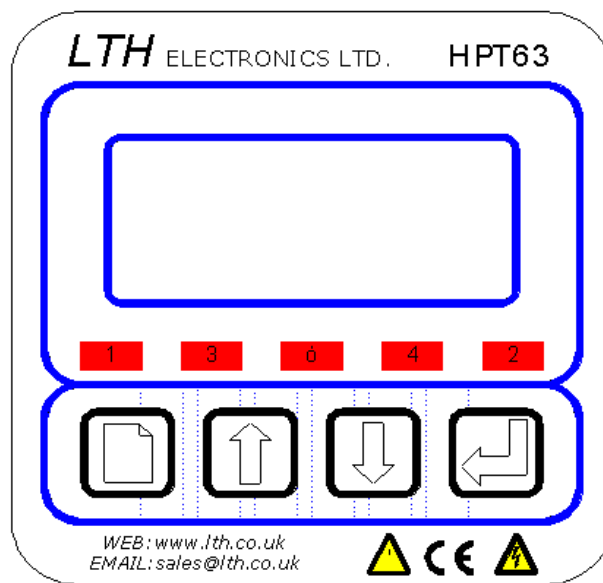


# HPT63

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pH / REDOX TRANSMITTER

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OPERATION GUIDE

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## PREFACE

### Product warranty

The HPT63 has a warranty against defects in materials and workmanship for three years from the date of shipment. During this period LTH will, at its own discretion, either repair or replace products that prove to be defective. The associated software is provided 'As is' without warranty.

### Limitation of warranty

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

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

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

### Disclaimer

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

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

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## 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.*

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## GLOSSARY

LCD	Liquid crystal display
LED	Light Emitting Diode
LSB	Least Significant Bit
MSB	Most Significant Bit
ppm	Parts per million.
ppt	Parts per thousand
PRT	Platinum Resistance Thermometer.
PSD	Programmable System Devices.
Redox	<b>Reduction/oxidation.</b> Chemical reaction involving oxidation and reduction.
RTD	Resistive Temperature Device
SP	Set point.

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Contents

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# 1 Introduction

## 1.1 About the HPT63

The HPT63 is a microprocessor-controlled pH or Redox transmitter. 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, alarm and feedback with up to two relays and two 0/4-20mA current output sources.

## 1.2 Unit Specification

<b>Measurement input</b>	Single ended or differential with solution ground.		
	<b>pH</b>	Separate glass and reference electrode pair. Separate Antimony and reference electrode pair or combination electrode	
	<b>Redox</b>	Separate metal and reference electrode pair or combination electrode.	
		Other manufacturers' sensors can be accommodated.	
<b>Ranges of measurement</b>	0.00 to 14.00pH -1999mV to +1999mV -50°C to +300°C		
<b>Accuracy</b>	±0.05pH ±3mV		
<b>Linearity</b>	±0.1% of range		
<b>Repeatability</b>	±0.1% of range		
<b>Operator adjustment</b>		<u>Slope</u>	<u>Offset</u>
	pH	60-120%	3 to 11 pH
	Antimony	60-120%	-4 to +4 pH
	Redox	NA	-400 mV to +400 mV
<b>Temperature sensor</b>	PT1000 RTD or 3K Balco thermistor.		
<b>Temperature accuracy</b>	±0.2°C		
<b>Operator adjustment (Temp)</b>	± 50°C, or ± 122°F		
<b>Temperature compensation type</b>	Automatic or manual 0°C to 100°C		
<b>Off-Line Facility ( for calibration and commissioning )</b>	The relays are de-energised and the current output is held at the last on-line value. Can be initiated remotely by a contact closure.		
<b>Ambient Operating Temperature</b>	-20°C to +50°C (-4°F to +122°F) for full specification.		
<b>Ambient temperature variation</b>	±0.01% of range / °C ( typical )		
<b>Display</b>	Custom back-lit LCD module. 4 character (& sign) 7 segment (20mm high) for measured value, 2x3 dot matrix for units indication, and 1x16 dot matrix for information and programming.		

## 1 Introduction

<b>Current output ( optional 1 or 2 outputs )</b>	Each selectable 0-20 mA or 4-20 mA into 1500 Ohms max., fully isolated to 2kV. Expandable up to 5% of any operating range (pH, mV, °C) and offset anywhere in that range.
<b>Operator adjustment ( Current ) Set points and control relays ( Advanced model only )</b>	±1 mA zero and ±1 mA span for remote monitor calibration Fully configurable set points (pH, mV, °C) with volt free contacts for both relays. Rated at 5A 30V DC / 5A 250VAC (non-inductive). Red LEDs indicate relay energised.
<b>Operating modes ( Control, All relays )</b>	On/Off, Time Proportioning, Pulse Proportioning, Band and Clean modes selectable for each relay. Adjustable delay timers up to 10:00 mm:ss and hysteresis in the On/Off mode. Adjustable dose alarm timer up to 15:00 mm:ss in all modes. Adjustable cycle time and proportional band in the proportional modes. Adjustable duration, recovery and interval periods in the clean mode.
<b>Operating modes</b>	The relay can be set to energise on any of the following instrument conditions:- Sensor alarm, Dose alarm, Calibration, Off line, Any error
<b>Switches</b>	Four tactile feedback push buttons
<b>EMC : Immunity</b>	BS EN 50082-2 1995
<b>EMC : Emissions</b>	BS EN 50081-1 1992
<b>Safety</b>	Designed and manufactured in accordance with BS EN 61010-1 1993
<b>Power Supply</b>	15 to 30V AC or DC at 200 mA
<b>Head Mount Housing</b>	Conductive ABS blue plastic, rated IP66
<b>Weight</b>	600g (instrument only)
<b>Dimensions</b>	110mm high x 116mm wide x 145mm deep, excluding connectors

## 2 Safety & EMC

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.

### 2.1 Wiring Installation

The specified performance of the HPT63 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.

**WARNING! : 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.**

**ADHERE STRICTLY TO LOCAL WIRING AND SAFETY REGULATIONS 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.

*Note: 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.*

### 2.2 Noise suppression

In common with other electronic circuitry, the HPT63 may be affected by high level, short duration noise spikes arising from electromagnetic interference (EMI) or radio

## 2 Safety & EMC

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 HPT63 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 HXT63 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 supply.
- ◆ In cases of very high background RF and HF noise environments, LTH can supply a length of proprietary RF suppressing mains cable.

## 3 Installation

### 3.1 Head-mounted Version Mechanics

This version of the HPT63 is designed for mounting on a pipe T-piece with the sensor in the main current flow.

Figure 1 shows the dimensions of the components required for installation.

Figure 2 shows the dimensions of the completed assemblies.

The two cells are physically similar.

