

BP9/BR9 series

pH/Redox Controllers



OPERATION GUIDE

Preface

Product warranty

This instrument has a warranty against defects in materials and workmanship for a period of 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.

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

All rights reserved. translations, reprinting or copying by any means of this manual, complete or in part or in any different form requires our explicit approval.

BP9, BR9, BP93, BP94, BP95 & BR93 are trademarks of LTH Electronics Ltd

Second edition January 2005

Part number: 6134

LTH Electronics Ltd

Chaul End Lane

Luton

Bedfordshire

LU4 8EZ.

England.

Web:

Email:

Telephone:

Fax:

www.lth.co.uk

sales@lth.co.uk

+44 (0)1582 593693

+44 (0)1582 598036

Manufacturing Standards



Electromagnetic compatibility

This instrument has been designed to comply with the standards and regulations called up by the European EMC Directive.

Safety

This instrument has been designed to comply with the standards and regulations called up 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

Preface	1
Manufacturing Standards	2
Contents	3
1 Introduction	5
Specifications	6
2 Installation	7
Surface-mounting version	7
Rail-mounting version	8
Special installation instructions	10
Connections and Controls	10
Noise suppression	18
3 Operation and setting up	21
Introduction	21
Setting up your controller	21
Select the current output mode (BP93, BP95 & BR93 Only)	22
Set the manual temperature compensation (BP9 & BP93 only)	22
Select the set point 1 operating mode	22
Select the set point 2 operating mode (BP93, BP95 Only)	23
Calibrating the control system	23
Setting the set point for Relay 1	25
Setting the set point for Relay 2 (BP93, BP95 only)	25
Calibrate the current output (BP93, BP95 Only)	25
Sensor Calibration	26
For calibration and test purposes, standard solutions at various potentials can be purchased.	27
LTH offer 2 standard Redox solutions:	27
Part No. 138/175 124mv Redox solution, 500ml	27
Part No. 138/176 358mv Redox solution, 500ml	27
Calibration of the BR9, BR93 Redox controllers is a single point calibration only.	27
4 Fault Finding	29
Instrument appears dead	29
The display and/or current output is unstable	30
5 Guarantee and service	33
Appendix A - Buffer Solutions	35
Appendix B	37
BP9 and BP93 chemical dosing applications	37
6 Index	39



Preface

This page left intentionally blank

1 Introduction

The BP9 series of pH and Redox controllers provide a low cost simple range of controllers, providing the following functions:

The BP9 and BP94 have a digital display of pH and a single changeover relay, with a fully adjustable Hi or Lo control set point that can be used for a variety of dosing and control applications.

The BP93 and BP95 have a second changeover relay, with a fully adjustable Hi or Lo control set point that can be used for a variety of dosing and control applications. It can also be configured as an alarm device, perhaps operating a safety valve or klaxon. It also provides a choice of an industry-standard, isolated, 0 - 20 mA or 4 - 20 mA output signal for remote monitoring.

A digital input can be used in conjunction with a flow switch to inhibit dosing in the event of no flow past the sensor. This feature is particularly useful in bypass installations where the sensor sample can be isolated.

The BR9 and BR93 provide the same functions for Redox measurement.

Calibration is by multi-turn pots that are accessible from the front of the instrument. The user with this handbook, standard solutions, and a suitable sensor can perform a full calibration. The controls for the set points and other adjustments are not accessible with the front cover fitted.

Simple manual temperature compensation can be adjusted from 0 – 100°C.

The BP94 and BP95 pH controllers have automatic temperature compensation when a pH sensor with a built in PT1000 compensator is used with the BP94 and BP95.

Throughout the manual references are made to BP9 and BP93, unless otherwise stated the information also applies to the BR9 and BR93 respectively.

Specifications

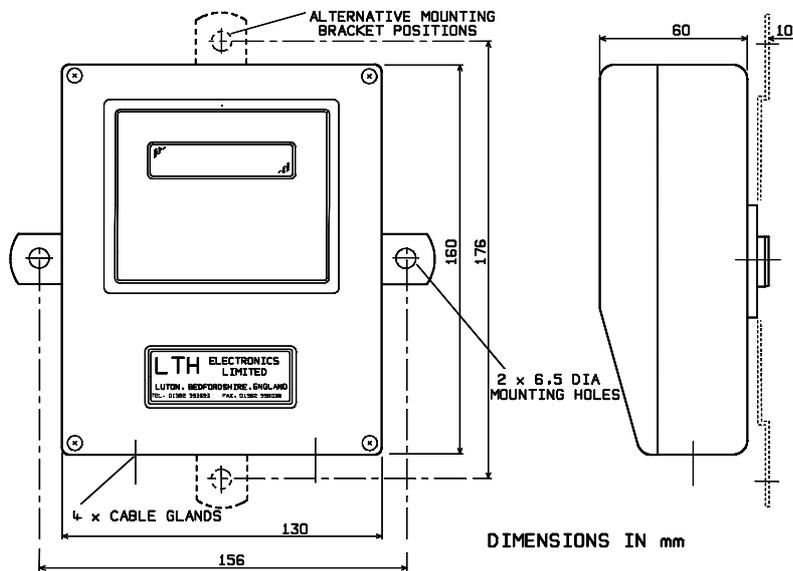
<p>Range of measurement and control</p> <p>Display</p> <p>Accuracy of measurement</p> <p>Temperature compensation</p>	<p>BP9, BP93, BP94, BP95 0 – 14.00 pH</p> <p>BR9, BR93 ± 1000 mV</p> <p>Backlit 3.5 digit LCD</p> <p>0.5% of full scale ± 1 digit</p> <p>BP9, BP93: Manual 0 - 100°C</p> <p>BP94, BP95: Automatic when used with a pH sensor with a built in PT1000 compensator</p> <p>BR9, BR93: None</p>
<p>Calibration</p>	<p>BP9, BP93, BP94, BP95 By buffer (offset) and slope adjustment.</p> <p>BR9, BR93 Offset adjustment only.</p>
<p>Input Cable</p>	<p>Accessible from the front of the instrument.</p> <p>A good quality low noise coaxial cable. LTH type LN10 or equivalent.</p> <p>Maximum length 30 metres.</p>
<p>Alarm control set points</p>	<p>BP9, BP94, BR9,</p> <p>Single set point with associated changeover relay contacts rated at 5A 250V AC.</p> <p>User selected High or Low.</p> <p>BP93, BP95, BR93</p> <p>Two set points with associated changeover relay contacts rated at 5A 250V AC.</p> <p>User selected High or Low.</p>
<p>Hysteresis (dead band)</p> <p>Alarm control lamps</p>	<p>1% of full scale</p> <p>Red high intensity LEDs denoting the state of each relay.</p>
<p>Output Signal</p>	<p>BP93, BP95, BR93 only. Fully isolated 0/4 – 20 mA DC into a maximum load of 300 ohms.</p> <p>Open contact disables relay operation</p>
<p>Flow switch input</p> <p>Ambient temperature</p> <p>Power supply</p> <p>Power consumption</p> <p>Housing</p> <p>Protection</p> <p>Weight</p> <p>Dimensions</p>	<p>0 - 50 °C for full specification</p> <p>100 - 120 V or 200 - 250 V AC 50/60 Hz.</p> <p>Less than 5VA</p> <p>Surface mounted flame retardant ABS</p> <p>IP 66</p> <p>Less than 800 grams</p> <p>156 x 176 x 60 mm</p>

2 Installation

This chapter describes how to install and mount the pipe-, rail- and surface-mounting versions, and how to connect the unit to auxiliary equipment and a power source.

