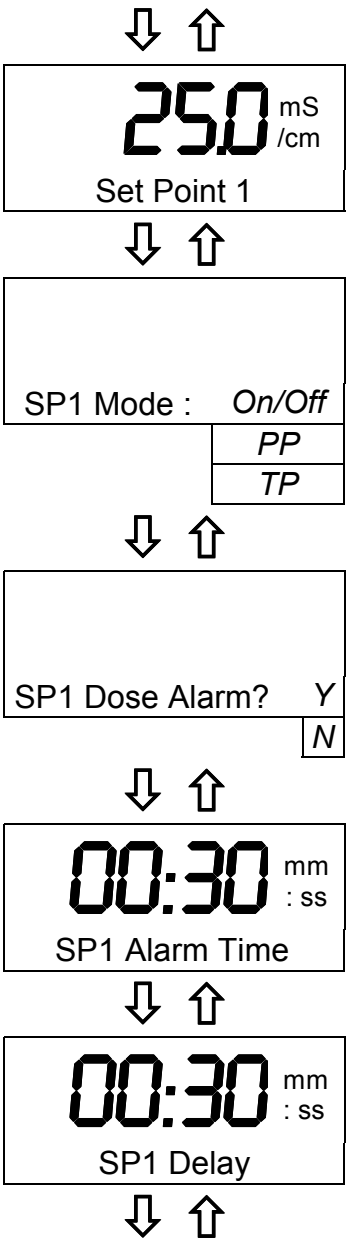
N.B. the simulation mode will only be available when the display range is set to a fixed range (i.e. not when "Autoranging" is selected).

SET POINTS

The Set Point configuration is separated into two menus, the first ***"Set Points 1&2"*** and the second ***"Set Points 3&4"*** (if fitted). The menu structures for Set points 1,2 & 3 are identical, and provide a high level of flexibility in the configuration of the relay outputs.



Continued on next page ……..



Set Point Level. If Band is selected you will be prompted to enter High and Low values.

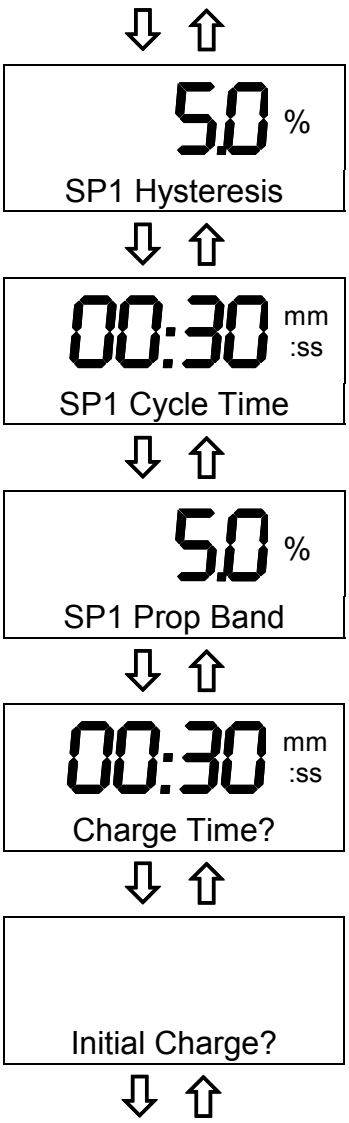
Set Point Mode. This menu will not appear if Trigger is set to "Band" the mode will default to On/Off in this state

Set Point 1 Dose Alarm Timer Enable.

Set Point 1 Dose Alarm Time
(Only visible when Timer Enable = Y)

Set Point Delay (to energising)
(Only appears if mode = On/Off)

Continued on next page ……



Set Point Hysteresis
(Only appears if mode = On/Off)

Set Point Cycle time for PP mode
(Only appears if mode is PP)

Set point proportional band as % of range
(Only appears if mode = PP or TP)

Enter Duration for Initial Charge

Press “ENTER” to begin Initial Charge (see page 50 for operation)

N.B. The Set Point 2 menus continue from here and are structured in the same manner.

SET POINT SOURCE

The set point operation on the MED53 can be configured to operate from one of two sources. The default source is the main sensor input reading, but the set point can also trigger from the temperature input. The menu structure for configuring the set points is basically the same for the sensor and temperature inputs.

SET POINT RANGE

If the main display has been set to "Autoranging" and the sensor units set to Siemens, then the Set Point is scaled according to the setting of the "***Set Point Range***" menu item. The range can be set from 999.9μS/cm to 999.9mS/cm.

SET POINT TRIGGER

The set points can be configured to trigger in three ways. The level where the set point triggers is set by editing the value under the "***Set Point 1***" (or "***Set Point 2***") menu item in the "***Set Points***" menu. When the trigger is set to band the "***Set Point 1***" menu disappears and "***SP1 Band High***" and "***SP1 Band Low***" menu items become available.

1. When the Trigger is set to "High", the relay will be activated when the source input becomes greater than the set point.
2. When the Trigger is set to "Low", the relay will become activated when the sensor input is less than the set point.
3. When the Trigger is set to "Band" the relay will become activated when it is either greater than the Band High set point, or lower than the Band Low set point.
4. When the trigger is set to ***"Latch"*** the relay will become activated when the source input becomes lower than the ***"Band Low"*** level, and will remain energised until it becomes higher than ***"Band High"*** level. It will then remain de-energised until the sensor input falls below the ***"Band Low"*** level again

SET POINT MODE

The relays can operate in one of three modes.

On/Off Mode

The On/Off mode is the default mode of operation for the relays. The relay energises when the set point is activated and is de-energised when the set point is de-activated.

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

"Hysteresis": A facility to apply hysteresis to the set point level allows the user to avoid relay "Chatter" when the sensor input level approaches the set point 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 a little larger than the input noise level.

In addition to the On/Off mode the MED53 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.

Time Proportional Mode

It is possible to control any on/off device by switching it's supply voltage, such as a solenoid valve or dosing pump using the time proportional mode.

The proportional band is displayed as a percentage of the full range value. For example, a proportional band of 20% on the 999.9μS/cm range would give a band of 200.0μS/cm. If the set point trigger was selected as LOW and the set point value was 500.0μS/cm, the band would cover 300.0 to 500.0μS/cm. When the reading falls below 300.0μS/cm the relay would be energised. As the input rises and approaches the set point the output relay starts to cycle on and off with the on time reducing and the off time increasing, respectively. The cycle time is adjustable and is the sum of the on and off times.

Pulse Proportional Mode

The Pulse Proportional (or PP) mode is intended to drive solenoid type dosing pumps which have the facility to accept an external pulse input. The proportional band operates in the same way as the Time Proportional mode. The output relay now operates by producing a series of pulses of fixed duration. The pulse rate increases as the measurement moves further from the set point, until it reaches the maximum frequency at the limit of the proportional band. (I.e. 300.0μS/cm in the previous example).

DOSE ALARM TIMERS

The dose alarm timer can be used to prevent overdosing under many different fault conditions , such as sensor failure or wiring faults. When the timer is enabled the user can set the "***Alarm Time***". If the associated relay remains energised for longer than the "***Alarm Time***" the alarm will activate, de-energising the relay to prevent over-dosing and flash the relative set point LED on the front panel. The display will also flash a warning message when the alarm is activated. **NB** During pulse or time proportional operation the cumulative "***on***" time that the set point is active will be taken.