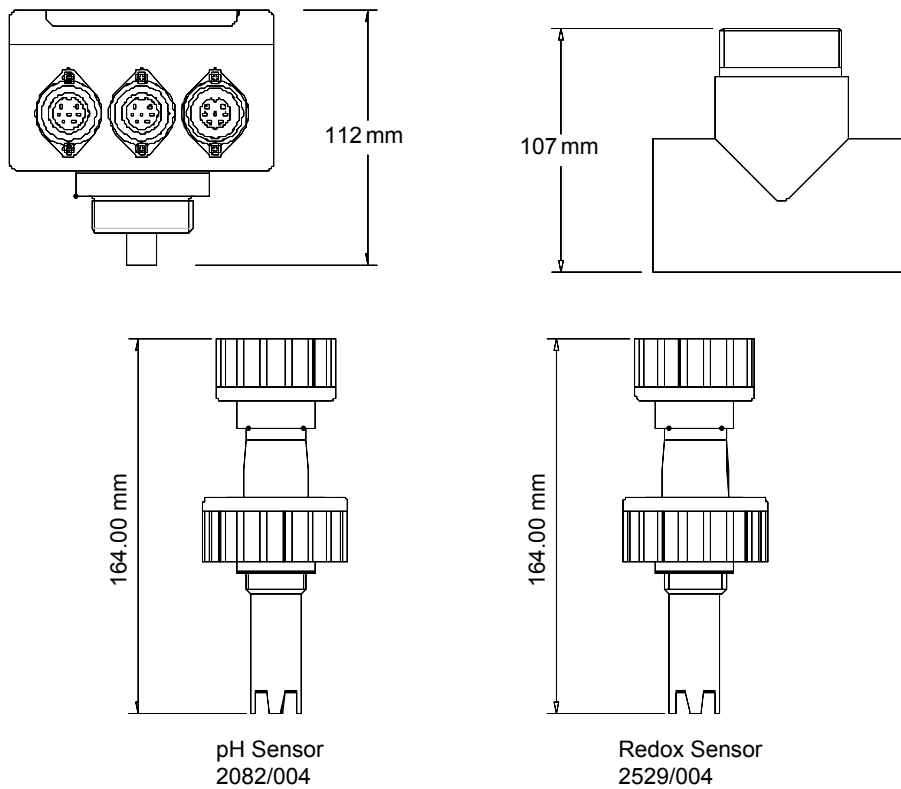


Figure 1 Head-mounting Installation components

### 3 Installation

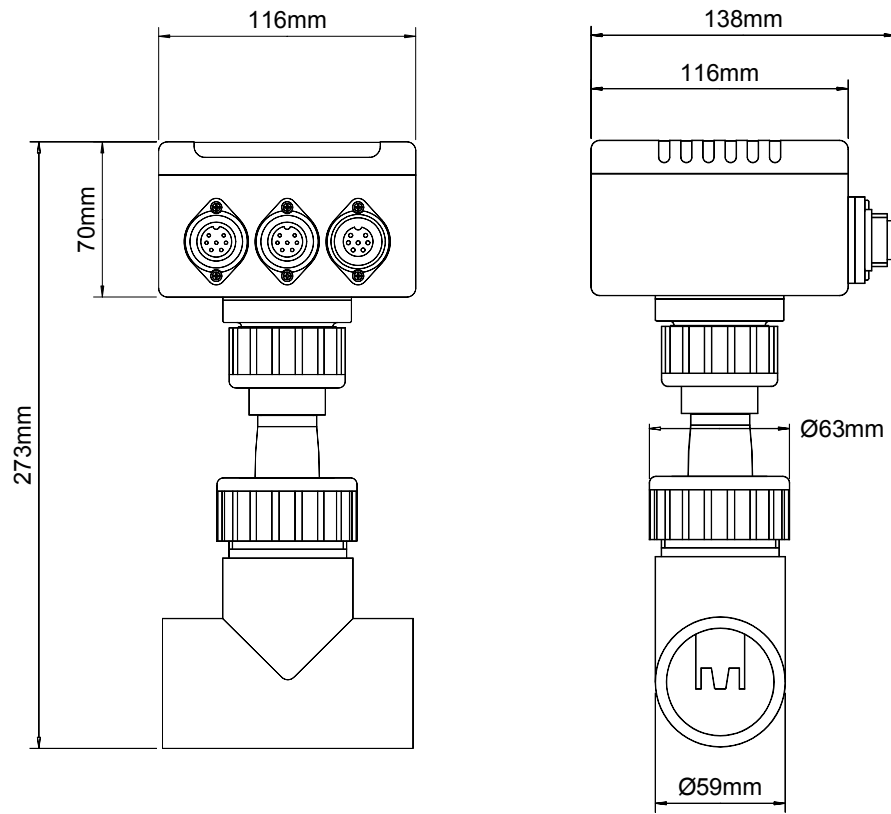


Figure 2 Head-mounting component dimensions

### 3.2 Wall-mounted Version Mechanics

This version is mounted on a wall and connects to sensors via a (maximum) 10m cable. Figure 3 shows the dimensions and fixing points of the unit.

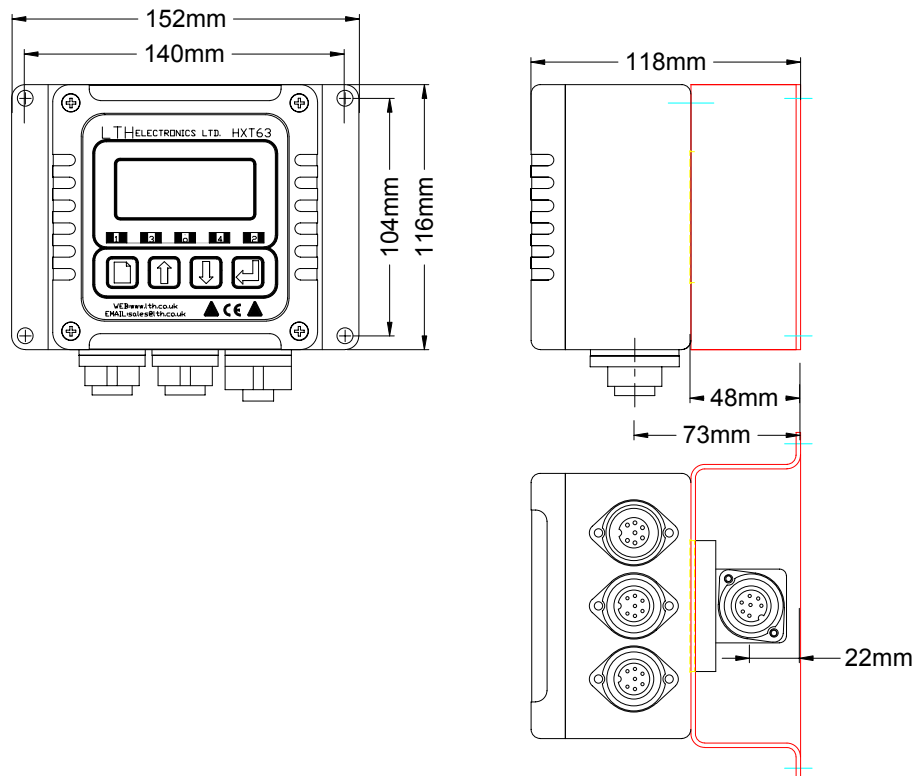
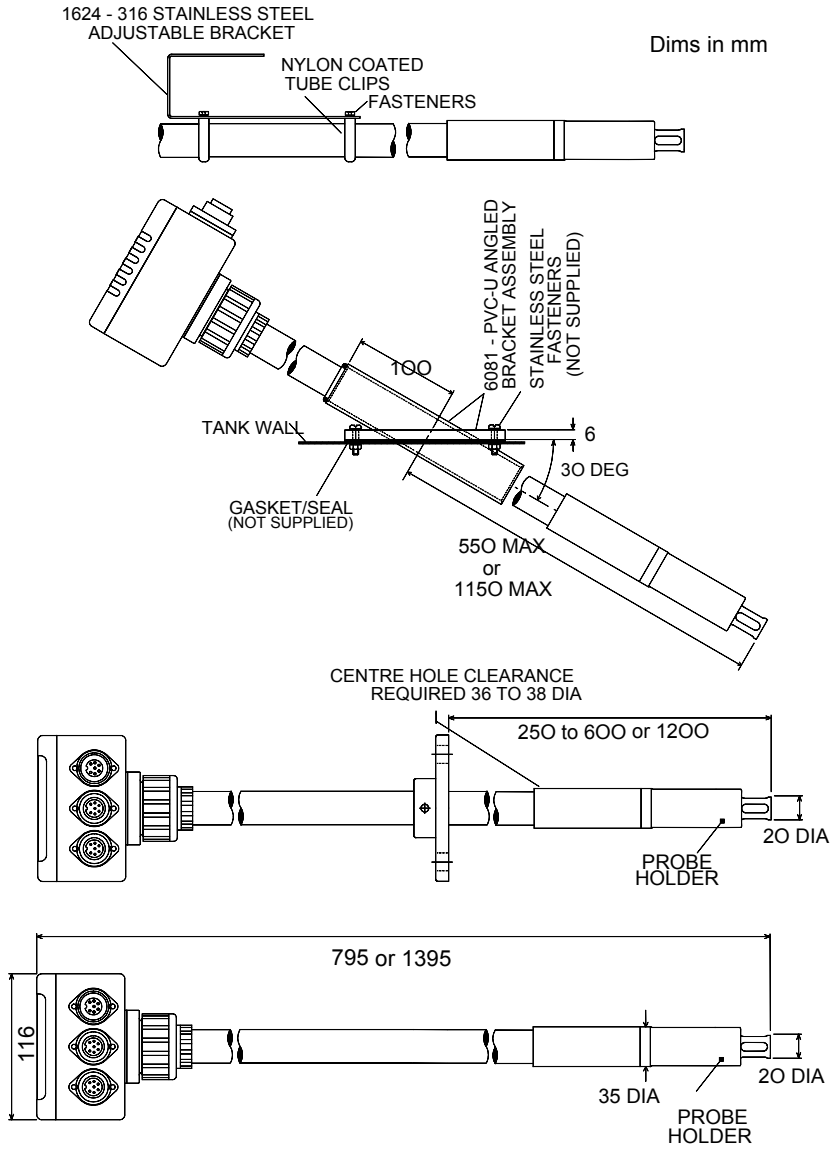