Surface-mounting version

The surface-mounting version is designed for fixing to a wall or other flat surface using the brackets provided.



Mounting brackets and dimensions

The brackets should be attached, either horizontally or vertically, to the back of the BP9 series using the four M4 pan head screws provided.

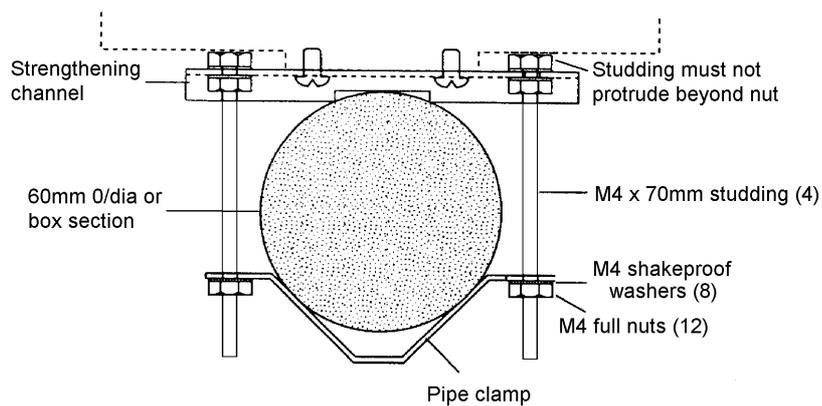
2 Installation

Rail-mounting version

The rail- & pipe-mounting version is designed for fixing to a vertical or horizontal handrail or pipe, of 25 mm min. to 60 mm max. outside diameter. The rail-mounting kit comprises two channels, two clamps and appropriate studs, nuts and washers, as shown in the exploded view opposite.

To mount the rail-mounting version proceed as follows:

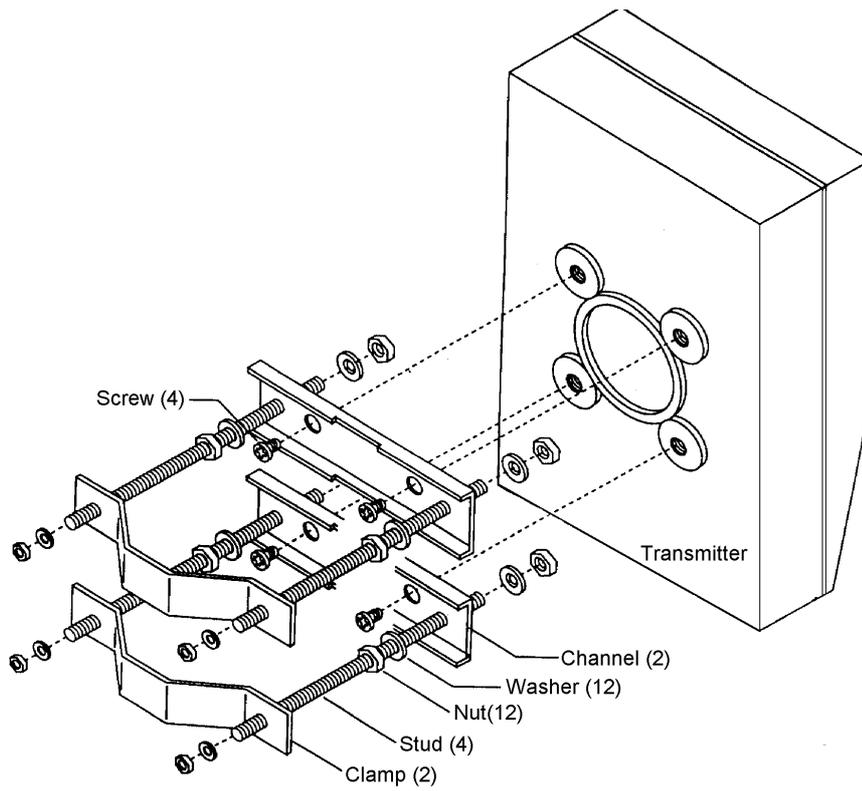
- ◆ Attach the four studs to the channels using four pairs of nuts and washers as shown in the following diagram. The studding must not protrude beyond the nut on the flat side of each channel
- ◆ Attach the two channels to the rear of the transmitter, using the four Posidrive screws provided.
- ◆ Attach to the pipe using the two clamps and fasten with nuts and washers, as above



Rail- & pipe-mounting brackets

Note: the brackets can be fitted vertically or horizontally

2 Installation



Exploded view of the pipe and rail fixing clamp assembly.

Note: the brackets can be fitted vertically or horizontally

Special installation instructions

Part of the method of EMC compliance is a strict limitation on the way in which all signal, supply and control cables are terminated at both the instrument and source or destination. It is essential that the types of cables which have been recommended (or direct replacements) are used. With the wrong cable fitted, incorrect readings will result.

If these installation instructions are followed carefully and precisely, the instrument will achieve and maintain the levels of EMC protection stated in the specification. The equipment to which it is connected must also have the same or similar EMC control to maintain operation without undue interference to the whole 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 the instrument housing.
- ◆ The instrument housing must be correctly re-assembled and securely fastened, to maintain a continuous electro-magnetic shield around the instrument.
- ◆ An Earth connection must be made to the Earth terminal of this instrument, both for SAFETY and to keep the EMC protective shield at Earth potential.

