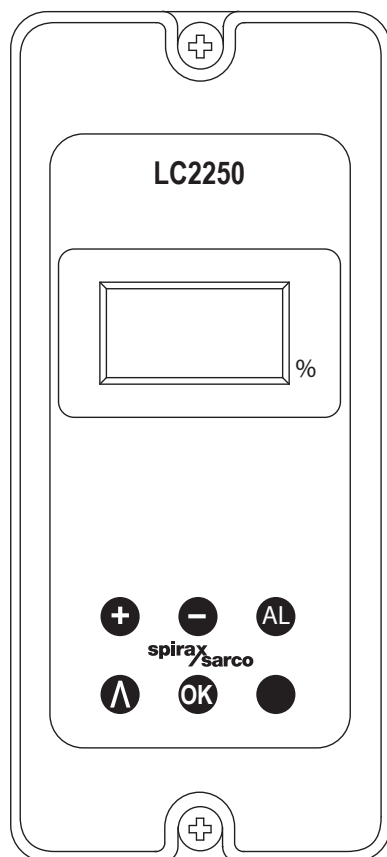


LC2250 Level Controller

Installation and Maintenance Instructions



1. Safety information
2. User instructions and delivery information
3. System overview
4. Mechanical installation
5. Electrical installation
6. Commissioning
 - Quick set-up
 - Full
7. Communications
8. Maintenance
9. Fault finding
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Commissioning password

Current legislation states that in order to prevent tampering and potentially hazardous programming errors, access to the pass codes required to enter commissioning mode should only be available to qualified and trained personnel.

Enter commissioning

To enter the commissioning mode, press and hold the **OK** button for 5 seconds.

The display will show the pass code '888'. Enter the pass code '745'. This is fixed and cannot be changed.

If an incorrect pass code is entered, the display will return to showing the current valve / pump status – run mode.

If the correct pass code is entered, the display will show the main menu structure. Select 'End' to leave the menu.

Once in the commissioning mode press the **▲** button:

- to scroll through the menus.
- to increase digits when in a menu.

Press the **OK** button to enter a menu choice (select a parameter or digit) and shift right, onto the next digit.

This page MUST be removed after commissioning and kept in a safe, access controlled location.



1. Safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

Your attention is drawn to IEE Regulations (BS 7671, EN 12953, EN 12952 and EN 50156). Elsewhere, other regulations will normally apply.

All wiring materials and methods shall comply with relevant EN and IEC standards where applicable.

Warning

This product is designed and constructed to withstand the forces encountered during normal use. Use of the product other than as a boiler controller, or failure to install the product in accordance with these Instructions, product modifications or repair could:

- Cause injury or fatality to personnel.
- Cause damage to the product / property.
- Invalidate the  marking.

These instructions must be stored in a safe place near the product installation at all times.

Warning

This product complies with Electromagnetic Compatibility Directive 2014/30/EU and all its requirements.

This product is suitable for Class A Environments (e.g. industrial). A fully detailed EMC assessment has been made and has the reference number:

- UK Supply BH LC2250 2012.

The product may be exposed to interference above the limits of heavy Industrial Immunity if:

- The product or its wiring is located near a radio transmitter.
- Excessive electrical noise occurs on the mains supply. Power line protectors (ac) should be installed if mains supply noise is likely. Protectors can combine filtering, suppression, surge and spike arrestors.
- Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.

This product complies with Low Voltage Directive 2014/35/EU by meeting the standards of:

- EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use.

This product has been type tested as a level control by meeting the standard:

- VdTÜV requirements for water level control and limiting devices, water level 100 (2010).



Static precautions (ESD)

Static precautions must be observed at all times to avoid damage to the product.

Level control and level limiting products in steam boilers

Products/systems must be selected, installed, operated, and tested in accordance with:

- Local or National standards and regulations.
- Guidance Notes, (Health and Safety Executive BG01 and INDG436 in GB).
- The requirements of Approvals Authorities.
- Boiler Inspection Bodies.
- Boiler manufacturer's specifications.

Two independent low water limiting systems must be installed on steam boilers.

Level probes must be installed in separate protection tubes/chambers, with sufficient clearance between the tips, and earth.

Each probe must be connected to an independent controller. The alarm relays must isolate the boiler heat supply at low alarm status.

A high water alarm may be part of the water level control, or a separate system. An independent high water alarm system must be fitted if it is considered a safety requirement.

In this case, the relays must simultaneously isolate the feedwater supply and the boiler heat supply at high alarm status. All boiler water limiters require regular functional testing.

The level probe and controller is only part of the safety system. To complete the system, additional circuitry (wiring, relays, alarm bell/lamp etc.) is required.

A suitable water treatment regime must be used to ensure continuous safe and correct operation of the control and limiter systems. Consult the above authorities and a competent water treatment company.

Symbols



Equipment protected throughout by double insulation or reinforced insulation.



Functional earth (ground) terminal, to enable the product to function correctly.
Not used to provide electrical safety.



Clean earth / ground.



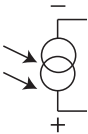
Safety earth.



Caution, risk of electric shock.



Caution, risk of danger, refer to accompanying documentation.



Optically isolated current source or sink.



Caution, Electrostatic Discharge (ESD) sensitive circuit. Do not touch or handle without proper electrostatic discharge precautions.



ac, alternating current.

1.1 Intended use

- i) Check that the product is suitable for use with the intended fluid.
- ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Determine the correct installation situation and direction of fluid flow.
- iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- v) Remove protection covers from all connections and protective film from all name-plates, where appropriate, before installation on steam or other high temperature applications.