Figure 3 Wall-mounted unit dimensions

### 3.3 Dip Tube Assembly





### 3.4 Connections

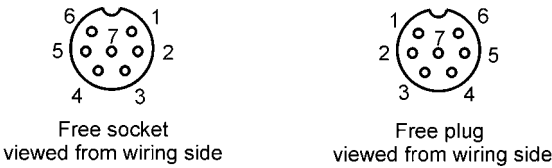
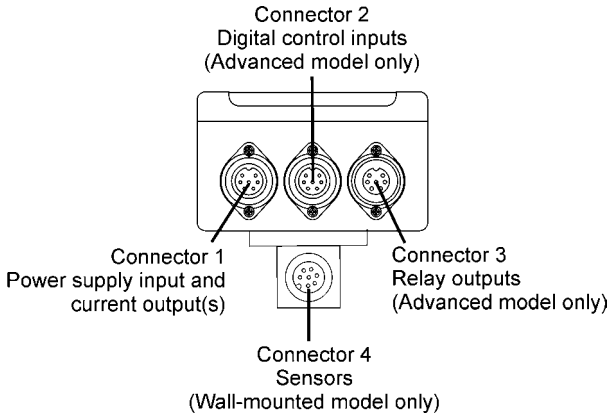


Figure 4 : Panel mount unit, rear view

Connections to the unit are made via the three circular connectors on the side of the unit plus an underside connector for the wall-mounted version. The connections are as follows:

#### 3.4.1 Connector 1 PS Input and Current Outputs

Free female socket

Pin	Function
1	Common 0V
2	24V supply
3	Current A output
4	Current B output (Advanced version only)
5	Not used
6	Not used
7	Earth – Connect to power supply earth pin1 to ensure shielding of electrical circuits.

### 3.4.2 Connector 2 Digital Range Selection Inputs

Free female socket. Advanced version only.

Pin	Function
1	Digital common
2	Not used
3	Not used
4	Digital input 3
5	Digital input 1
6	Digital input 2
7	Not used

### 3.4.3 Connector 3 Relay Outputs

Free male plug. Advanced version only.

Pin	Function
1	Relay 1 common
2	Relay 1 normally open
3	Relay 1 normally closed
4	Relay 2 common
5	Relay 2 normally open
6	Relay 2 normally closed
7	Not used

### 3.4.4 Connector 4 Sensor Cable Inputs

Free male plug. Wall-mounted version only.

Pin	Function
1	Reference
2	No connection
3	Electrode
4	Temperature input A
5	Temperature input B
6	0V Solution Ground
7	Earth

*Note: Pins 4 and 5 each have two wires connected.  
See table on next page.*

**pH/Redox Connections-to Connector 4**

HPT Connector		With temperature element and solution ground		Without temperature element		
Con 4 Pin	Function	Optional 54E extn. cable	pH electrode	Optional LN10 extn. cable	pH electrode	Redox electrode
1	Reference	* Inner screen	Black	Screen or black wire	Screen or black wire	Screen or black wire
2	N/C					
3	Electrode	Green core	Clear core	Clear core	Clear core	Clear core
4	Temperature compensation	Yellow wire & blue wire	Red			
5	Temperature compensation	Black wire & white wire	Black			
6	0V Solution Ground	Clear core	Green			
7	Earth	Outer screen				

*\*Note: On the extension cable, use the inner screen around the green core as the Reference connection. The inner screen around the clear core is not used – cut it back.*

**3.4.5 Power Supply**

The unit requires a supply between 15 and 30V (24V nominal) at 200 mA.

Note: The maximum current output load resistance depends on the unit supply voltage:  $R_{load} \text{ (Ohms)} = (V_{supply} - 2) / 0.04$

**3.4.6 Current Output Connections**

The Basic HPT63 has a single current output of 0-20 or 4-20 mA. The Advanced version has two such outputs designated A and B. The current output ranges are selected via the instrument menu.

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.

**3.4.7 Relay Connections**

The relay outputs are available only on the Advanced version. The relay contacts are volt-free (electrically isolated) and can handle up to 5A at 30V DC or 250V AC. **They must be connected in series with a 5 Amp fuse.**

### 3 Installation

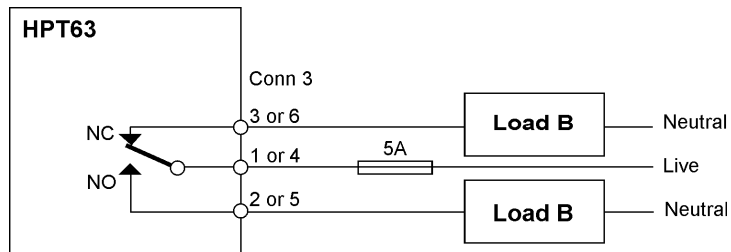


Figure 5 : Relay contact connection

Depending on the load, a contact arc suppressor may be required to prevent excessive electrical noise. To switch more than 5 Amps, use a slave relay.

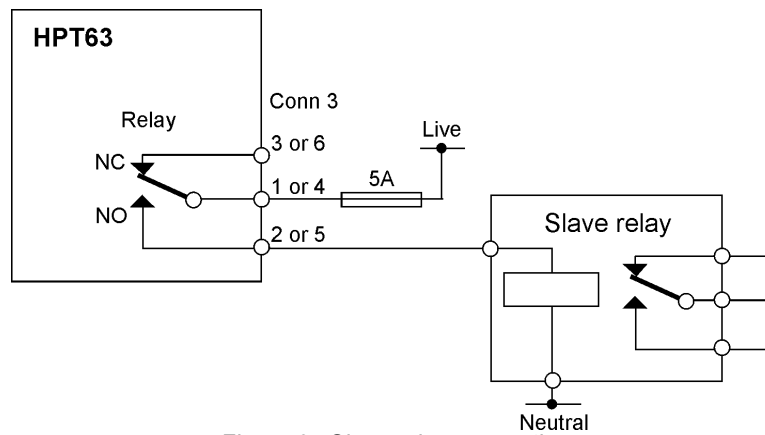


Figure 6 : Slave relay connection

### 3.5 Digital Inputs

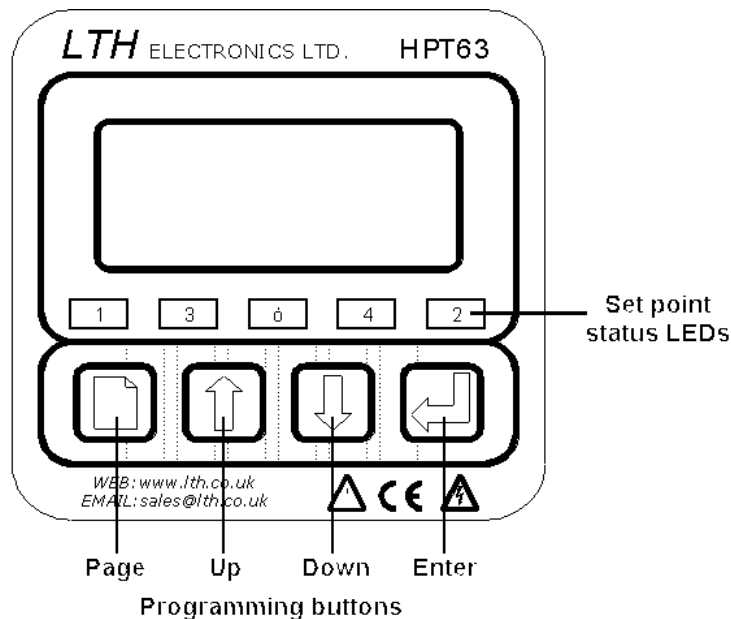
The digital inputs are used to externally initial a cleaning cycle or to take the unit off line. These inputs are intended to be switched using a volt-free link, switch or relay. Closing a contact initiates the action.