Connections and Controls

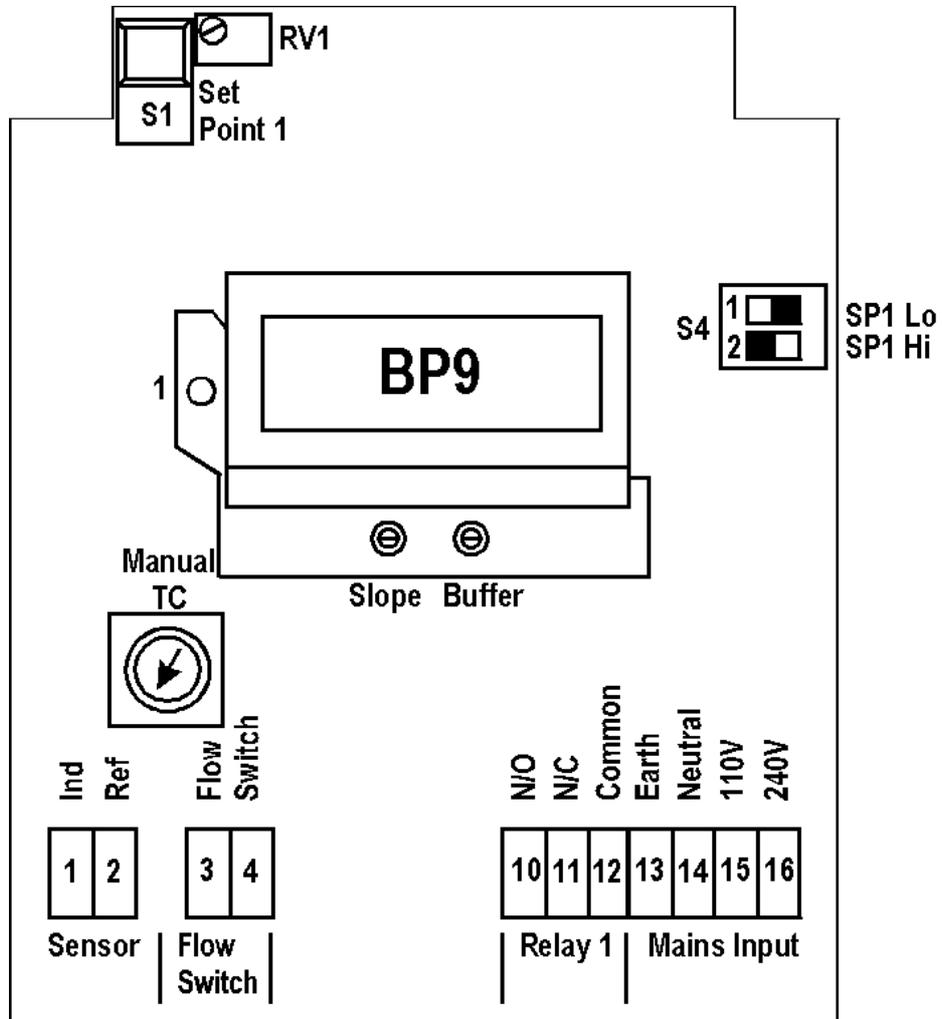
CAUTION: Before installing or making any changes to the High Voltage terminals, ensure the mains power has been switched off and cannot be switched back on by accident during wiring of the instrument.

Connections to the BP9 series are made through groups of terminal blocks, accessible by removing the front panel. The following four diagrams of the BP9 series connections also show the position of the calibration controls which are referred to in the section on setting up the instrument.

NOTE: the BP9, BP94 and BR9 are not fitted with a current output or a second relay (relay 2).

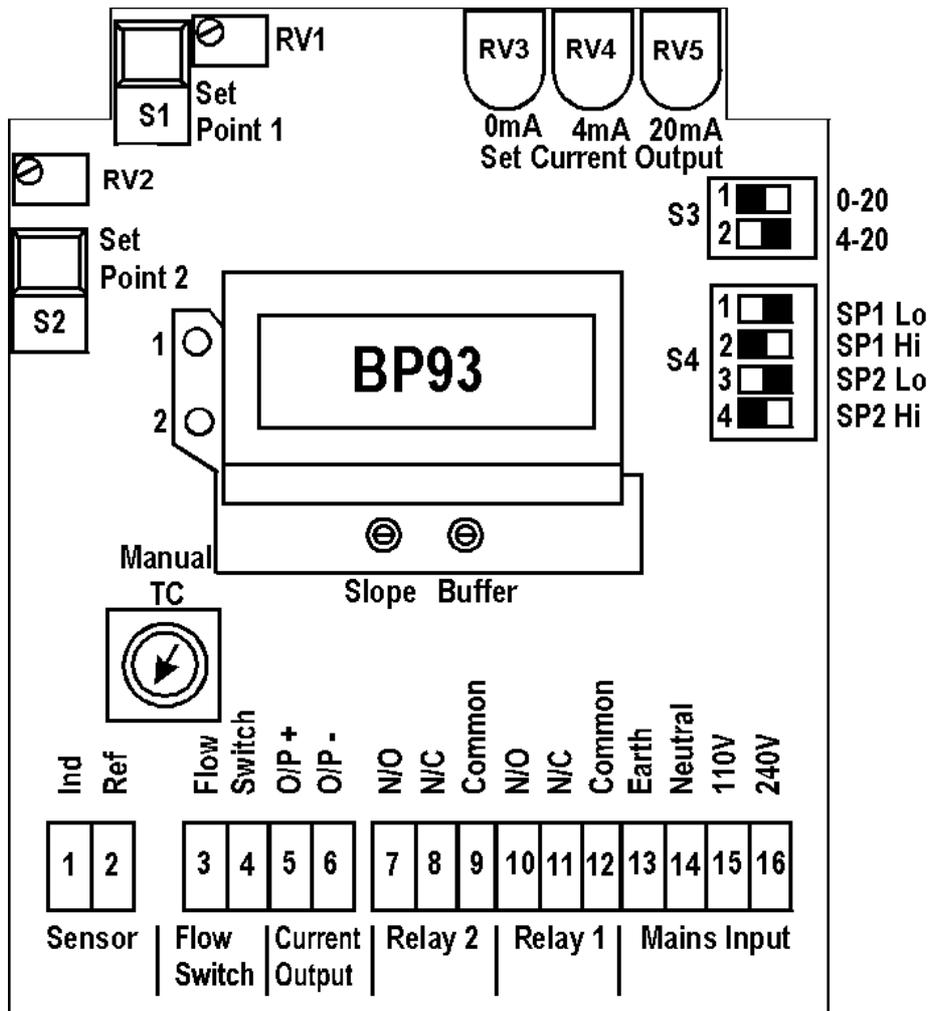
Connection of pH Probes

For most suppliers of pH probes, the IND connection is the centre core and the REF connection is the screen.