To cancel the warning, and reactivate the set point, the user need only press the "ENTER" button on the front panel. **NB**. If more than one Alarm is active, set point 1 takes priority over set point 2 which takes priority over set point 3, and they are cancelled in that order by additional presses of the "ENTER" button.

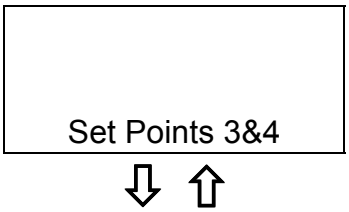
Set Point 4 can be set to activate when a Dose Alarm is detected (see page 51).

INITIAL CHARGE

A feature has been added to the Set Point 1 operation that will allow it to perform the "Initial Charge" feature as found in the MSD43 instrument. In essence this allows the user to over-ride the Dose Alarm Timer when first filling a tank. The user enters the "Charge Time" and initiates the charge by pressing the "ENTER" key at the "Initial Charge?" menu item. The unit will then disable the dose alarm timer until either the relay becomes inactive because the set point has been reached, or the charge timer reaches zero in which event the unit will automatically display a "SP1 Dose Alarm" error message and disable the relay. Whilst an initial charge is active the unit will display a count down clock both in the SP1 menu and in the secondary parameters displayed on the bottom row of the normal main menu. When viewing the count down timer in the SP1 menu, the user can cancel the initial charge function by pressing the "ENTER" key twice.

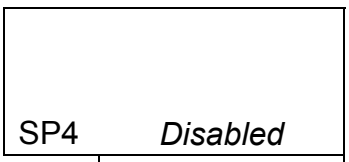
SET POINT 4

Set Point 4 can be configured as an alarm output triggered by one of a number of events. This can be configured by editing the SP4 trigger, which can be found after the Set Point 3 configuration in the “Set Points 3&4” menu..



Set Points
Menu Header

The Set Point 3 menu continues from here and is structured in the same manner as Set Point 1 and 2



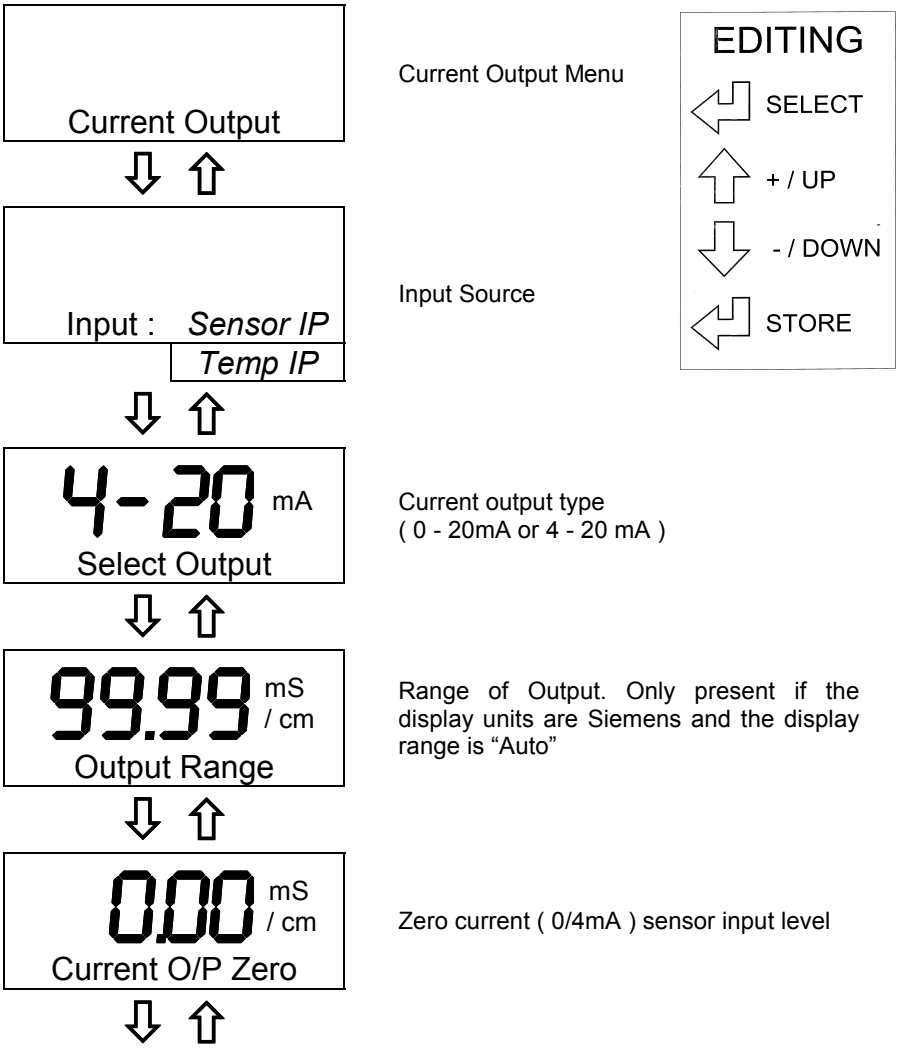
Set Point Mode.
Relay 4 will energise on the selected mode of operation.

Sensor Err	- When a sensor related error is detected
Dose Alarm	- When any of the Dose Alarms activates
Calibration	- When a calibration is in progress
Off-Line	- When the unit is taken ***“Off-Line”***
Any Error	- When any system error is detected.

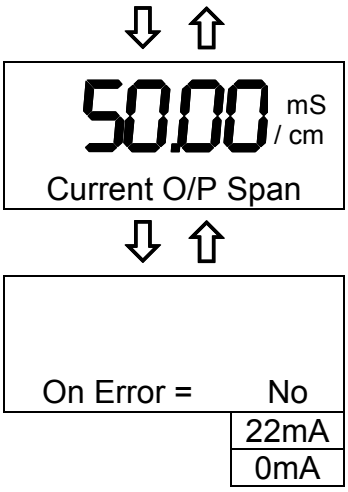
This page intentionally blank.

CURRENT OUTPUT

The current output menu structure contains all of the necessary setup functions to configure the current output source(s). If one current output is fitted then the menu will be as follows. If two current outputs are fitted they are referred to as A and B respectively. **When either of the outputs is open circuit, in a dual output unit, the other can be made to indicate a fault by transmitting a 0, 2 or 22mA signal as selected by the user. This will be accompanied by a flashing error message on the display (E41, see Appendix H, page 95).**



Continued on next page ……



Span current (20mA) sensor input level

Select state of current output when input source error is detected (i.e. Sensor Input Fault, Temperature input Over range)

INPUT

The input for the current output can be one of two options. The unit can use the sensor input or the temperature input as the source for the zero and span.

OUTPUT RANGE

The output range for the current output can be set to one of two ranges, either 0 - 20mA or 4-20mA. This selection sets the limits of the zero and span output levels. The output will continue to provide an extrapolated output above (>20mA) and below (<4mA) these points but will flag an error message on the main display. The maximum current limit is approximately 22mA, the minimum limit is 0mA (i.e. the unit cannot source a negative current)

ZERO & SPAN

The zero and span levels are set as the limits of the source input. This provides a totally flexible method of configuring the current output. The zero can be set anywhere within the input source range and the span up to 5% of the selected range, providing total control of the output range and offset. An inverse relationship can easily be achieved by simply setting the zero level to be higher than the span level.

DUAL CURRENT OUTPUTS

If the instrument is supplied with two current outputs they are designated A & B respectively. The menu for current output B is identical to A and is displayed after the A menu.