The connections to connector 2 are as follows:

- Ground to pin 6 = clean
- Ground to pin 4 = off line.

## 4 User Interface

**WARNING!** 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 HPT63 is configured to the default pH set-up ( see *Appendix A – Factory Default Setups*). In this state the instrument can perform all of the necessary function for a basic pH monitoring instrument.




### 4.1 The Front Panel



The HPT63 uses a versatile 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 to indicate secondary readings or states, and display scrolling error messages.




Along with the LCD display, the front panel also incorporates five LEDs. The two outer LEDs (labelled 1 and 2) 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. *Note: Not all relay channels may be fitted.*

The four keys - , ,  and  - allow the user to control and configure the unit. The keys are used for changing display options, navigating around the menu system and for changing unit parameter values. To operate a key, press it until the display responds (about half a second). If you hold a key down, the display will cycle through the available options at a rate of about one per second.

## 4.2 The Menu System

The fold-out sheet at the end of the manual shows the menu system. Each column constitutes a menu. Use the  (Page) key to move from one menu column to the head of the next. When you select the next menu, the display shows the menu title e.g. Parameters. Pressing  with  moves backwards through the menus.

Use the  and  keys to move up and down the menu options in each column. Depending on the current settings, some menu options may not be present. For example, if Set Point 1 is disabled, the screen displaying Set Point 1 will not appear.











When the instrument is switched on, it shows the main display screen. You can use the  and  keys to select various display options, depending on the configuration of the unit. However, on pressing the  (page) key to reach the configuration menus, the first screen encountered is the Access Code screen. To proceed beyond this screen you must enter an access code as detailed in *Section 18 Menu Access*.

*Note: When in the menu structure, if none of the buttons are pressed for two minutes, the unit will time out and return to the main display. The Access Code display will be reset to 0000, 30 seconds after returning to the main display.*



### 4.3 Unit Configuration





The unit can be configured by navigating around the menu system and setting up the various unit facilities.

The general principle of setting a parameter is as follows:




1. Use the , , and  keys to navigate to the parameter to be changed.
2. Press the  key to select the parameter for editing. The current parameter value will start to flash, indicating that it can be changed.
3. Use the  and  keys to cycle through the available values of the parameter to the required value.
4. Press the  key to confirm your selection of the required value. The parameter value will stop flashing, indicating that it has been set.
5. Use the , , and  keys to navigate to the next parameter to be changed.

This method can be used for:






- Turning a facility on or off, e.g. **Temperature Compensation** in the **Parameters** menu. The  and  keys toggle the facility on and off.
- Selecting between several options, e.g. **Unit types** in the **Parameters** menu.
- Setting a numeric value such as an access code or trigger level. See *Section 4.4 Number entry*.

For functions such as Resets and Restoring Setups, press the  key to initiate the function, the system will then ask for confirmation. Press  to confirm the function:  or  to cancel.

#### 4.4 Number entry



The ,  and  keys allow you to set up a number between 0000 and 9999 on the main seven-segment display as a parameter value or access code.

To set up a number, proceed as follows:

1. Press  to begin editing a number. The first (left-hand) digit will start to flash.
2. Use the  and  keys to increment or decrement the flashing digit.
3. When the flashing digit is correct, press  to confirm the setting. The next digit will start to flash.
4. Repeat steps 2 and 3 to set the remaining three digits.
5. After pressing  to confirm the last digit, none of the digits will be flashing and the number is then ready for use.

If the number is an access code, the Padlock symbol on the display will change to a Key symbol if the new code you have entered is correct. If the number is a parameter value, the parameter has now been set to that value.

#### 4.5 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 in *Appendix F – Error Messages*. Pressing the  key when an error message is flashing will scroll a more detailed description of the error along the bottom line. Pressing  again will return the unit to the flashing display. The error messages can be disabled within the **Configuration** menu (see *Section 12.2 Error Messages*). 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 a set point relay to provide external signalling of error conditions (see *Section 8.5 Alarms*).




## 5 Main Display

There are two modes of display operation – digital and bargraph. The mode can only be changed via the Configuration menu, requiring a Level 2 access code.

In bargraph mode, the display shows an analogue representation of Output A or B, or both, alternating. The output identity and units are shown in the upper display.

In digital mode, the display shows the sensor reading, in the units assigned via **Parameters/Units**, on the top row and a secondary reading on the bottom row. The user can select the desired secondary reading parameter by means of the  and  keys. If bargraph display has been enabled, digital readings can be selected but the bargraph display will be restored after a timeout period. The secondary parameters vary according to the instrument configuration, and are as follows:

	Sec. display	Comment
Temp. input	Units C or F, as selected via <b>Parameters/Temperature Units</b>	
Output A	This shows the output current from Channel A in mA.	
Output B	This shows the output current from Channel B in mA.	
SP1	This appears when Set Point 1 is enabled and trigger is set to Low or High. It shows set point value in the assigned units.	
SP1H	This appears when Set Point 1 is enabled and trigger is set to Band, Latch Lo or Latch Hi. It shows set point upper value in the assigned units.	
SP1L	This appears when Set Point 1 is enabled and trigger is set to Band, Latch Lo or Latch Hi. It shows set point lower value in the assigned units.	
SP2	This appears when Set Point 2 is enabled and trigger is set to Low or High. It shows set point value in the assigned units.	
SP2H	This appears when Set Point 2 is enabled and trigger is set to Band, Latch Lo or Latch Hi. It shows set point upper value in the assigned units.	
SP2L	This appears when Set Point 2 is enabled and trigger is set to Band, Latch Lo or Latch Hi. It shows set point lower value in the assigned units.	


The default secondary parameter can be set by selecting the parameter and pressing the  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.

If the unit has detected an error, an error message will flash alternately with the secondary parameter or bargraph. See *Appendix F – Error Messages*.

## 6 Menu Access

The instrument parameters are protected against unauthorised or accidental tampering by access codes.

There are three levels of access – Basic, Level 1 and Level 2. For Basic access, no access code is required but access is restricted to the main display modes. A user with Level 1 access can change some parameters and Set Point trigger levels. A user with Level 2 access has full access to all user-selectable parameters. The pull-out chart at the rear of this manual shows the access permitted the three levels.

When the unit is switched on, it shows the main display screen. To reach the menu system from there, press the  key to reach the Access Code screen and then enter the Level 1 or Level 2 access code. A character on the right of the display indicates whether or not access is permitted. The character will be a key for permitted access and a padlock for denied access.

**As supplied, the unit has the following default access codes:**

- 0001    Restricted access at Level 1.**
- 0002    Full access at Level 2.**







On first use, it is recommended that the user change the access codes to restrict unauthorised access. See *Section 6.1 Changing the Access Code*.

Entering the access code for a level, e.g. for Level 2, gives access to that level. The procedure for entering the access code is detailed in *Section 4.4 Number entry*. On entering a valid code, the padlock character on the display changes to a key.

### 6.1 Changing the Access Code

On first use, it is recommended that the user change the access codes to restrict unauthorised access.

You need Level 2 access in order to change the Level 2 access code. You can change the Level 1 access code if you have either Level 1 or Level 2 access.

1. From the Main Display screen, press  once to reach the Access Code screen.
2. Use the  and  keys to reach the Set Level 1 (or 2) Code screen.
3. Use the ,  and  keys to edit and store the new access code, as described in *Section 4.4 Number entry*.

## 7 Parameters

The **Parameters** menu contains the basic configurations for the sensor inputs. The various parameters can be changed using the method described in *Section 4.3 Unit Configuration*.

The Parameters menu structure is as follows:

```

Parameters
  Units
  |   pH
  |   mV (Redox)
  Electrode
  |   Glass
  |   Antimony
  T Units
  |   °C
  |   °F
  TC Mode (Temperature Compensation)
  |   Auto
  |   Manual
  |   |   0-100 °C
  Simulated input
  
```

### 7.1 Units

The HPT63 can be set up as either a pH or a Redox instrument. This is achieved by simply setting the appropriate units (either pH or mV). The rest of the menu structure for the instrument responds by enabling and disabling the appropriate menu items (e.g. the slope calibration menu is disabled when mV are selected). When “mV” are selected the instrument displays the unprocessed input voltage to the electrode terminals, this can also be used as a diagnostic tool for pH measurements. All appropriate set point levels etc. have their units changed automatically.