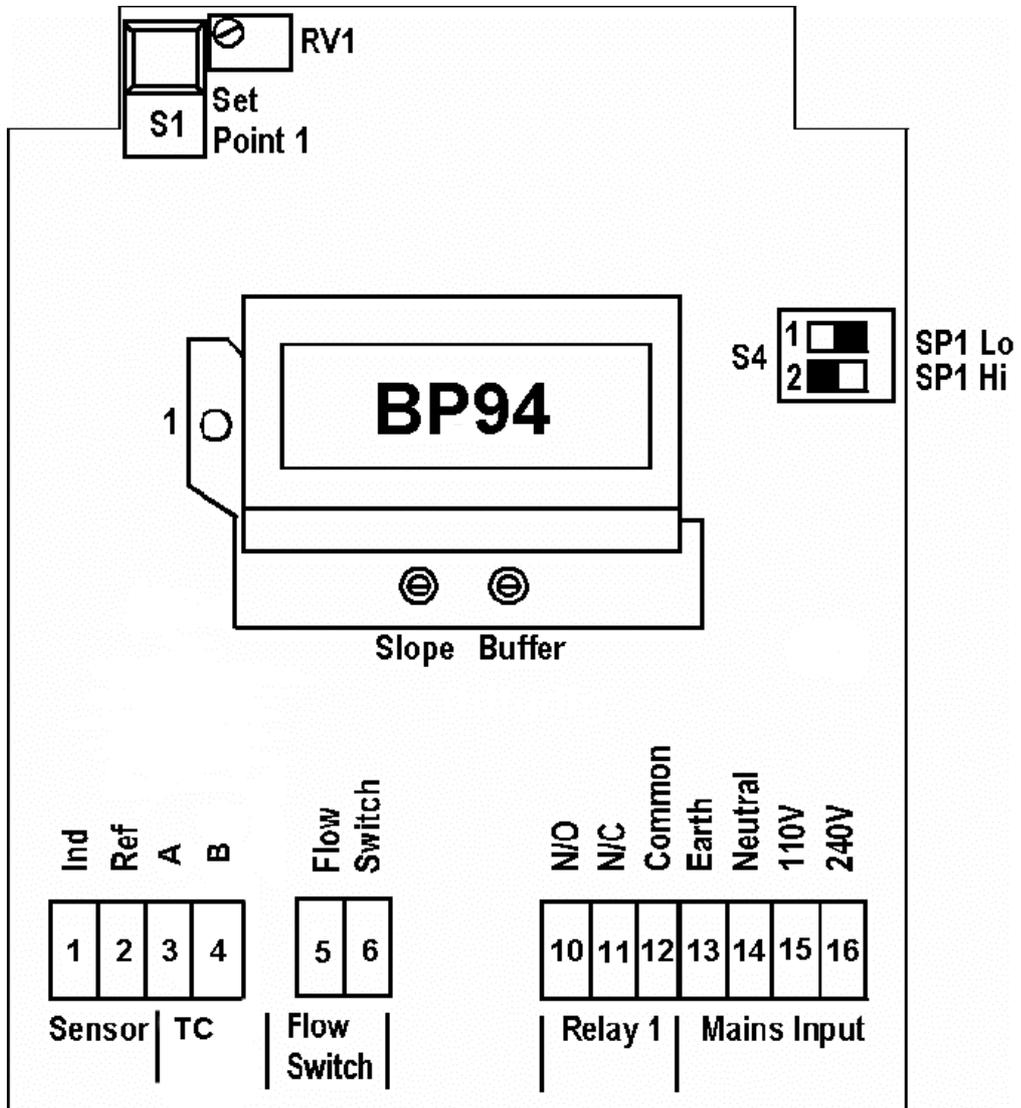
BP9 Connections and Controls

DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.



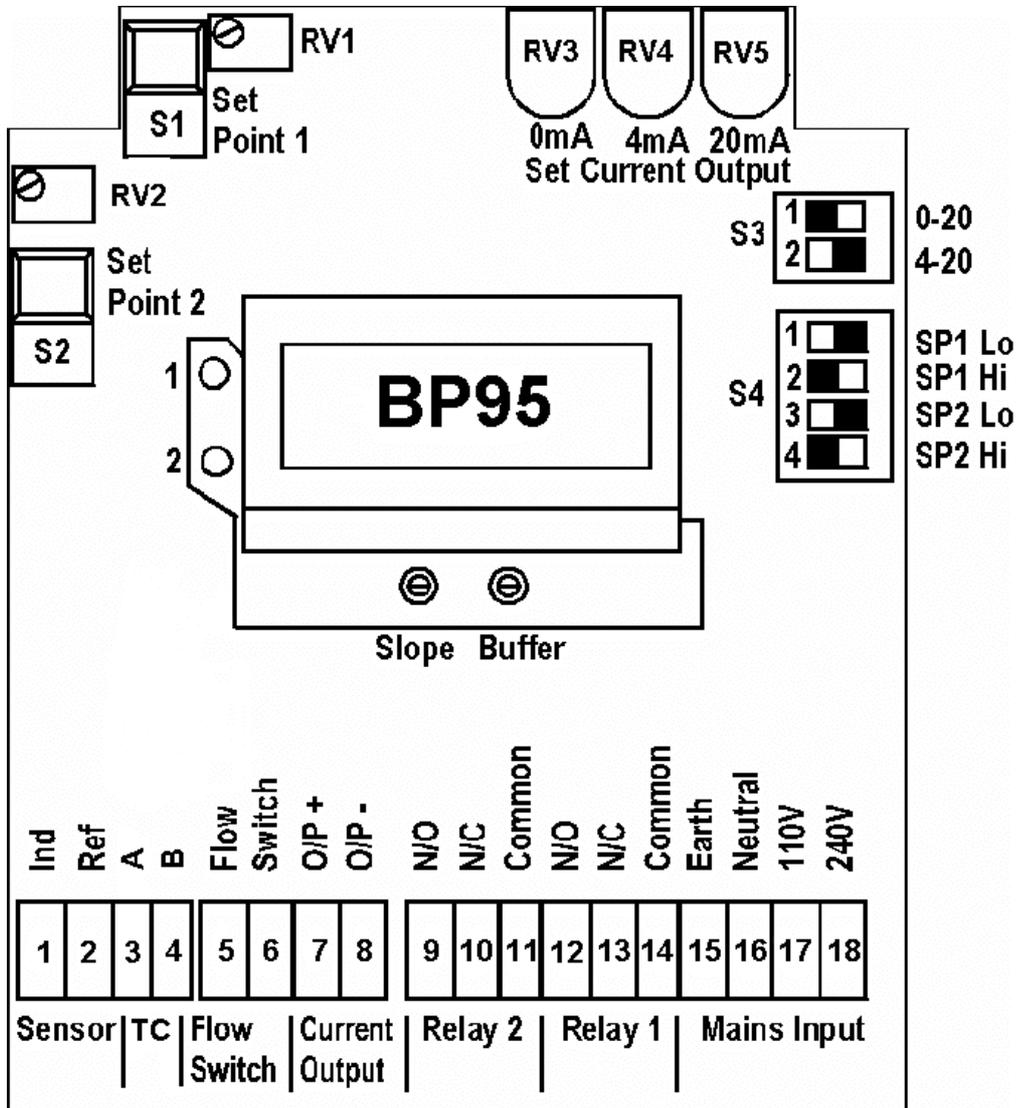
BP93 Connections and Controls

DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.