PROPORTIONAL CONTROL

Many devices such as motor speed controllers, valve actuators, or stroke positioners will accept an analogue 4-20 mA control signal.

It is possible to use the measurement signal from the instrument as a control signal. By setting the point at which the output is 4 mA as the set point (e.g. 50.00mS/cm) and the point at which the output is 20 mA as the proportional band (e.g. 20.00mS/cm) a simple form of proportional control is achieved. If this signal was used to drive a valve actuator, the valve would be fully open at 20.00mS/cm, half open at 35.00mS/cm and closed at 50.00mS/cm.

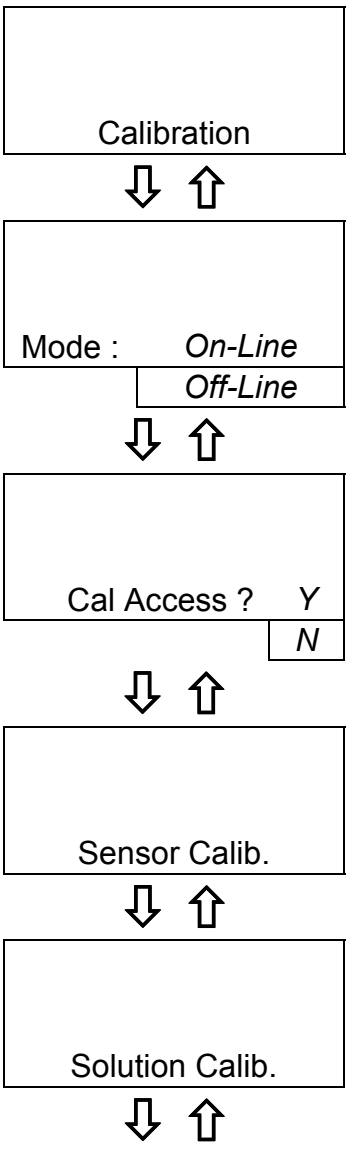
ERROR CONDITION

The current outputs can be programmed to output 22mA or 0mA when an error is detected on the source (i.e. Sensor Fault, Temperature Over or Under Range), to provide remote warning of error conditions or to ensure fail safe operation. The default state is disabled, where the parameter is set to ”***No***”.

This page intentionally blank.

CALIBRATION

The MED53 provides the facility within the "***Calibration***" menu to adjust the sensor inputs and current output levels to tailor the unit to the system in which it is operating.



Calibration Menu Header

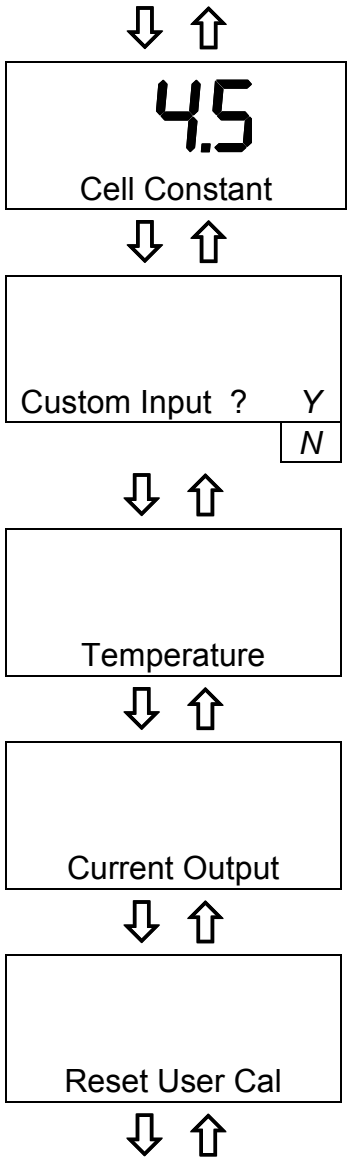
System Operating State
When Off-line the relays are de-energised and the current output held at its present level.

Calibration Access
Setting this to "Y" enables the calibration menu items on the main display (see page 38).

Sensor Offset Calibration
(See below for explanation)

Solution Offset Calibration
Only available when units = "Solution"
(See below for explanation)

Continued on next page ……



Custom Cell Constant adjustment.
(Only present if Custom Sensor selected under Parameters menu [Page 43]).

Custom Solution Entry
If = Y , point entry menus will appear
(See Custom Solution Range [Page 70])

Temperature offset calibration
(Only present if Compensation is Automatic)
(See below for explanation)

Current Output Calibration
(0,4 & 20mA levels)
(See below for explanation)

Reset all User calibrations to factory default
(See below for explanation)

ON-LINE/OFF-LINE OPERATION

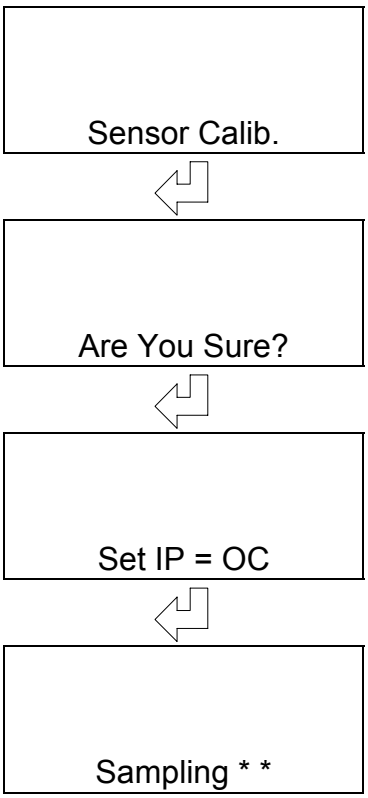
Selecting the "***Mode***" menu will allow the user to place the unit in the "***Off-line***" state. If the state is set to ***"Off-line"*** the relays will be de-energised and the current output level frozen for the duration of the ***"Off-Line"*** state. When ***"On-Line"*** is selected the relays and current output will operate normally. The middle LED on the front panel display will indicate when the unit is ***"Off-Line***".

CALIBRATION ACCESS

A feature has been included in the MED53 to allow users to access the solution calibration from the main display. To enable this feature the "***Cal Access?"*** state should be set to "Y". To disable this feature, thus preventing the users from altering the calibration from the main display, the "***Cal Access?***" state should be set to "N".

SENSOR CALIBRATION

The sensor calibration is a one off configuration calibration, to allow for losses due to cable length and sensor output variations. Calibrate the zero point with the sensor in air and the span with a loop resistor, using the following procedure.



Sensor Calibration
Press “ENTER” to start

Initiate Sensor Calibration

Press “ENTER” to confirm or any other key to abandon calibration

Press “ENTER” to Confirm

Zero calibration with the sensor in free air.

Press “ENTER” when ready

The unit will sample the sensor input. When Sampling is finished, the next menu will appear automatically.