When pH is selected the HPT63 will automatically apply the correct temperature compensation and electrode type to the mV input to provide a display of pH. All of the set point units etc. will then be changed to pH. The temperature compensation is referenced to either the measured input temperature or a fixed user selectable temperature (which one, depends on the temperature compensation mode, see *Section 7.3 Temperature Input*).

## 7.2 Electrode Type

The HPT63 can scale its pH input readings to operate with either a glass or antimony electrode. This sets the isopotential point, for a glass electrode this is 7.00pH, for an antimony electrode it is 0.00pH.

## 7.3 Temperature Input

The HPT63 has a very accurate temperature measurement facility. The user can apply either automatic or manual temperature compensation to the pH measurement. The operator can select between these two modes of operation by selecting the **Temp Comp** menu item within the **Parameters** menu. Note the temperature input must be enabled under the Configuration menu (see Section 12.2). It is also possible to select the temperature sensor type in this menu. When the manual mode of operation is selected, the user can enter the fixed process temperature under the **Fixed Temp** menu.



*Note: When the automatic mode is selected the **Fixed Temp** menu will not be present.*




*Note: When the unit detects a fault in the temperature sensor it will default to using the **Fixed Temp** setting for compensation purposes.*

The operator can also select to display all temperatures in either °C or °F by selecting the **Temp Units** menu. All temperature related displays will reflect the units selected in this menu.

*Note: The system will under normal conditions convert all temperature related variables when the units are changed, however it may be wise for the operator to ensure that changing the units has not altered the set points or current outputs.*

## 7.4 Simulated Input

The facility exists within the HPT63 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  and  keys and display the current output level, with the relays responding accordingly.

To select the **Simulate** menu item from the **Parameters** menu, press the  key. The unit will now display the simulation menu. Pressing the  and  keys will cycle the displayed value between its minimum and maximum levels in steps of 1% . In Redox mode, the steps are 1% of -2000mV to +2000mV i.e. 40mV. In pH mode, the steps are in 0.20pH. 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.

## 8 Set Point Relays

Two Set Point relays, designated SP1 and SP2, are fitted on the Advanced version of the HPT63. No relays are fitted on the basic version. Indicators on the front panel show when a relay has operated.

A relay can be set to operate when a sensor or temperature set point is exceeded or when an alarm occurs. The menu structures for set points 1 and 2 are identical, and provide a high level of flexibility in the configuration of the relay outputs, as follows:

```

SPn Source (SP1 or SP2)
|
| Disabled - no further SPn options are available
| Sensor IP (or Temp IP)
|   Trig: Hi (or Lo)
|   |   Set point n value
|   |   SPn: Mode
|   |   |   On/Off
|   |   |   PP – Pulse Proportional
|   |   |   TP – Time Proportional
|   |   SPn: Dose Alarm No
|   |   |   Yes - SPn Alarm time
|   |   SPn: Delay (On/Off mode only)
|   |   SPn: Hysteresis (On/Off mode only)
|   |   SPn: Cycle Time (TP mode only)
|   |   SPn: Proportion (PP and TP modes only)
|   Trig: Lo – see Trig: Hi
|   Trig: Band
|   |   High set point
|   |   Low set point
|   |   SPn: Dose Alarm No
|   |   |   Yes - SPn Alarm time
|   |   SPn Delay
|   |   SPn Hysteresis
|   Trig: Latch Hi (or Lo)
|   |   High set point
|   |   Low set point
|   |   SPn Dose Alarm No
|   |   |   Yes - SPn Alarm time
|   |   SPn Delay
|   |   SPn Hysteresis
|   Trig: Latch Lo – see Trig: Latch Hi
| Temp IP - see Sensor IP
| Alarm
|   Alm: Disabled
|   Alm: Sensor Err
|   Alm: Dose Alarm
|   Alm: Calibration
|   Alm: Off-line
|   Alm: Any Error
| Cleaning – see Section 13
|   Duration
|   Interval
|   On/Off-line
|   Recovery time (Off-line) or Delay Y/N (On-line)

```

## 8.1 Set Point Source

Each set point relay can be disabled or triggered from a sensor input (the default), a temperature input or from an alarm.

## 8.2 Set Point Trigger

The set points can be configured to trigger from the sensor or temperature source in six ways:

- |                |   |
|----------------|---|
| Trig: Hi       | The relay will be activated when the source input becomes greater than the set point. Delay and hysteresis can be applied.  |
| Trig: Lo       | The relay will be activated when the source input becomes less than the set point. Delay and hysteresis can be applied.   |
| Trig: 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. Delay and hysteresis can be applied.  |
| Trig: Latch Lo | the relay energises when the source input falls below the <b>Band Low</b> level and remain energised until it rises above the <b>Band High</b> level. It then remains de-energised until the sensor input falls below the <b>Band Low</b> level again.  |
| Trig: Latch Hi | the relay energises when the source input rises above the <b>Band High</b> level and remain energised until it falls below the <b>Band Low</b> level. It then remains de-energised until the sensor input rises above the <b>Band High</b> level again. |

## 8.3 Set Point Mode

The relays can operate in one of three modes.

### 8.3.1 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 deactivated.

**Delay:** In order to prevent short duration changes at the input affecting the relay operation a delay can be set before the relay energises. 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 HPT63 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.

### 8.3.2 Time Proportional Mode

It is possible to control any on/off device 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 0-14 pH range would give a band of 2.8 Ph. If the set point trigger was selected as LOW and the set point value was 7 Ph, the band would cover 4.2 to 7.0 pH. When the reading falls below 4.2 pH 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 can be set by the user and is the sum of the on and off times.




### 8.3.3 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. 4.2 pH in the previous example).

## 8.4 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 overdosing and flash the set point LED on the front panel. The display will also flash a warning message when the alarm is activated.

*Note: 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, press the  key on the front panel.

*Note: If more than one Alarm is active, set point 1 takes priority over set point 2 and they are cancelled in that order by additional presses of the  key.*

## 8.5 Alarms

The two set point relays can be configured as an alarm output triggered by one of the following events:

- Sensor error
- Dose alarm
- Calibration – when a calibration is in progress.
- Off-line – unit has been taken off line, e.g. for servicing.
- Any error – when any system error is detected.

To set an alarm output, choose the SP1 or SP2 menu, select **Alarm** from the menu options and then select the required trigger.

## 8.6 Cleaning

The Cleaning menu options allow a set point relay to be used for controlling a device for cleaning the sensor. For information on sensor cleaning, refer to Section 13.

## 9 Current Output

The current output menu structure contains all of the necessary set-up 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.

The menu structure is as follows:

```

O/P Source (A or B)
  |
  | Sensor IP
  |   |
  |   | Select Output (0/4-20 mA)
  |   |   |
  |   |   | Output A/B Zero
  |   |   |
  |   |   | Output A/B Span
  |   |   |
  |   |   | Temp IP
  |   |   |   |
  |   |   |   | Select Output (0/4-20 mA)
  |   |   |   |   |
  |   |   |   |   | Output Zero
  |   |   |   |   |   |
  |   |   |   |   |   | Output Span
  |   |   |   |   |   |
  |   |   |   |   |   | Disabled
  
```

On Error = (No, 22 mA or 0 mA)

The maximum load resistance that the current output can drive depends on the power supplied to the unit and is:  $R_{load} \text{ (Ohms)} = (V_{power} - 2) / 0.04$ .

### 9.1 Input

The unit can use the sensor input or the temperature input as the sources for the current outputs. Alternatively, the source can be switched off by selecting **Disabled** for that source.

### 9.2 Select Output

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

### 9.3 Zero & Span

The zero and span levels define 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 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.

## 9.4 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. 7 pH) and the point at which the output is 20 mA as the proportional band (e.g. 4 pH) a simple form of proportional control is achieved. If this signal were used to drive a valve actuator, the valve would be fully open at 4 pH, half open at 5.5 pH and closed at 7 pH.

## 9.5 Error Condition

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

## 10 Calibration

The HPT63 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.