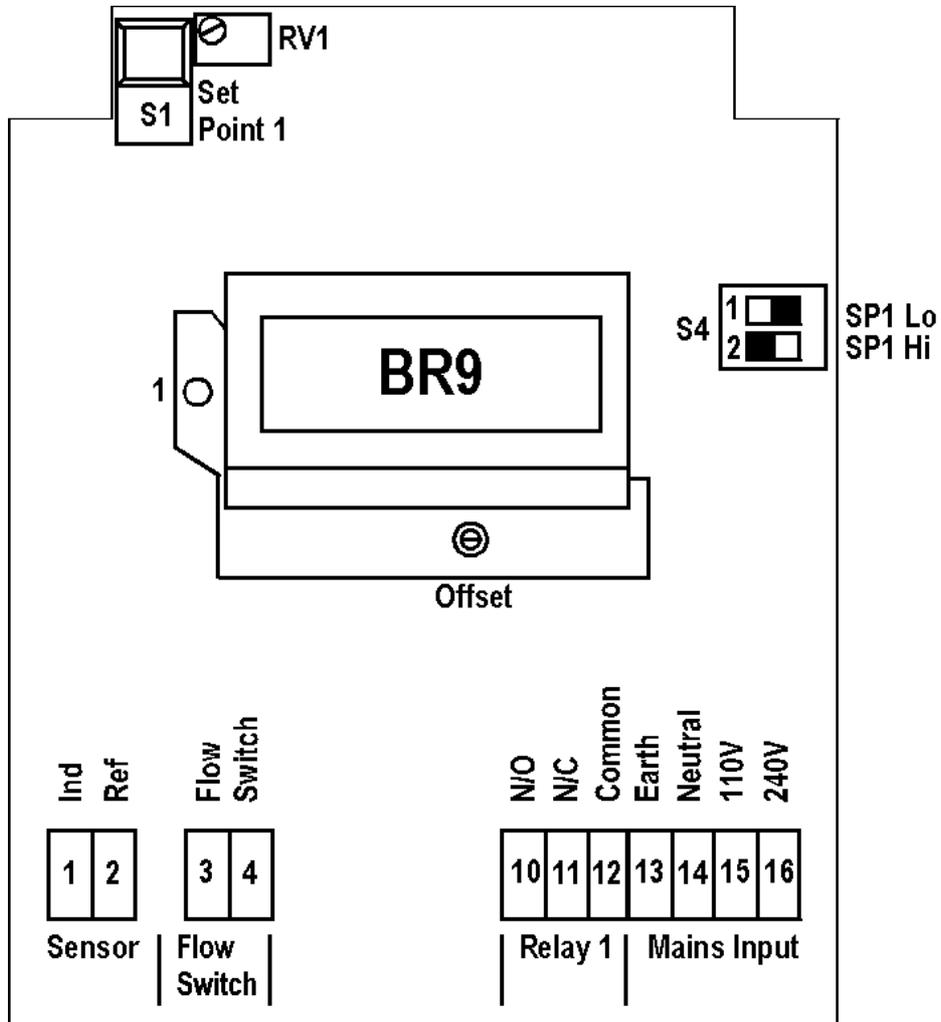
BP94 Connections and Controls

DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.



BP95 Connections and Controls

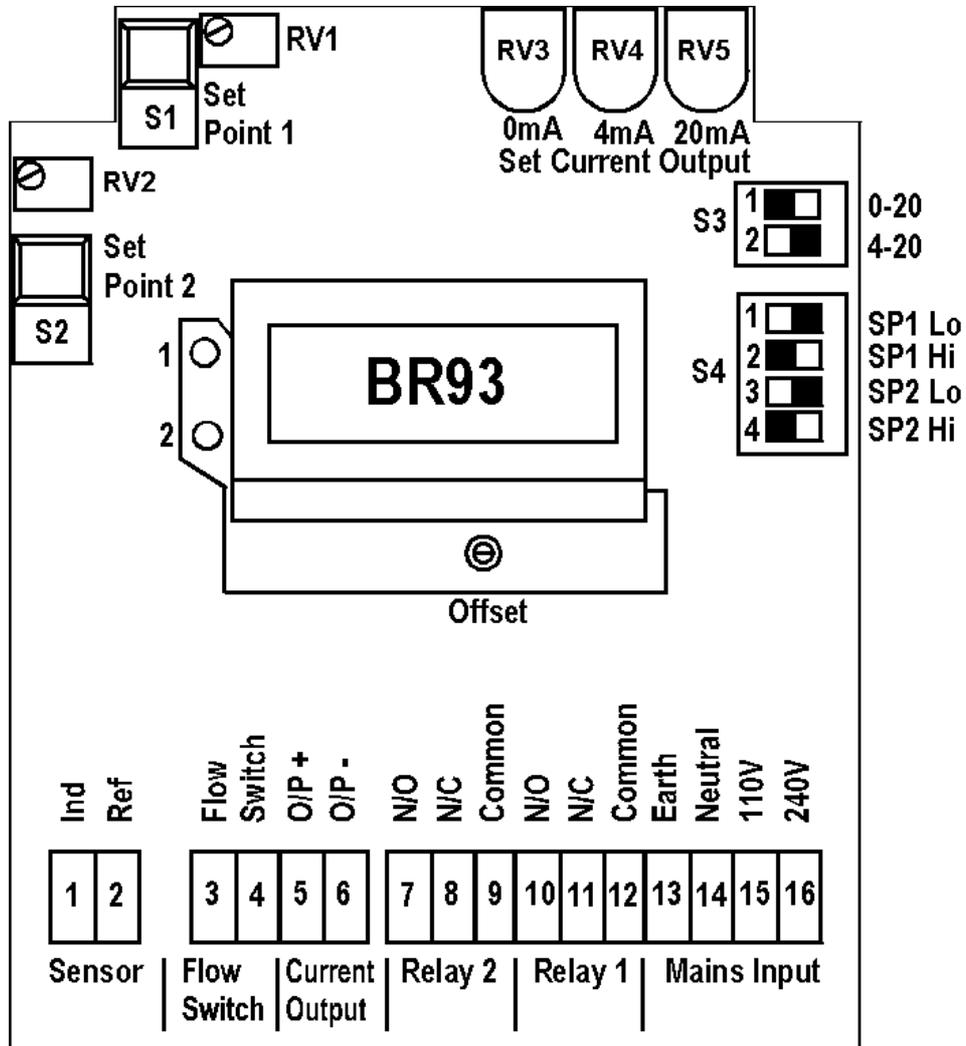
DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.