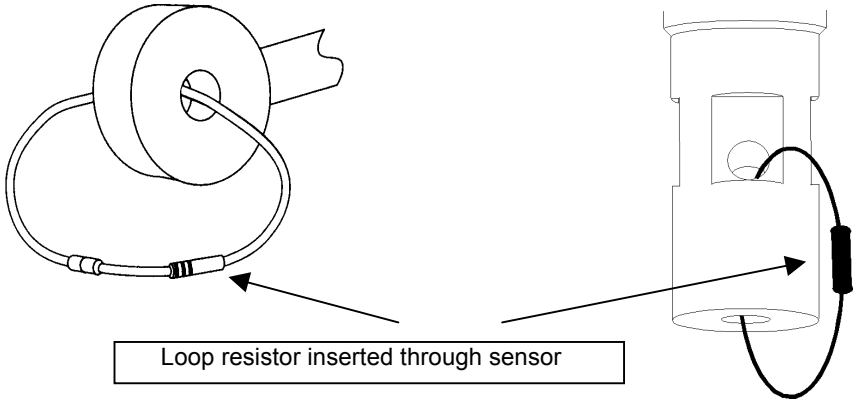
Each measurement range of the instrument is automatically sampled and the zero adjusted. As each range is completed a * is indicated on the display. On the lowest range (last to be sampled) this may take a few minutes particularly in electrically noisy environments, where pickup could interfere with the low level sensor signal. It is possible to abort the lowest range zero calibration by pressing the enter button.

Attach Loop

Attach a green (50Ω) loop resistor to the sensor as shown below.

ECS20 Series Sensor

ECS40 Series Sensor



Loop resistor inserted through sensor

Press “ENTER” when ready

Sampling

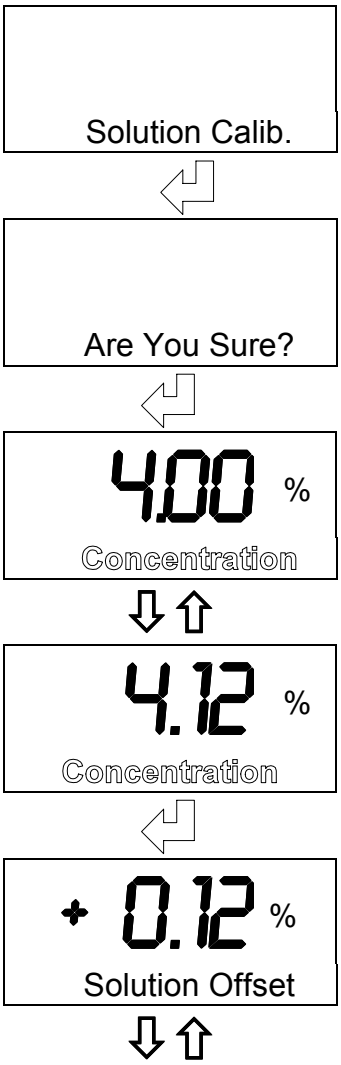
The unit will sample the sensor input. When Sampling is finished, the next menu will appear automatically.

The loop resistor must be removed from the sensor before installing into a pipe or tank. Keep it in a safe place as it will be useful for future checks, or if a probe or cable is changed.

SOLUTION CALIBRATION

This calibration feature allows the user to fine-tune the reading on the instrument to a standard solution or to a titrated sample.

To adjust the solution calibration, ensure first that the sensor units are set to "Solution. Select the "***Solution Calib.***" menu item within the "***Calibration***" menu. Reference should be made to APPENDIX C
, page 85, for instructions on the best practice.



Solution Calibration
Press "ENTER" Initiate Sensor Calibration

Press "ENTER" to Confirm , or any other key to abandon the calibration

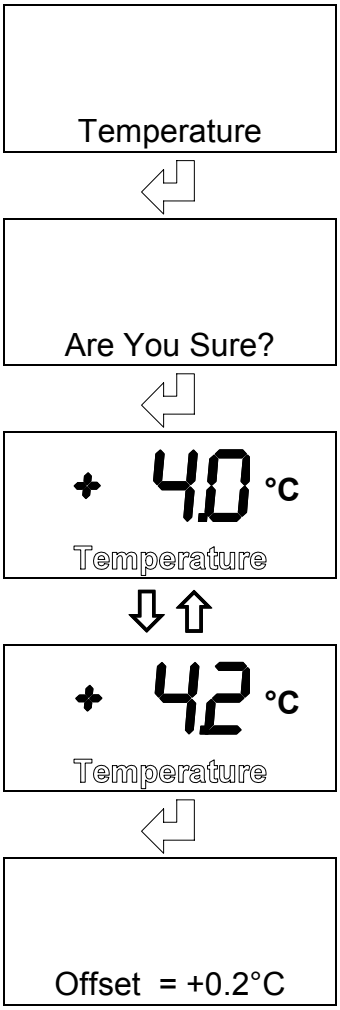
Sensor solution is displayed.
Bottom row of the display flashes

Adjust the reading using the up/down buttons. Press "ENTER" to store when the value is correct.

The Resulting Offset to the solution concentration is displayed for information.

TEMPERATURE CALIBRATION

To initiate the temperature calibration select the "***Temperature***" menu item in the "***Calibration***" menu and press the "ENTER" key.



Temperature offset calibration
(Only present if Compensation is Automatic)

Press "ENTER" to initiate calibration

Press "ENTER" to confirm, or any other key to abandon the calibration.

Press "ENTER" to confirm

The temperature reading is displayed on the top row. The bottom row of the display flashes

Adjust the reading using the up/down buttons

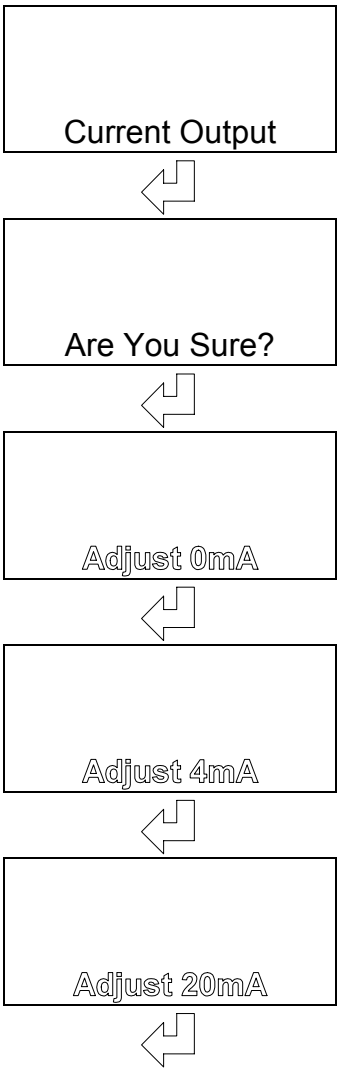
When the reading is correct, press the "ENTER" key to store the calibration

Press "ENTER" to store.

The unit will then display the offset used

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. To adjust the current output select the "***Current Output***" menu item in the "***Calibration***" menu. Please keep in mind that the current output cannot go below 0mA. The maximum offset is +2mA. If two current outputs are fitted they are referred to as A and B respectively.



Current Output Calibration
(0,4 & 20mA levels)

Press "ENTER" to initiate the calibration

Press "ENTER" to confirm, or any other key to abandon the calibration.

Press "ENTER" to confirm

The bottom row of the display flashes
Adjust the output to the required level using the "UP" and "DOWN" keys

Press the "ENTER" key when ready to move on to the 4mA calibration

The bottom row of the display flashes
Adjust the output to the required level using the "UP" and "DOWN" keys

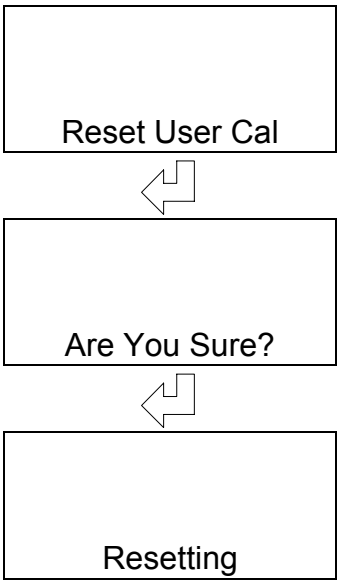
Press the "ENTER" key when ready to move on to the 20mA calibration

The bottom row of the display flashes
Adjust the output to the required level using the "UP" and "DOWN" keys

Press the "ENTER" key when ready, the unit will return to the "***Current Output***" menu item.