The menu structure is as follows:

```

Calibration
  Mode:
  |   On-line
  |   Off-line
  Cal Access Y/N
  Sensor Buffer
  |   Are You Sure?
  |   Buffer value displayed/adjusted
  |   Buffer value displayed
  Sensor Slope
  |   Are You Sure?
  |   Slope value displayed/adjusted
  |   Slope value displayed
  Temperature Calibration(if TC mode set to Auto)
  |   Are you sure?
  |   Temperature reading displayed/adjusted
  |   Offset displayed
  Current Output A/B calibration
  |   Are you sure?
  |   Adjust 0 mA
  |   Adjust 4 mA
  |   Adjust 20 mA
  Reset User Cal
  |   Are you sure?
  |   Resetting
  
```

### 10.1 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**.

### 10.2 Calibration Access

A feature has been included in the HPT63 to allow users to access the sensor calibration from the main display. To enable this feature, set **Cal Access?** to **Y**. To disable this feature, thus preventing the users from altering the calibration from the main display, set **Cal Access** to **N**.

### 10.3 Calibration Practices

Observe normal good practices when calibrating electrode systems against standard solutions.

- Always clean the electrode system before inserting in the standard solution to avoid contamination and to obtain the best response from the electrode system.
- Rinse the electrode system in clean (preferably demineralised) water between standard solutions.
- Allow time for the electrode system temperature to stabilise in each standard solution.
- Use standard solutions of known quality. If in doubt make up fresh solutions.
- Use clean beakers and bottles for standard solutions.
- The HPT63 can be taken offline, which de-energises the relays and holds the current outputs at their last values. This facility is useful when calibrating the system, however the operator must ensure the relays are in a safe state when using this feature.

### 10.4 pH Electrode Condition

Depending on the measurement environment, sensor sensitivity (slope) can vary with age and, hence, periodic slope recalibration may be required. The buffer (offset) value can also be adjusted, but this should not require regular adjustment once the unit has been set up for a given sensor.

For a glass electrode, the buffer (offset) adjustment after calibration will be displayed as 7 pH  $\pm$ 2 pH. For antimony electrode, the adjustment will be displayed as 0 pH  $\pm$ 2 pH. The Slope Limit adjustment for a glass electrode is 80% to 110%, for an antimony electrode 75% to 115%.

#### 10.4.1 pH Buffers

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

Using the **Buffer** and **Slope** menu items, it is possible to do single (**Buffer** only) or two-point calibration,. It is important to do the calibration in the correct order:

1. Buffer (Offset) adjustment at 7  $\pm$ 2 pH
2. Slope (Gain) adjustment at another pH – normally 4 or 9 pH (for two point calibration only)

The output from an ideal glass/reference electrode pair will normally be 0mV at 7pH.







Check the temperature of the solutions. From the documentation supplied with the solutions, determine the true values of the solutions at the measured temperatures. Use these (true) values for calibration purposes.

*Note: Appendix D – Buffer Solutions lists typical buffer solution pH values at various temperatures.*

Prepare a beaker of clean, preferably de-mineralised water for washing the sensor between measurements.

### 10.4.2 Procedure

For each prepared buffer solution, carry out the following procedure:

1. Wash sensor in de-mineralised water.
2. Insert the sensor in the prepared buffer solution.
3. From the **Sensor Buffer** or **Sensor Slope** page, press the  key. The screen will display 'Are you sure?'.
4. Press  to confirm (or any other key to abandon calibration). On pressing , the display will show the sensor reading.
5. Use the  and  keys to set the reading to the known true (temperature-compensated) value of the solution.
6. Press  to confirm the correct reading. The display will show the buffer or slope calculated by the instrument (where 0 pH and 100% are the default values).
7. Rinse the sensor in clean water.

## 10.5 Redox Sensor Calibration







For the Redox setup only the offset (zero) can be adjusted - by  $\pm 200\text{mV}$ . To adjust the Redox offset, with the sensor units in mV, select the **Sensor Buffer** menu item from the **Calibration** menu.

### 10.5.1 Redox Standards

Unlike pH electrodes, the Redox electrode's slope does not change. Nevertheless, incorrect Redox potentials may occasionally be measured and the cause of these errors is usually a contaminated platinum (Pt) surface, or a contaminated or plugged reference junction.







Standard Redox solutions are available from various sources at potentials of 385 mV (from LTH), 124, 200, 250, 300, 465, 600 and 650 mV. It is possible to make up standards as detailed in Appendix C – Redox Solutions.

### 10.5.2 Procedure

1. Make up a standard Redox solution in accordance with the instructions supplied.
2. Immerse the electrode system in the solution.
3. From the **Sensor Buffer** page, press the  key. The screen will display 'Are you sure?'.  
The confirm key icon is a square with a right-pointing arrow and a checkmark.
4. Press  to confirm (or any other key to abandon calibration). On pressing , the display will show the sensor reading..  
The confirm key icon is a square with a right-pointing arrow and a checkmark.
5. Use the  and  keys to set the reading to the potential of the solution, e.g. 358 mV.  
The up arrow key icon is a square with an upward-pointing arrow, and the down arrow key icon is a square with a downward-pointing arrow.
6. Press  to confirm the correct reading. The display will show the offset calculated by the instrument (where 0mV is the default).  
The confirm key icon is a square with a right-pointing arrow and a checkmark.

### 10.6 Temperature Calibration



Use this option to calibrate the temperature sensor against a solution at a known temperature. Proceed as follows:

1. Ensure that the sensor is immersed in a solution of known temperature.
2. From the **Temperature Calibration** page, press the  key. The screen will display 'Are you sure?'.  
The confirm key icon is a square with a right-pointing arrow and a checkmark.
3. Press  to confirm (or any other key to abandon calibration). On pressing , the display will show the temperature reading.  
The confirm key icon is a square with a right-pointing arrow and a checkmark.
4. Use the  and  keys to set the reading to the known correct temperature.  
The up arrow key icon is a square with an upward-pointing arrow, and the down arrow key icon is a square with a downward-pointing arrow.
5. Press  to confirm the correct reading. The display will show the slope calculated by the instrument (where 100% is the default).  
The confirm key icon is a square with a right-pointing arrow and a checkmark.

### 10.7 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  $\pm 2$ mA. If two current outputs are fitted they are referred to as A and B respectively.

## 10.8 Resetting the User Calibration





This option resets all of the user calibrations to their default. From the **Reset User Cal** page, press the  key. The message 'Are you sure?' will appear. Press  to confirm and continue with the reset, or any other key to abandon the reset.



## 11 Save/Restore

This facility allows you to save and recover two instrument set-ups. The menu structure is as follows:

```
Save/Restore
  Save as Setup A
  Save as Setup B
  Restore Setup A
  Restore Setup B
  Default pH
  Default Redox
```

To use these functions select the **Save/Restore** menu item and use the  and  keys to select the required function. Pressing the  key will prompt the unit to ask for confirmation. Pressing the  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 for testing or fault finding. The set-up can be stored prior to testing and restored once testing is complete. The default set-ups are provided to give a basic instrument set-up for each configuration.

Note: There is no protection for the set-up stores other than the systems request for confirmation, so be very careful not to overwrite already saved set-ups.

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

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## 11 Save/Restore

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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.

## 12 Configuration

Options on the Configuration menu allow you to set up some basic operating parameters. The menu structure is as follows:

### Configuration

#### Language (some units only)

- | English
- | Francais
- | Espanol
- | Italiano

#### Temperature Input sensor (T input)

- | PT1000
- | 3k Balco
- | Disabled

#### Errors

- | Enabled
- | Disabled

#### IP Filter

- | Out
- | 10 Secs
- | 20 Secs
- | 40 Secs
- | 1 Min
- | 3 Min
- | 5 Min




#### Bar Graph

- | Off
- | A
- | B
- | A & B alternating




#### Software version

## 12.1 Language

This option is not available on some (English-only) units.

Use the  and  keys to select the required language and the  key to confirm your selection.

## 12.2 Temperature Input Sensor

Use the  and  keys to select or disable the temperature sensor and the  key to confirm your selection.

## 12.3 Error Messages

Use this option to display or hide any error messages that may occur. Error messages flash alternately with the secondary parameters on the display.

## 12.4 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).

## 12.5 Bargraph

The display can include a bargraph that shows the state of the current outputs. Use the Bargraph configuration option to turn the bargraph off or to display output current A or B, or both, alternating.