BR9 Connections and Controls

DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.

2 Installation



BP93 Connections and Controls

DISCONNECT the mains power to the instrument and the control relays before making changes to connections under the mains terminal safety cover.

All Connections

This applies to all cables and cable glands for all installations. After each cable has been connected up, pull most of the cable slack back through the cable gland to prevent any unwanted RF energy being radiated inside the housing. Make sure you do not tension 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. Unused cable glands should be sealed with the washer provided.

Supply voltage connections

Remove the plastic mains cover as follows. Squeeze the top of the mounting post with fine pliers or similar and then lift the cover clear of the terminals.

Feed the mains supply cable through the outer right hand cable gland. Do not use individual strands of wire if it is necessary to achieve an IP66 level of environmental seal. Connect the power supply to the 110 or 240v terminals as required.

Replace the plastic mains cover if relay connections are not required.

Relay connections

For typical external wiring configurations, refer to the Appendices at the back of this guide.

Remove the plastic mains cover (unless already removed above) as follows. Squeeze the top of the mounting post with fine pliers or similar and then lift the mains cover away from the terminals.

The relay contacts are connected to the I/O terminals only and are not powered from the instrument itself. They must be connected in series with a supply, a load and a 5 Amp fuse. A contact arc suppressor may be required to prevent excessive electrical noise, depending upon the load. To switch more than 5 Amps will require a slave relay

Feed the relay cable through the inner right hand cable gland. Do not use individual strands of wire if it is necessary to achieve an IP66 level of environmental seal. Please refer to Appendix B, page 33 for relay wiring examples.

Pull most of the cable slack back through the cable gland to prevent any unwanted R.F being radiated inside the housing. Make sure you do not tension 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.

Replace the plastic mains cover.

Current output connections

[BP93/BP95 only]

Feed the current output cable through the inner left hand cable gland [the smallest cable gland on the instrument]. Do not use individual strands of wire if it is necessary to achieve an IP66 level of environmental seal. Connect the current output to terminals OP+ & OP- using a standard 2 core screened cable. Connect the screen to Earth at one end only.

Pull most of the cable slack back through the cable gland to prevent any unwanted R.F being radiated inside the housing. Make sure you do not tension 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.

Sensor input connections

Only use a good quality low noise coaxial cable equivalent to LTH LN10 for the sensor input connections. This type of cable has a conductive plastic layer between the inner insulator and the braid, which must be removed, to prevent a possible short circuit of the sensor.

On the BP94 and the BP95 a pH electrode with built in PT1000 will need to be connected. The PT1000 wires will connect to terminals A and B TC.

Flow Switch Input

The flow switch input must be linked if it is not in use. When the input is open circuit, the relays will be disabled. This input is intended to be used to prevent the relays from operating under no flow sample conditions. This input could also be used to prevent the relays from operating during calibration or maintenance.

Noise suppression

In common with other electronic circuitry, the BP9 series 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.

Potential noise sources

The following noise generating sources can affect the BC9 series 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 BC9 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.

Recommended wiring practices

- ◆ All the wiring should conform to local codes and practices.
- ◆ Cables transmitting low-level signals should not be routed near contactors, motors, generators, radio transmitters or wires carrying large currents.

Reducing interference

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 earthed steel trunking as much as 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.



2 Installation

This page left intentionally blank

3 Operation and setting up

Introduction

This chapter explains the best and quickest set-up method for this equipment. Carefully follow the procedures below systematically to ensure optimum performance from your instrument. Remember that a little extra time spent getting this right can make a lot of difference in terms of efficiency savings, maintenance calls, faulty installations and so on.

Note 1: for operators familiar with the setting up of this type of instrument, use the summary tables in Appendix A in conjunction with the component layout diagrams in Section 2.

Setting up your controller

To set up a BP9 series controller ensure that the instrument and sensor have been installed in accordance with all the requirements of Section 2. Configure the option switches according to the following tables.

IMPORTANT: READ THE FOLLOWING TABLE KEY

The switch tables below have been designed for ease of installation with minimum chance of incorrect settings. Each switch table has a specific function. Each function should be carefully considered and the switches set accordingly. Think about the following example...

Switch 4			Display....
#1	#2	#3	
1	0	0	Set.....

Switch 4 is the component number of a group of switches.

#1, #2 etc. is the **Nth** switch in that group of switches.

1 or **0** indicates the required switch position. **1** means ON or CLOSED, and **0** means OFF or OPEN.

The right hand column details the function and options for the switch group.

If in doubt contact LTH Electronics or your local distributor for technical support. When the switches have been configured, adjustment of the calibration potentiometers should be carried out in the correct sequence as shown at the end of this Section.

Unscrew and remove the instrument housing cover.

Select the current output mode (BP93, BP95 & BR93 Only)

Switch 3		Current Output Reference Current
#1	#2	
0	0	<i>Illegal set-up for current output</i>
0	1	Set current output range 4 - 20 mA
1	0	Set current output range 0 - 20 mA
1	1	<i>Illegal set-up for current output</i>

Set the manual temperature compensation (BP9 & BP93 only)

Note: The BR9 and BR93 (Redox) instruments do not have temperature compensation, so skip past this item.

Set the Manual TC potentiometer to the process solution temperature. It is scaled 0–25-50-75-100°C, on the PCB. If the solution temperature and the buffer calibration solution temperatures differ by more than 10°C, you should adjust the Manual TC potentiometer to the buffer solution temperature when calibrating. Do not forget to return the potentiometer to the process temperature when you have finished

The BP94 and BP95 instruments have automatic temperature compensation when a pH sensor with a built in PT1000 temperature compensator is connected between terminals A and B TC.

Select the set point 1 operating mode

Note: The relays supplied with the BP9 series are of the changeover type. The choice of wiring configuration to be made here is whether the relay is to be used to dose alkali (increase the pH) or to dose acid (decrease the pH). In either case, the relay wiring selected should permit the system to fail in a safe way (usually to de-energise the load) if the power fails. The set point 1 LED indicates that the relay is in an energised state.