RESETTING THE USER CALIBRATION

If required the user can reset all of the user calibrations to their default states by selecting the "***Reset User Cal.***" menu item .



Reset all User calibrations to factory default

Press "ENTER" to initiate reset

Confirmation is requested.
Press "ENTER" to confirm, any other key to abandon the reset

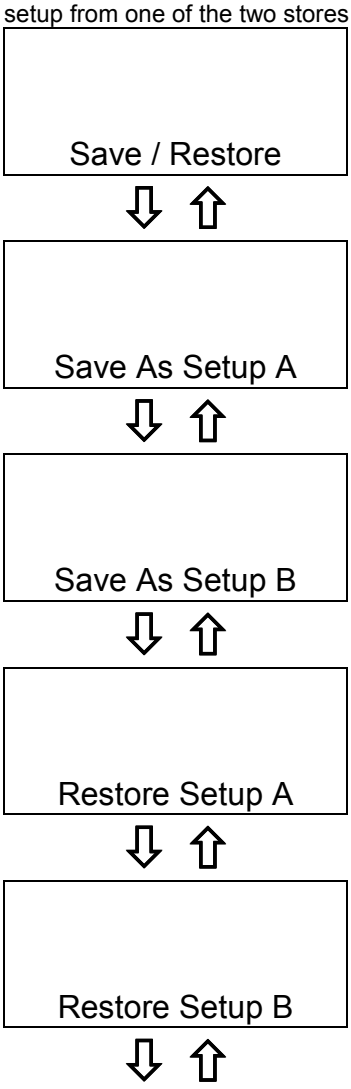
Press "ENTER" to confirm

The User Calibrations are reset to the factory defaults, after which the display returns to the top of the calibration menu

This page intentionally blank.

SAVE & RESTORE

One of the many new features in the MXD53 series of instruments is the availability to the user of a setup storage and recovery facility. Using these functions the user can save an instrument setup in one of two stores, or restore a previously saved setup from one of the two stores and two default setups.



Save /Restore Menu Header

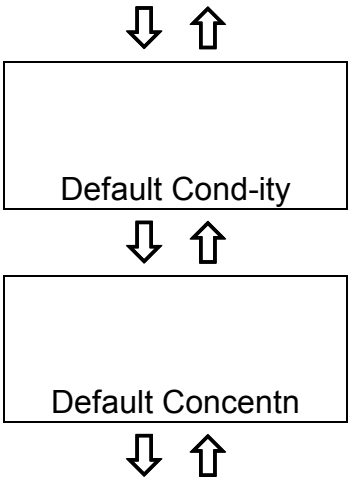
Save current instrument setup to store A
Press “ENTER” to select and confirm

Save current instrument setup to store B
Press “ENTER” to select and confirm

Restore instrument to setup held in store A
Press “ENTER” to select and confirm

Restore instrument to setup held in store B
Press “ENTER” to select and confirm

Continued on the next page .....



Reset instrument setup to default Conductivity measurement (see page 79). Press “ENTER” to select and confirm

Reset instrument setup to default Solution measurement (see page 79). Press “ENTER” to select and confirm

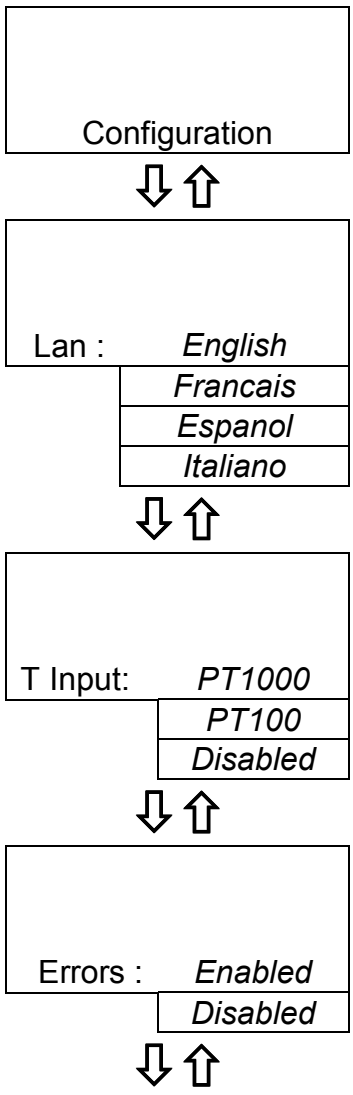
To use these functions select the “***Save/Restore***” menu item and use the ”UP” and “DOWN” keys to select the required function. Pressing the “ENTER” key will prompt the unit to ask for confirmation. Pressing the “ENTER” key again will initiate the function. The unit will then perform the function and then return to the main menu.

This facility is very useful when testing or fault finding is required. The setup can be stored prior to testing and restored once testing is complete. The two default setups are provided to give a basic instrument setup for each of the Conductivity and Concentration configurations.

N.B. There is no protection for the setup stores other than the systems request for confirmation, so be very careful not to overwrite already saved setups.

CONFIGURATION

The units also includes a configuration menu which sets up some basic operating parameters for the instrument



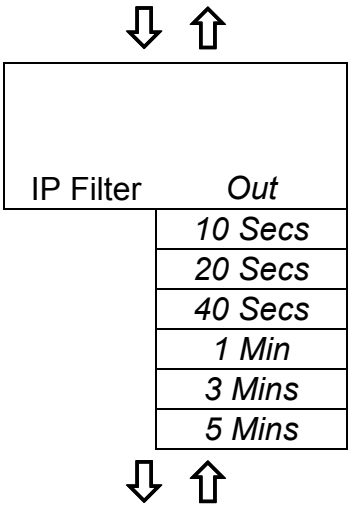
Configuration menu header

The MED53 has the ability to support multilingual text messaging

The temperature sensing input can be configured to accept a variety of resistive sensing elements

This function will disable/enable the flashing error messages on the main display. When disabled, a flashing “Bell” character will indicate an error is present.

Continued on next page .....



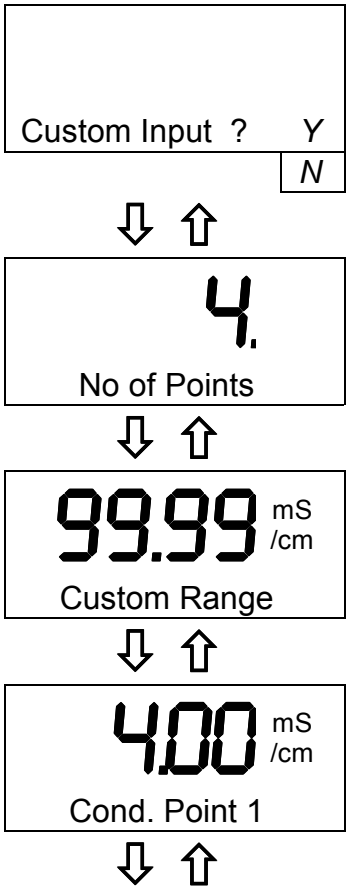
Input Filtering.