Digital display can only be restored by changing the Bargraph option under the Configuration menu.

## 12.6 Software Version

This option displays the version number of the software embedded in the unit.

## 13 Cleaning Menu

Cleaning  
 Duration  
 Interval  
 On/Off-line  
 Recovery time (Off-line) or Delay Y/N (On-line)

A set point relay can be configured to operate a jet spray wash or rotary electrode cleaning system on a timed cycle. The purpose is to prevent accumulation of particulate matter on the active surfaces of the sensor. The Set Point relay would control the supply to the cleaning device.

The **Cleaning** item on the Set Point menu (see *Section 8 Set Point Relays*) has the following parameters:

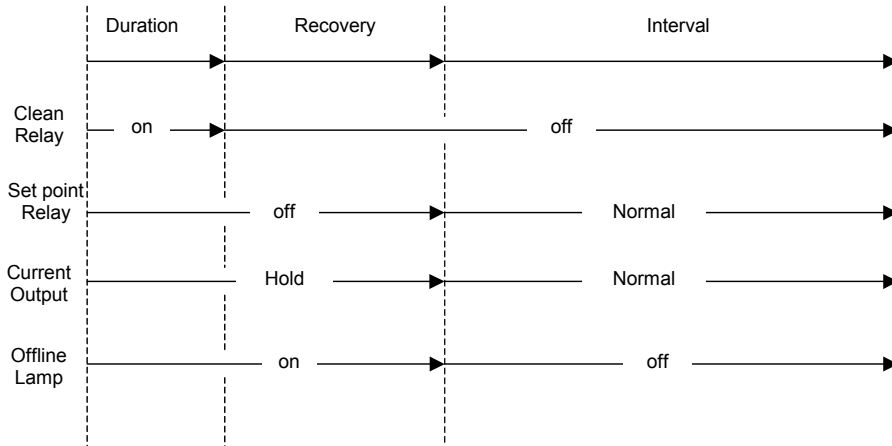
- Duration – The duration of the cleaning operation (5s to 10 min.)
- Interval – The interval between cleaning operations (5 min to 48 hours).
- On/Off line – The required system state during a cleaning operation. When Off line, the other current output and relays are disabled.
- Recovery – This option only appears if Off-line has been selected. This is the time allowed for the sensor to recover from cleaning. It is the time from the end of cleaning to the return to the On-line state (5s to 10 min).
- Delay Y/N – This option only appears if On-line has been selected. If unit is to remain On line during cleaning, a **Y** option forces the cleaning to wait until all relays are inactive. While cleaning is being delayed, an E23 error message may be displayed.

The instrument can be taken off-line during a 'Clean' cycle. This will de-energise the set point relay and freeze the current output which could otherwise cause chaos in the control system as a result of cleaning solution being sprayed onto the sensor.

By selecting the automatic Off-Line facility in the menu, spurious relay / current output changes are prevented during the **Duration** and **Recover** periods. Normal operation is restored during the **Interval** period. The clean **Delay** function gives priority to the control relays. This means that a 'Clean' cycle will be delayed for as long as necessary until the control relays are in the Off state.

A manual clean cycle can be initiated by a remote switch/contacts connected to the instrument digital input terminals (see *Section 3.4 Connections*). The 'Clean' cycle software, if selected, runs automatically and continuously from power up, beginning with the **Interval** period. It can only be stopped by changing the operating mode of the Set Point relay or Current output which it is controlling.

Typical Operation with Clean Offline



## 14 Fault Finding

### **NOTE : THERE ARE NO USER SERVICEABLE PARTS INSIDE THE UNIT**

The HPT63 has been designed to include a wide range of self diagnostic tests, some of which are performed at switch on, and some on a continuous basis. This guide aims to provide a route to diagnosing and correcting any faults that may occur during normal operation. The table shown in Appendix F – Error Messages gives a list of the error messages that the HPT63 generates, along with their probable causes. If the fault has not been cleared after these checks have been made, contact LTH. Please have as much of the following information available as possible, in any communication with LTH, to enable quick diagnosis and correction of the problem.

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

It is often worthwhile to check the measurement by an independent method, for example using a handheld meter. (See also *Section 2.2 Noise suppression.*)

### **The Instrument Appears Dead**

Check that power is available to the unit. Using a voltmeter, set to AC or DC (as appropriate), check the power supply voltage at the connector. The unit can accept from 15 to 30V AC or DC. Check that the power cable is securely and correctly attached – wired as detailed in *Section 3.4 Connections*. There are no user serviceable fuses fitted within this unit.

### **The Access Code Does Not Work**

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

### **The Sensor Reading Is Constantly Over-range or Under-range**

1. Ensure that the sensor and temperature inputs are correctly connected (wall-mounted version only, see *Section 3.4 Connections*) and that the sensor is not faulty or damaged.

2. Check that the correct sensor units have been selected within the Parameters menu (see *Section 7.1 Units*).
3. If the units are set to pH, check the temperature compensation state (see Parameters *Section 7.3 Temperature Input*). 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.
4. Check the sensor using a hand held meter.

#### **The Sensor Reading Is Incorrect**

- ◆ If reading pH, check that the correct electrode type has been selected (see *Section 7.2 Electrode Type*).
- ◆ Check that no error messages are being displayed (see *Appendix F – Error Messages*). Check that the sensor cable has been correctly connected (wall-mounted version only - see *Section 3.4 Connections*).
- ◆ Check that the Temperature reading is correct.
- ◆ Check the instrument calibration using a pH simulator. Adjust the user calibration if necessary (see *Section 10 Calibration*).
- ◆ Use another instrument to check the sensor.

#### **The Sensor is not Functioning Correctly**

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

#### **The Temperature Reading Is Incorrect**

- ◆ Check that the temperature sensor is correctly attached. (wall-mounted version - see *Section 3.4 Connections*).
- ◆ Check that the temperature sensor type is correctly selected in the **Configuration** menu (See *Section 12.2 Temperature Input Sensor*)



- ◆ Where practical check the temperature sensor resistance against the table in Appendix E – Temperature Sensor Data.

### **Current Output is Incorrect or Noisy**

- ◆ Check that the maximum load resistance for the current loop has not been exceeded. ( $1000\Omega$ ). Maximum load resistance is related to the supply voltage by the equation  $R_{\max} = (V_{\text{supply}} - 2)/0.04$ .
- ◆ Check that the terminals have been wired correctly (see *Section 3.4 Connections*).
- ◆ 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 *Section 2.2 Noise suppression*).
- ◆ Check that the current output has been configured properly (see *Section 10.7 Current Output Calibration*).

### **Relays Appear to Malfunction**

- ◆ Check that the unit is On-Line (see *Section 10.1 On-Line/Off-Line Operation*)
- ◆ Check that the set point configuration is correct (see *Section 8 Set Point Relays*)
- ◆ If the relays are vibrating or 'chattering' as they pass the set point, check the hysteresis setting (see *Section 8.3.1 On/Off Mode*) and increase if necessary.
- ◆ Ensure that the relays are connected properly (see *Section 3.4.7 Relay Connections*) and that the voltage/current levels are not exceeding the specification (see *Section 1.2 Unit Specification*).
- ◆ Check that the instrument input cables are not picking up excessive noise, (see *Section 2.2 Noise suppression*).

### **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 *Section 12.3 Error Messages*). Enable the error messages, correct the error and then disable the error messages only if absolutely necessary.

## **14.1 Problems with Cables and Connectors**

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

### **Input Resistance**

The high input resistance, required for the optimum performance from a pH electrode system, will be seriously degraded if any grease, dirt, or dampness is allowed to

collect around any of the connections between the electrode and the instrument. This includes any connectors or junction boxes which may be used. Particular attention must be paid to the method of extending the pH electrode cable. A general rule would be the fewer connections there are, the less problems are likely to occur.

### **Input Cable**

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

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

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

### **Cable Length**

The response of the instrument to a sudden change in the sensor input will be determined mainly by the source resistance of the electrode and the length of the connection cable. For a typical pH electrode of  $1000M\Omega$  resistance, in combination with a typical cable, the time taken to settle to its new value is about 0.5 seconds per metre of cable ( depending on the cable capacitance ).