Switch 4		Select set point 1 Mode Hi or Lo
#1	#2	
0	0	Illegal set-up for Relay 1 set point
0	1	Energised if pH/redox is greater than set point (HI)
1	0	Energised if pH/redox is less than set point (LO)
1	1	Illegal set-up for Relay 1 set point

Select the set point 2 operating mode (BP93, BP95 Only)

Note: The relays supplied with the BC9 series are of the changeover type. The choice of wiring configuration to be made here is whether the relay is to be used to dose alkali (increase the pH) or to dose acid (decrease the pH), or to sound an alarm which indicates abnormal (fault) conditions. In either case the relay wiring selected should permit the system to fail in a safe way (usually to de-energise the load) if the power fails.. The set point 2 LED indicates that the relay is in an energised state.

Switch 4		Select set point 2 Mode Hi or Lo
#3	#4	
0	0	<i>Illegal set-up for Relay 2 set point</i>
0	1	Energised if pH/redox is greater than set point 2 (HI)
1	0	Energised if pH/redox is less than set point 2 (LO)
1	1	<i>Illegal set-up for Relay 2 set point</i>

Calibrating the control system

First set up all option switches as detailed above, using the component layout diagrams in Section 2 to identify the controls.

3 Operation and setting up

Potentiometer function summary		
<u>Control</u>	<u>Function</u>	<u>Set by</u>
RV 1	Adjust set point 1 with Switch 4 depressed	Operator
RV 2 ②	Adjust set point 2 with Switch 5 depressed	Operator
RV 3 ①	Set current output 0 mA with sensor open circuit	Factory & Operator
RV 4 ①	Set current output 4 mA with sensor open circuit	Both
RV 5 ①	Set current output 20 mA using sensor loop resistor	Both

NOTE: the controls above marked ①, are not fitted to the BP9. The controls marked ② are only fitted to the BP93 or BP95.

NOTE 2: power up for at least 10 minutes prior to calibration for the circuits to reach their working temperature

Setting the set point for Relay 1

- ◆ The set point 1 LED is lit when the relay is energised.
- ◆ A single momentary acting push button switch (S1) which, when held down, displays the pH/redox set point for Relay 1 on the digital display.
- ◆ To change the set point hold down the set point monitor switch (S1) and adjust RV1 until the display shows the desired set point value.
- ◆ Relay action and set point hysteresis can be checked by slowly adjusting the set point control RV1 above and below the measured pH/redox value.
- ◆ If the Set point action is incorrect, change both S4#1 and S4#2 over, then repeat this section.

Setting the set point for Relay 2 (BP93, BP95 only)

- ◆ The set point 2 LED is lit when the relay is energised.
- ◆ A single momentary acting push button switch (S2) which, when held down, displays the pH/redox set point for Relay 2 on the digital display.
- ◆ To change the set point hold down the set point monitor switch (S2) and adjust RV2 until the display shows the desired set point value.
- ◆ Relay action and set point hysteresis can be checked by slowly adjusting the set point control RV2 above and below the measured pH/redox value.
- ◆ If the Set point action is incorrect, change both S4#3 and S4#4 over, then repeat this section

Calibrate the current output (BP93, BP95 Only)

Note: the current outputs are calibrated at the factory. It should not be necessary to adjust these under normal installation procedures.

Use a current meter in series with the output or another method to monitor current.

- ◆ Use a pH/redox simulator to set the display to zero
- ◆ Check that the display reads 000 pH or – 1000 mV.
- ◆ Adjust the Set current = 0 mA (RV3) or 4 mA (RV4) as required. The 0mA control should be backed off until the current drops to virtually zero... it will always fall short of zero by a few microamps.
- ◆ Use a pH/redox simulator to set the display to 14.00 pH or 1.000 mV.
- ◆ Adjust the Set current = 20 mA control (RV5) until the current output equals the current calibration value listed in the tables above.
- ◆ Repeat until the current output zero and span are both correct.
- ◆ Further small adjustments can be made with RV3, RV4, RV5 if it is necessary to set specific values on a external monitoring system.

Sensor Calibration Calibration Procedures

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

- Always clean the electrode system before inserting in the standard solution to avoid contamination and to obtain the best response from the electrode system.
- Rinse the electrode system in clean (preferably demineralised) water between standard solutions.
- Allow time for the electrode system temperature to stabilise in each standard solution.
- Use standard solutions of known quality. If in doubt make up fresh solutions.
- Use clean beakers and bottles for standard solutions.
- The BP9, BP93, BP94, BP95 can be taken offline, which de-energises the relays by disconnecting the link between 3 and 4 or disconnecting the flow switch if it is connected. This facility is useful when calibrating the system, however the operator must ensure the relays are in a safe state when using this feature.

pH Buffers

LTH supplies buffer powders, which are prepared from pure dry chemicals, sealed in a sachet or capsule, which prevents the absorption of moisture and subsequent deterioration. Alternatively LTH can also supply buffer solutions with traceable certification if required. Please contact our sales department for further details. Buffer solutions should be prepared in accordance with the instructions supplied with them.

The BP9, BP94, BP93, BP95 offer a simple method of calibration for pH electrode systems. It is possible to do single or two point calibration, using the **Buffer** and **Slope** controls. It is important to do the calibration in the correct order.

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

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

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

Temperature has an effect on the output from the pH electrode as well, so it is important that the buffer temperature is used, if manual temperature compensation is more than 10°C from the set value.

Redox Standards

For calibration and test purposes, standard solutions at various potentials can be purchased.

LTH offer 2 standard Redox solutions:

Part No. 138/175 124mv Redox solution, 500ml.

Part No. 138/176 358mv Redox solution, 500ml.

Calibration of the BR9, BR93 Redox controllers is a single point calibration only.

This page left intentionally blank

4 Fault Finding

Introduction

Note: There are no user serviceable parts inside the instrument.

Fault finding hints are included in this section. If the fault has not been cleared after these checks have been carried out, contact LTH. Please have as much of the following information available as possible in any communication with LTH, to enable a quick repair or diagnosis of the problem to be made:

- ◆ Serial number of the instrument.
- ◆ The approximate date of purchase.
- ◆ Details of the application.
- ◆ Electrical environment and supply details.
- ◆ Circumstances under which failure occurred.
- ◆ The nature of the fault or faults.
- ◆ Relay and current o/p loads, cables and lengths.
- ◆ The sensor type, cable length and serial number.

Note: most faults are due to incorrect wiring or sensor mounting. It is essential that the pH/Redox sensor is measuring a representative sample and that all connections are correct.

It is often worthwhile to check the measurement by an independent method, for example, by use of a portable meter or by titration.

Faults

Instrument appears dead

- ◆ Check that power is available to the unit. Using an AC voltmeter, check the mains supply voltage at the connector.