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)

CUSTOM RANGE INPUT

The MED53 provides the user with the facility to enter a customised conversion from conductivity to % concentration, for solutions not specifically defined in the standard ranges. To use this facility the user must first ensure that the "***Units***" are set to "***Solution***" and that the "***Display Range***" is set to "***Custom***". When this is the case the "***Custom Input?***" menu item will appear in the "***Calibration***" menu. To enable the custom point entry, set the state to "***Y***". This will then enable the custom input menu items below.



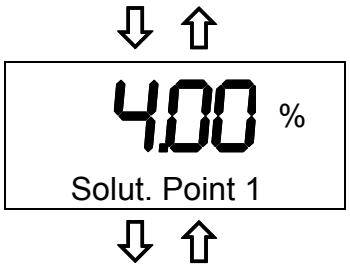
Custom Input Slope entry
Select "Y" to enable slope entry

When slope entry is enabled, the no of points In the slope needs to be entered (not including the zero point)

Select the conductivity range over which the slope is to be defined.

Enter the conductivity for the first point on the slope

Continued on next page .....



Enter the Solution % value for the first point

The menus continue from here for the number of points selected above

The suggested procedure for custom slope entry is first to note down the number and position of the required points on a copy of the record sheet (follows). When setting the number of points, remember that this figure does not include the zero point. The unit will always assume that zero is 00.00% at 000.0μS/cm. Sufficient point entry menus will appear for the number of points selected. Enter the data for each point along the slope in ascending order of conductivity. For input levels greater than the last conductivity point in the slope, the unit will generate an over-range error (Error 33).

The user must remember that the Temperature Compensation Slope in the "***Parameters***" menu must be set correctly (see page 41).

WORKSHEET

No. of Points _____

TC Slope _____%/°C

Conductivity Range

- ☐ **999.9µS/cm**
- ☐ **9.999mS/cm**
- ☐ **99.99mS/cm**
- ☐ **999.9mS/cm**

	Conductivity	Concentration
Point 1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

This page intentionally blank.

FAULT FINDING

NOTE : THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT

The MED53 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 tables starting on page 95 give a list of error messages that the MED53 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.

1. Serial number of the instrument,
2. The approximate date of purchase.
3. Details of the program settings and application
4. Electrical environment and supply details
5. Circumstances under which the fault occurred.
6. The nature of the fault or faults
7. Any error messages that are displayed
8. The sensor type, cable length and type
9. Current output configuration
10. Relay connection configuration

It is often worthwhile to check the measurement by an independent method, for example using a handheld meter. (See also Noise Suppression, page 21)

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 MED53 can accept from 85 to 250V AC or DC without any degradation in performance. A low voltage version is available which can accept 18 to 36V AC or DC. Check that the power cable is securely and correctly attached. There are no user serviceable fuses fitted.

The Access Code Does Not Work

It is probable that the access code has 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

(Also see Application Note AN1008, ECS Sensors Testing Procedure)

- Ensure that the sensor and temperature inputs are correctly connected (see page 18) and that the sensor is not faulty or damaged.
- Check that the correct sensor units have been selected within the Parameters menu (see pages 41 and 43).
- Check the temperature compensation state (see Parameters Section page 41). 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 (see Main Display Section page 39).
- Check the sensor using a hand held meter.

The Sensor Reading Is Incorrect

- Check that the correct sensor type has been selected (see Parameters Section, page 41).
- Check that no error messages are being displayed (see page 95). Check that the sensor cable has been correctly connected (see page 18).
- Check that the Temperature reading is correct.
- Use another instrument to check the sensor.

The Sensor is not Functioning Correctly

The Temperature Reading Is Incorrect

- Check that the temperature sensor is correctly attached. (See "Wiring Installation", pages 28 & 20).
- Check that the temperature sensor type is correctly selected in the "Configuration" menu (See page 69)
- Where practical check the temperature sensor resistance against the table in APPENDIX F
- see page 91.

Current Output is Incorrect or Noisy

- Check that the maximum load for the current loop has not been exceeded. (1000Ω).
- Check that the terminals have been wired correctly (see pages 15 & 25).
- 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 (see page 21).
- Check that he current output has been configured properly (see page 50).

Relays Appear to Malfunction

- Check that the unit is "On-Line" (see page 59)
- Check that the set point configuration is correct (see page 45)
- If the relays are vibrating or "chattering" as they pass the set point, check the hysteresis setting (see page 49) and increase if necessary.
- Ensure that the relays are connected properly (see pages 15 & 26) and that the voltage/current levels are not exceeding the specification (see page 5).
- Check that the instrument input cables are not picking up excessive noise, (see page 11 Wiring Installation).

A Bell Symbol is Flashing on the Display

The system has detected an error but the error messages have been disabled in the "***Configuration***" menu (See Page 69). Enable the error messages, correct the error and then disable the error messages only if absolutely necessary.

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.

This page intentionally blank.

APPENDIX A

FACTORY DEFAULT SETUPS

Parameters	Conductivity	Concentration
Units	Siemens	Solution
Sensor Type	ECS40	ECS40
Range	Auto	NaOH
Temperature Units	°C	°C
TC	In	In
TC Base	25°C	N/A
TC Slope	2%/°C	N/A
TC Mode	Automatic	Automatic
Manual Temperature Input	+25.0°C	+25.0°C
Set Points 1&2		
SP1 Source	Sensor	Sensor
SP1 Range	99.99 mS/cm	N/A
SP1 Trigger	Low	Low
SP1 Level (Band High)	10.00 mS/cm	3%
SP1 Band Low	1.000 mS/cm	1%
SP1 Mode	On/Off	On/Off
SP1 Dose Alarm	No	No
SP1 Alarm Time (mm:ss)	05:00	05:00
SP1 Delay (mm:ss)	00:00	00:00
SP1 Hysteresis (% of SP Level)	1.0%	1.0%
SP1 Cycle Time (mm:ss)	00:30	00:30
SP1 Proportional Band (% of range)	20.0%	20.0%
SP2 Source	Sensor	Sensor
SP2 Range	999.9 mS/cm	N/A
SP2 Trigger	High	High
SP2 Level (Band High)	100.0 mS/cm	5%
SP2 Band Low	10.00 mS/cm	3%
SP2 Mode	On/Off	On/Off
SP2 Dose Alarm	No	No
SP2 Alarm Time (mm:ss)	05:00	05:00
SP2 Hysteresis (% of SP Level)	1.0%	1.0%
SP2 Cycle Time (mm:ss)	00:30	00:30
SP2 Proportional Band (% of range)	20.0%	20.0%

Setpoints 3&4		
SP3 Source	Sensor	Sensor
SP3 Range	9.999 mS/cm	
SP3 Trigger	Low	Low
SP3 Level (Band High)	1.000 mS/cm	3%
SP3 Band Low	0.100 mS/cm	1%
SP3 Mode	On/Off	On/Off
SP3 Dose Alarm	No	No
SP3 Alarm Time (mm:ss)	05:00	05:00
SP3 Hysteresis (% of SP Level)	1.0%	1.0%
SP3 Cycle Time (mm:ss)	00:30	00:30
SP3 Proportional Band (% of range)	20.0%	20.0%
SP4 Mode	Disabled	Disabled
Current Output(s)		
Input A	Sensor	Sensor
Output A	4-20 mA	4-20 mA
Output A Range	999.9 mS/cm	% NaOH
Output A Zero	0.0 mS/cm	0.0%
Output A Span	100.0 mS/cm	5.0%
Input B	Sensor	Sensor
Output B	4-20 mA	4-20 mA
Output B Range	999.9 mS/cm	% NaOH
Output B Zero	0.0 mS/cm	0.0 mS/cm
Output B Span	100 mS/cm	100 mS/cm
Calibration		
Mode	On-Line	On-Line
Calibration Access	No	No
Configuration		
Language	English	English
Sensor	Pt1000	Pt1000
Errors	Enabled	Enabled
IP Filter	Out	Out