### **Problems with Electrodes**

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

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

## 15 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.

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

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15 Guarantee and Service

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## 16 Appendix A – Factory Default Setups

Parameters	pH	Redox
Units	pH	mV
Electrode Type	Glass	N/A
Temperature Units	°C	°C
Temperature Compensation	Automatic	N/A
Fixed Temperature Input	+25.0°C	+25.0°C
<b>Set Points</b>		
SP1 Source	Sensor	Sensor
SP1 Trigger	Low	Low
SP1 Level ( Band High )	7.00pH	200mV
SP1 Band Low	4.00pH	100mV
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 Trigger	High	High
SP2 Level ( Band High )	9.00pH	300mV
SP2 Band Low	4.00pH	100.0mV
SP2 Mode	On/Off	On/Off
SP2 Dose Alarm	No	No
SP2 Alarm Time (mm:ss)	05:00	05:00
SP2 Delay ( mm:ss )	00:00	00:00
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%

<b>Cleaning</b>		
Duration ( mm:ss )	00:05	00:05
Interval ( hh:ss )	01:00	01:00
Mode	Off-Line	Off-Line
Recovery ( mm:ss )	00:05	00:05
Delay	N	N
<b>Current Output</b>		
Output A Source	Sensor	Sensor
Output A Mode	4-20mA	4-20mA
Output A Zero	0.00 pH	0 mV
Output A Span	14.00 pH	+ 1000mV
Output B Source	Temperature	Temperature
Output B Mode	4-20mA	4-20mA
Output B Zero	0.00	0.00
Output B Span	100°C	100°C
On error	No	No
<b>Calibration</b>		
Mode	On-Line	On-Line
Calibration Access	No	No
<b>Configuration</b>		
Language	English	English
T Input	Pt1000	Pt1000
Errors	Enabled	Enabled
Input Filter	Out	Out

## 17 Appendix B – Customer Setup

Use this appendix to record unit settings.

**Instrument Serial No** .....

**Sensor Serial/Type No** .....

Parameters	Set up
Units	
Electrode Type	
Temperature Units	
Temperature Compensation	
Fixed Temperature Input	
<b>Set Points</b>	
SP1 Source	
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)	
SP2 Source	
SP2 Trigger	
SP2 Level ( Band High )	
SP2 Band Low	
SP2 Mode	
SP2 Dose Alarm	
SP2 Alarm Time (mm:ss)	
SP2 Delay ( mm:ss )	

17 Appendix B – Customer Setup

SP2 Hysteresis ( % of SP Level )	
SP2 Cycle Time ( mm:ss )	
SP2 Proportional Band (% of range)	
<b>Cleaning</b>	
Duration ( mm:ss )	
Interval ( hh:ss )	
Mode	
Recovery ( mm:ss )	
Delay	
<b>Current Output</b>	
Output A Source	
Output A Mode	
Output A Zero	
Output A Span	
Output B Source	
Output B Mode	
Output B Zero	
Output B Span	
On error	
<b>Calibration</b>	
Mode	
Calibration Access	
<b>Configuration</b>	
Language	
T Input	
Errors	
Input Filter	
Bargraph	







## 19 Appendix D – Buffer Solutions

The following table gives the LTH buffer solution values. Prepare and use buffer solutions in accordance with the instructions supplied with them.

pH variation against temperature			
Temperature (°C)	4 pH Buffer	7 pH Buffer	9 pH Buffer
0	4.00	7.11	9.49
10	4.00	7.06	9.35
20	4.00	7.01	9.24
25	4.01	7.00	9.19
30	4.02	6.98	9.14
40	4.04	6.97	9.07
50	4.06	6.97	9.01
60	4.09	6.97	8.96
70	4.13	6.99	8.92
80	4.16	7.03	8.89
90	4.21	7.08	8.87

## 20 Appendix E – Temperature Sensor Data

The table below lists approximate resistance values of temperature sensors that may be used with the HXT63 series. Not all options are available on all models.

Temperature ( °C )	PT1000 RTD	3K Balco
0	1000.0Ω	2670Ω
10	1039.0Ω	2800Ω
20	1077.9Ω	2930Ω
25	1097.3Ω	3010Ω
30	1116.7Ω	3070Ω
40	1155.4Ω	3200Ω
50	1194.0Ω	3340Ω
60	1232.4Ω	3470Ω
70	1270.7Ω	3610Ω
80	1308.9Ω	3740Ω
90	1347.0Ω	3880Ω
100	1385.0Ω	4020Ω





<b>E35</b>	<b>Temperature Sensor Fault</b> The temperature sensor is reading open or closed circuit, due in most cases to a damaged sensing element or incorrect wiring. Check Configuration menu Temperature Sensor is set to the correct type. Under this condition, the unit will default to the fixed temperature setting for compensation purposes.
<b>E36</b>	<b>Temperature Input Over-range</b> Temperature input is greater than +300.0°C Could be a result of the faults listed under Error E35.
<b>E37</b>	<b>Temperature Input Under-range</b> Temperature input in less than -50.0°C Temperature. Could be a result of the faults listed under Error E35.
<b>E38</b>	<b>Compensation Outside Limits</b> The temperature reading is less than 0.0°C or greater than 100.0°C, leading to an error in compensation.

**Current Output Errors**

<b>E41</b>	<b>Current Output A Hardware Fault</b> 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. It can also be caused by insufficient supply voltage for the load (see <i>Section 3.4.5 Power Supply</i> ).
<b>E42</b>	<b>Current Output B Hardware Fault</b> 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. It can also be caused by insufficient supply voltage for the load (see <i>Section 3.4.5 Power Supply</i> ).
<b>E43</b>	<b>Sensor Input &lt; Current OP A Zero Level</b> The sensor input level is below that set for current output A zero.
<b>E44</b>	<b>Sensor Input &gt; Current OP A Span Level</b> The sensor input level is above that set for current output A span.
<b>E45</b>	<b>Sensor Input &lt; Current OP B Zero Level</b> The sensor input level is below that set for current output B zero.
<b>E46</b>	<b>Sensor Input &gt; Current OP B Span Level</b> 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.

<b>E51</b>	<b>Overflow Error</b>
<b>E52</b>	<b>Underflow Error</b>
<b>E53</b>	<b>Divide by 0 Error</b>
<b>E54</b>	<b>Too Large For Conversion</b>
<b>E55</b>	<b>Too Small For Conversion</b>



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Sensor & temperature	ACCESS CODE	PARAMETERS	SETPOINTS 1 & 2	<sup>1</sup> CURRENT OUTPUT	CALIBRATION	SAVE / RESTORE	CONFIGURATION
↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
Sensor & current O/P A	Edit Level 1 access code	Display units	SP1 source	O/P A source	Online / offline	Save as Setup A	<sup>2</sup> Language
↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
Sensor & current O/P B	Edit Level 2 access code	Electrode type	SP1 trigger	O/P A mode (0/4-20 mA)	Cal Access	Save as Setup B	Temperature sensor
↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
Sensor & set point 1 *		Temperature units	SP1 level (band high)	O/P A zero	pH buffer/Redox offset	Restore Setup A	Error messages
↑ ↓		↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
Sensor & set point 2		TC mode	SP1 band low	O/P A span	pH Slope (N/A to Redox)	Restore Setup B	Input filter
↑ ↓		↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
Bargraph		Manual temperature	SP1 mode	O/P B source	Temperature	Restore default pH	Bargraph on/off
↑ ↓		↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
		Simulated current output A	SP1 dose alarm	O/P B mode (0/4-20 mA)	Current O/P A	Restore default Redox	Software issue
		↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓	↑ ↓
		Simulated current output B	SP1 delay	O/P B zero	Current O/P B		
		↑ ↓	↑ ↓	↑ ↓	↑ ↓		
			SP1 hysteresis	O/P B span	Reset User Calibration		
			↑ ↓	↑ ↓	↑ ↓		
			SP1 cycle time	Source error			
			↑ ↓	↑ ↓			
			SP1 proportion band				
			↑ ↓				
			SP2 source				
			↑ ↓				
			Etc, as SP1				

- Key:
- Universal access
  - Level 1 access
  - Level 2 access

- Notes :
1. The Current Output menu will only appear when the unit is configured for Current Outputs.
  2. The Language option is not available on some (English-only) units.
  3. Depending on unit settings, some menu items may not appear. (See the appropriate sections in the main text.)
  4. N/A = not applicable

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