The reading is over range or under range

- ◆ Ensure that the input is correctly connected and that the sensor is not faulty or damaged.
- ◆ Check the sensor and its cable for possible short or open circuits, including any junction boxes or connectors.
- ◆ If an extension cable is being used try connecting the sensor directly to the instrument.
- ◆ Disconnect the sensor and place a link between terminals IND & REF. The instrument should read $7 \text{ pH} \pm 2 \text{ pH}$ or $0 \text{ mV} \pm 200 \text{ mV}$ using the buffer/offset control. This test checks most of the instrument operation, so the sensor or cable would be suspect.

The display and/or current output is unstable

- ◆ Ensure that the pH or redox sensor is of the right type and in good condition.
- ◆ Ensure that the mains voltage supply to the unit is in the right terminals, and that the wire insulation has been cut back to facilitate a good connection.
- ◆ Check the flow through the sensor is representative.
- ◆ Instability may be due to trapped air or cavitation occurring within the sensor.
- ◆ Check that the conductivity of the solution is above 50 $\mu\text{S}/\text{cm}$. Special care is required to measure the pH of low conductivity solutions. Contact LTH for more advice.

The display reads 7pH or zero mV

- ◆ Check for short circuit sensor or its connecting cable.
- ◆ Check that the black conductive layer in the LN10 cable is stripped back.
- ◆ Check that all input connections are secure.
- ◆ If an extension cable is being used, try connecting the sensor directly to the instrument.
- ◆ Disconnect the sensor and place a link between terminals IND & Ref. The instrument should read $7 \text{ pH} \pm 2\text{pH}$ or $0\text{mV} \pm 200\text{mV}$ using the buffer/offset control. This test checks most of the instrument operation, so the sensor or cable would be suspect.

Instrument display appears to malfunction

- ◆ Switch the unit off and on again. Check that the display backlight is on, indicating power is reaching the unit.

pH or redox potential reading appears incorrect

- ◆ If another sensor is available, this can be used to determine whether the fault lies with the instrument or the sensor.
- ◆ Check that the sensor cable is not damaged or broken and that the screen does not make contact with any other terminals or metal work. It should not be grounded.
- ◆ Check that the sensor cable is not bundled together with power cables and is routed away from electrical noise sources.
- ◆ Check that the correct sensor type has been installed.
- ◆ Check that the correct sensor calibration values have been used.
- ◆ Check that the calibration procedure has been followed precisely.
- ◆ Check that the manual temperature compensation has been set correctly.
- ◆ Check that the sensor cable does not exceed the maximum specified length 30 metres.

The relays don't operate at the set point value

- ◆ Check that the flow sensor input is shorted (terminals 3 & 4) if this option is not used. If a flow switch is connected check the switch is closed for the flowing condition.

5 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 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 agent. Special arrangements will be made in individual cases for goods returned from overseas.



5 Guarantee and service

This page left intentionally blank

Appendix A - Buffer Solutions

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

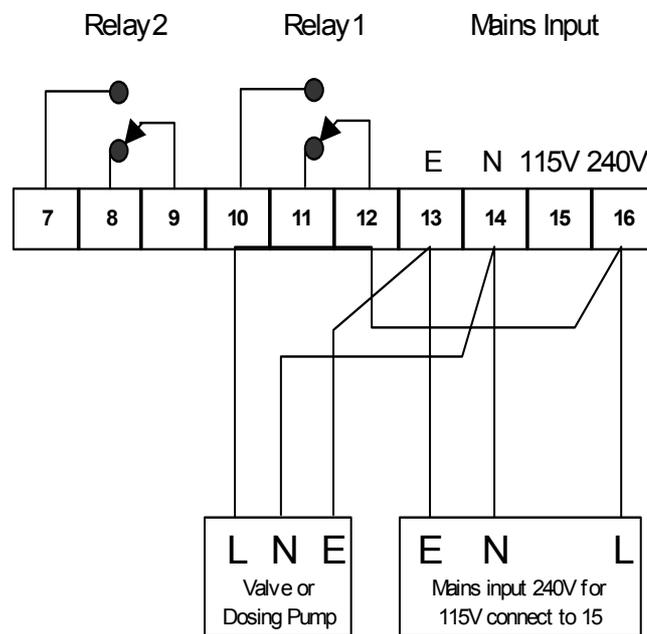
pH variation against temperature			
Temperature (°C)	4pH Buffer	7pH Buffer	9pH Buffer
10	4.00	7.07	9.21
15	4.01	7.04	9.14
20	4.01	7.02	9.06
25	4.01	7.00	9.00
30	4.01	6.99	8.96
35	4.02	6.98	8.92
40	4.03	6.97	8.88
50	4.06	6.96	8.83
60	4.08	6.96	8.81

Appendix A - Buffer Solutions

This page left intentionally blank

Appendix B

BP9 and BP93 chemical dosing applications



The figure shows a basic wiring configuration for a simple chemical dosing / regulating system. For enhanced system safety, a BP93 could be used, with set point 2 configured to indicate a fault condition and sound an alarm when the pH exceeds a safe pre-determined limit.

Appendix B

This page left intentionally blank

6 Index

brackets.....	7, 8, 9	over range	29
Buffer	26, 35	pipe-mounting	8
Solutions	35	preface	1
cable.....	30	quality	2
cable gland.....	17, 18	rail-mounting.....	8
Calibration	5, 6, 26	range	30
cavitation	30	Redox	27
connections	10, 18	Redox Standards	27
Connections .	10, 11, 12, 13, 14, 15, 16	relay	17
controls	11, 12, 15, 16	relay 1	25
current output.....	18, 22, 25	relay 2	25
dimensions	7	RFI.....	18
directive	2	safety.....	2, 10, 11, 12, 13, 14, 15, 16
display.....	21	screen	18, 30
dosing	5, 37	sensor	29
earth.....	10, 18	Sensor Calibration.....	26
Email.....	1	Sensor input	18
EMC	2, 10	service.....	33
EMI.....	18	setpoint.....	22, 23, 25
fault finding	29	setting up.....	10, 21
Fax	1	setup.....	21
flow sensor.....	31	Specifications.....	6
flow switch.....	5, 18, 26, 31	standards	2
Flow switch input.....	6	summary.....	21
Flow Switch Input	18	supply.....	10, 17, 29
guarantee.....	33	suppression	18
installation	7, 10	surface-mounting	7
interference	10, 18, 19	Telephone	1
IP66	17, 18	temp. compensation	30
key	21	temperature compensation	5, 22, 27
mains.....	10, 17, 29	under range	29
operation.....	21	warranty	1

LTH Electronics Ltd

Chaul End Lane
Luton
Bedfordshire
LU4 8EZ
United Kingdom

Telephone : +44 (0) 1582 593693
Fax : +44 (0) 1582 598036
E-mail : sales@lth.co.uk
Web site : www.lth.co.uk