APPENDIX B

CUSTOMER SETUP

Instrument Serial No ……

Sensor Serial/Type No ……

Parameters	Settings
Units	
Sensor Type	
Range	
Temperature Units	
TC	
TC Slope	
TC Mode	
Manual Temperature Input	
Set Points	
SP1 Source	
SP1 Range	
SP1 Trigger	
SP1 Level (Band High)	
SP1 Band Low	
SP1 Mode	
SP1 Dose Alarm	
SP1 Alarm Time (mm:ss)	
SP1 Delay (mm:ss)	
SP1 Hysteresis (% of SP Level)	
SP1 Cycle Time (mm:ss)	
SP1 Proportional Band (% of range)	

Continued on next page ……

SP2 Source	
SP2 Range	
SP2 Trigger	
SP2 Level (Band High)	
SP2 Band Low	
SP2 Mode	
SP2 Dose Alarm	
SP2 Alarm Time (mm:ss)	
SP2 Hysteresis (% of SP Level)	
SP2 Cycle Time (mm:ss)	
SP2 Proportional Band (% of range)	
SP3 Source	
SP3 Range	
SP3 Trigger	
SP3 Level (Band High)	
SP3 Band Low	
SP3 Mode	
SP3 Dose Alarm	
SP3 Alarm Time (mm:ss)	
SP3 Hysteresis (% of SP Level)	
SP3 Cycle Time (mm:ss)	
SP3 Proportional Band (% of range)	
SP4 Mode	

Continued on next page ……

Current Output(s)	
Input A	
Output A	
Output A Range	
Output A Zero	
Output A Span	
Input B	
Output B	
Output B Range	
Output B Zero	
Output B Span	
Calibration	
Mode	
Calibration Access	
Configuration	
Language	
Sensor	
Errors	
IP Filter	

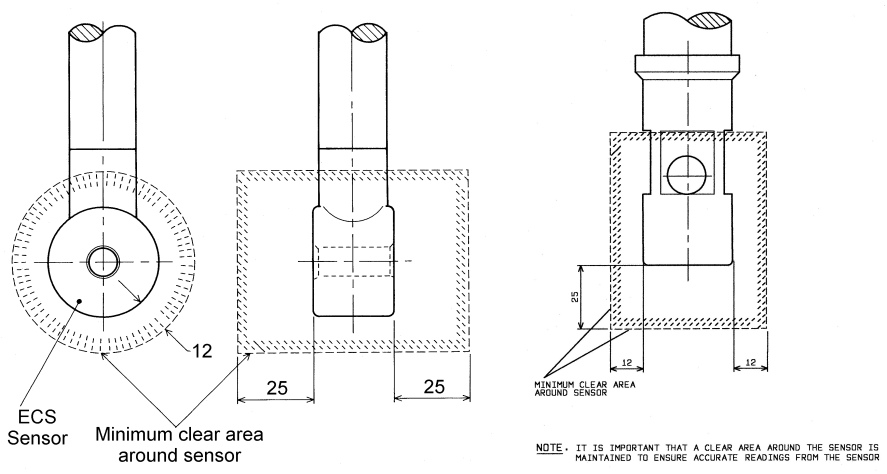
This page intentionally blank.

APPENDIX C

CALIBRATION

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

- Two calibration procedures are provided with the MED53.
- An initial installation calibration, that matches the sensor, cable and instrument, using a loop resistor. 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.
- Always clean the sensor, before making adjustments.
- The MED53 can be taken offline, which de-energises the relays and holds the current output at the last value. This facility is useful when calibrating the system, however the operator must ensure the relays are in a safe state when using this feature.
- Temperature has a large effect on conductivity measurements, it is essential that an understanding of the relationship between conductivity and temperature, for the application being measured, is understood when calibrations are made.
- 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 Figure 24 for details.



ECS20 AND ECS30 SERIES SENSORS ECS40 SERIES SENSORS

Figure 24

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.

Most standards are made up from a solution of KCl dissolved in high purity water. BS 6438 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 E

Calibration by Comparison with Another Instrument

This can provide the easiest method for in-situ calibrations but does have 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.

APPENDIX D

SOLUTION CONVERSION

The following table provides some of the data points which have been used in the MED53 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 MED53 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

This page intentionally blank.

APPENDIX E

TEMPERATURE COEFFICIENT

Calculating the temperature coefficient of a solution

If the temperature coefficient of the solution being monitored is not known, the MED53 can be used to determine that coefficient. You should set the MED53 to a suitable range and the temperature coefficient to 0.0% or ***T.C.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:

$$\alpha = \frac{(Gx-Gy) \times 100\%}{Gy(Tx-25) - Gx(Ty-25)}$$ (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.

This page intentionally blank.

APPENDIX F

TEMPERATURE DATA

The table below lists approximate resistance values of temperature sensors that may be used with the MXD53 series. Not all options are available on all models.

Temp-erature (°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

This page intentionally blank.

APPENDIX G

SAVE & RESTORE

Saving and restoring set-up data

It is now possible for the instrument set-up to be “saved” and “restored” as a safeguard against accidental erasure of some or all of the programmed data.
There are three banks of data that can be interchanged as required.
Working Data: the operating data and set-up parameters that are used by the instrument and which can be changed or viewed on the display by the user.
Primary backup: the “A” stores can be written to or read back as a block of data. Data in these stores cannot be viewed without first loading it into the Working data stores. This read back will overwrite the existing Working data, leaving the “A” store data unchanged.
Secondary backup: the “B” stores can be written to or read back as a block of data. Data in these stores cannot be viewed without first loading it into the Working data stores. This read back will overwrite the existing Working data, leaving the “B” store data unchanged.
When an individual parameter is saved, the corresponding data is copied into a single non-volatile memory location (this simply means the data is not lost when the power is removed or interrupted).
When a complete programme sequence or set-up has been entered into the Working data stores, the whole set-up can be copied (using “Save/Restore”) into either the “A” or “B” stores. We strongly recommend that this feature is used.
It is also possible to restore the default parameters. This can be useful for fault finding, since a working configuration can quickly and easily be “programmed in” to aid commissioning or testing the instrument. Remember to Save the normal set-up first and restore it afterwards.
If corruption of data is reported by the software with an error message, the saved set-up can be copied back into the Working stores from either the “A” or “B” stores.

This page intentionally blank.

APPENDIX H

ERROR MESSAGES

Switch On Diagnostic Errors

E01 :	***Internal Processor RAM Read/Write Error*** Try switching the unit off then on again. If the message persists, consult with your supplier, as this unit will require to be returned for repair.
E02 :	***EPROM Checksum Error*** The software runs a checksum test on the program memory store at power on, to ensure that the integrity of the software has not been compromised. Switch the unit off then on again. If the error message persists call LTH Electronics or authorised local distributor.
E03 :	***External RAM Read/Write Error*** Try switching the unit off then on again. If the message persists, consult with your supplier, as this unit will require to be returned for repair.
E04 :	***Setup Checksum Error*** The instrument configuration has for some reason become corrupted. Restore a setup from store A or B, or one of the two default setups.
E05 :	***Store A Checksum Error*** The data in setup store A has been corrupted. Save the current setup back to store A.
E06 :	***Store B Checksum Error*** The data in setup store B has been corrupted. Save the current setup back to store B.
E07 :	***Factory Calibration Checksum Error*** The factory calibration data for this instrument has been corrupted. The instrument will need to be re-calibrated. Consult your supplier.
E08 :	***User Calibration Checksum Error*** The user calibration data has been corrupted. Reset the user calibration and re-enter

Calibration Errors

E11 :	***Sensor Cal Zero***
	Sensor Zero Calibration at Limit
E12 :	***Sensor Cal Span***
	Sensor Span Calibration at Limit
E13 :	***Temp Cal Zero***
	Temperature Zero Calibration at Limit
E14 :	***Temp Cal Span***
	Temperature Span Calibration at Limit

Sensor Input Errors

E31 :	***Sensor Zero***
	The sensor input is at or below zero
E32 :	***Sensor Limit***
	The sensor input is at maximum limit
E33 :	***Sensor Input Over-range***
	The sensor reading is greater than the specified upper limit.
E34 :	***Sensor Input Under-range***
	The sensor input is less than the specified lower limit
E35 :	***Temperature Sensor Fault***
	The temperature input is incorrect, due in most cases to a damaged sensing element or incorrect wiring. Check correct temperature sensor type is selected under Configuration Menu. When this error occurs the unit will use the “Fixed Temp.” setting for compensation purposes (see page 44)
E36 :	***Temperature Input Under-range***
	Temperature input is less than -50.0 °C
E37 :	***Temperature Input Over-range***
	Temperature input is greater than +300.0 °C
E38 :	***Temperature Compensation Outside Limits***
	The temperature reading is less than 0.0°C or greater than 100.0°C, leading to an error in compensation.

Current Output Errors

E41 :	***Current Output Hardware Fault*** The current output circuit has detected an error in the output, this is most commonly due to either a broken loop or too large a load resistor.
E42 :	***Sensor Input < Current I OP A Zero Level*** The sensor input level is below that set for current output A zero.
E43 :	***Sensor Input > Current OP A Span Level*** The sensor input level is above that set for current output A span.
E44 :	***Sensor Input < Current OP B Zero Level*** The sensor input level is below that set for current output B zero.
E45 :	***Sensor Input > Current OP B Span Level*** The sensor input level is above that set for current output B span.

Floating Point Maths Errors

These errors are only flagged when an internal maths calculation fails. As such, they should not appear if the software is functioning properly. The error message should time out after approx. 5 seconds. If the error continues to be displayed, call LTH or an authorised distributor for advice.

E51 :	***Overflow Error***
E52 :	***Underflow Error***
E53 :	***Divide by 0 Error***
E54 :	***Too Large For Conversion***
E55 :	***Too Small For Conversion***

This page intentionally blank.

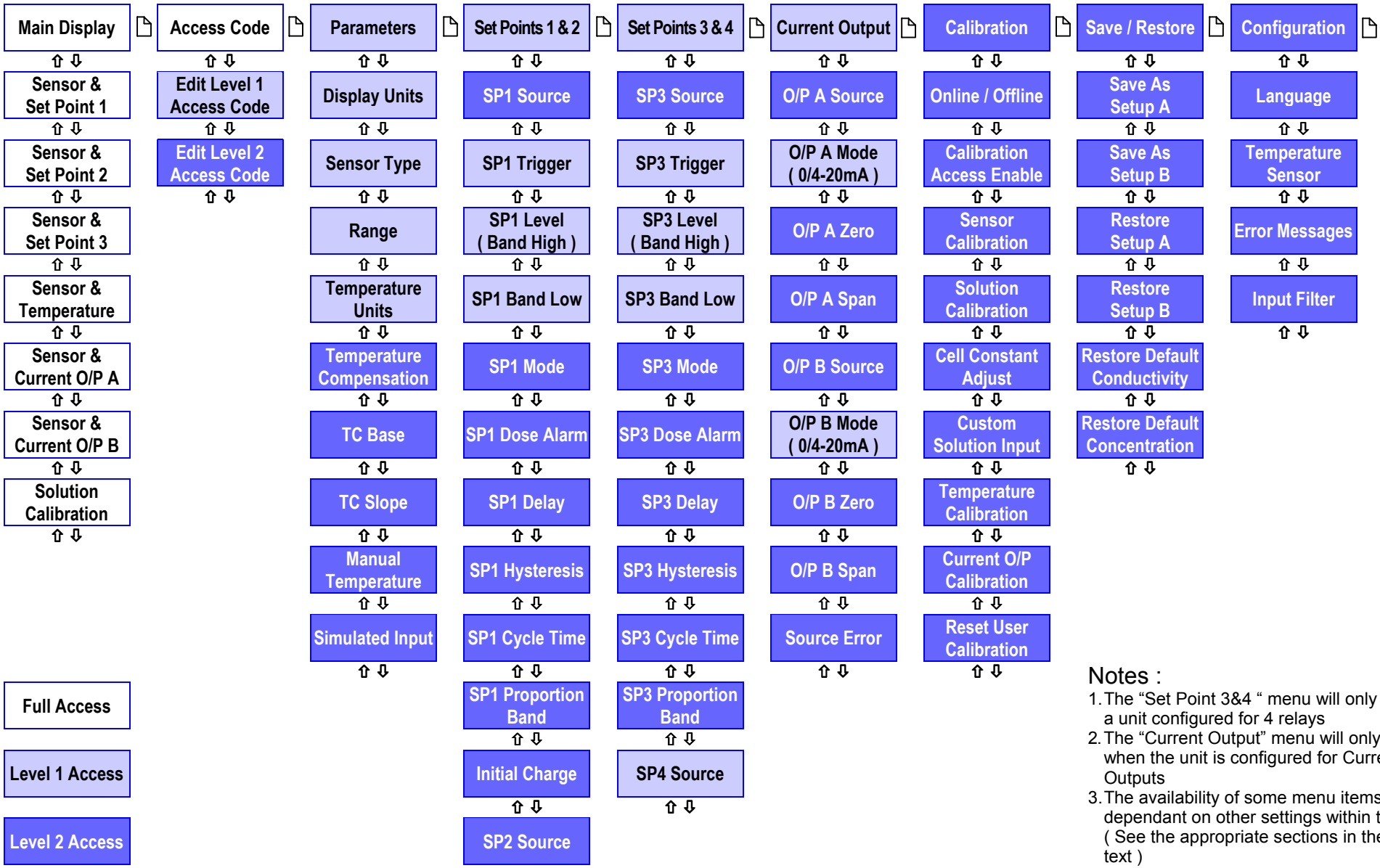
ADDENDA

{ See also “ERRATA” on page 9 }

This page intentionally blank.

INDEX

MED53



Notes :

1. The “Set Point 3&4 “ menu will only appear in a unit configured for 4 relays
2. The “Current Output” menu will only appear when the unit is configured for Current Outputs
3. The availability of some menu items is dependant on other settings within the unit. (See the appropriate sections in the main text)

KLAY-INSTRUMENTS B.V.

Nijverheidsweg 5
Postbus 13
Tel. 0521-591550
Fax 0521-592046

7991 CZ DWINGELOO
7990 AA DWINGELOO
Nederland
E-mail: info@klay.nl