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high/low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In normal use the external surface of the product may be very hot.

Many products are not self-draining. Take due care when dismantling or removing the product from an installation.

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

On disposal of the unit or component, appropriate precautions should be taken in accordance with Local/National regulations.

Unless otherwise stated in the Installation and Maintenance Instructions this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

2. User instructions and delivery information

Certain computer programs contained in this product were developed by Spirax-Sarco Limited ("the Work(s)").

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Spirax-Sarco Limited grants the legal user of this product (or device) the right to use the Work(s) solely within the scope of the legitimate operation of the product (or device). No other right is granted under this licence.

In particular and without prejudice to the generality of the foregoing, the Work(s) may not be used, sold, licensed, transferred, copied or reproduced in whole or in part or in any manner or form other than as expressly granted here without the prior written consent of Spirax-Sarco Limited.

2.1 General description

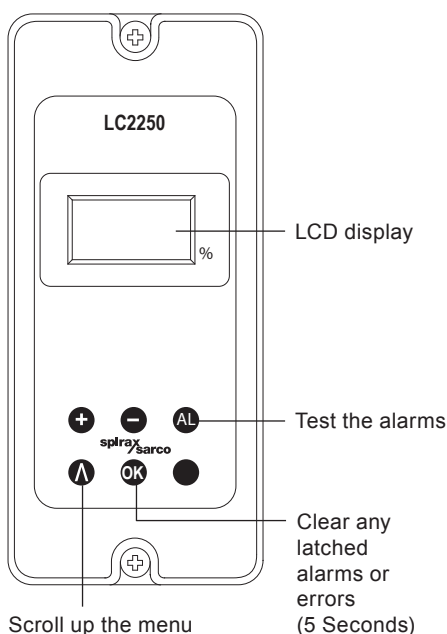
The LC2250 is a level controller for conductive liquids. It has two alarms that can be configured high or low.

WARNING: The minimum conductivity when used with the LP20 / PA20 or PA420.

2.2 Front panel

The front panel has a 3-digit LCD and a five-button keypad.

Fig. 1
Front panel keypad and definitions



2.3 Using the buttons

Use the **▲** button to:

- scroll through the menus.

The **OK** button is used to:

- enter the commissioning mode (press and hold for five seconds).
- enter the alarm reset passcode.

The **AL** button is used to:

- test the alarm relays.
- test the external circuits.

2.4 LCD display

The LCD display shows what the system is doing.

It indicates whether:

- an alarm condition is present.
- the pump is operating (on / off control).
- the valve is moving (proportional control).

Moving segments show whether the water is rising or falling. A single static segment indicates the water input/ steam output is in equilibrium.

Alarm

AL1 or AL2

ALarm. This warns of a level alarm condition.

Level alarm if occurring or has been latched.

AL and tSt

Testing the alarm relays and circuit. To do this press the 'AL' button, either in run or commissioning mode.

Note: In commissioning mode only **AL** is displayed.

AL and OOr

The level signal is out of range (OOr).

On / off control

Water level rising – pumping in.

Pumping in mode, pump on - vessel filling.

PP_ PP= PP≡

The moving segment display shows that the level is rising.

Water level falling – pumping out

Pumping out mode, pump on ~ vessel draining.

PP≡ PP= PP_

The moving segment display shows that the level is falling.

Pump off

Water level between pump on / pump off positions.

PP-

Segment does not move.

Proportional control

Valve opening.

Pr_ Pr= Pr≡

The moving segment display shows that the valve is opening, causing the amount of water entering the boiler / tank to increase.

Valve closing.

Pr≡ Pr= Pr_

The moving segment display shows that the valve is closing, causing the amount of water entering the boiler / tank to decrease.

Valve stationary – Water input / steam output in equilibrium.

Pr-

Segment does not move.

2.5 View parameter mode

Press the **▲** button in run mode to view the current level as a percentage of the gauge glass. The display remains in view for 2 minutes to give time to record it if required. Reference Section 6.4, Figure 11.

Press the **▲** button again to step through the parameters selected. Each parameter will remain on view for a further 2 minutes unless the button is pressed again.

2.6 Alarm / error display messages

If an error occurs, an error menu 'ErX' will be displayed at the end of the parameter screens. Pressing and holding the **OK** button for 3 seconds can clear a message and re-energize the alarm relay(s). If the cause has not been corrected, the same error message will reappear. If the error or alarm is of a latching type, only the message will disappear. The alarm relay will remain de-energised until cleared by the operator. This is achieved by holding the '**OK**' button for 5 seconds and entering the alarm reset code '325' or by entering the correct passcode for the commissioning menu. If more than one error or alarm has occurred, the next message will appear (in priority order) after the previous one has been cleared. See Section 9 - Fault finding.

2.7 Equipment delivery, handling and storage

Factory shipment

The product is tested, calibrated and inspected prior to shipment, to ensure reliable operation.

Receipt of shipment

Each carton should be inspected at the time of delivery for possible external damage. Any visible damage should be recorded immediately on the carrier's copy of the delivery slip.

Each carton should be unpacked carefully and its contents checked for damage. If it is found that some items have been damaged or are missing, notify Spirax Sarco immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

Storage

If the product is to be stored for a period prior to installation, the environmental storage conditions should be at a temperature between 0 °C and 65 °C (32°F and 149°F), and between 10% and 90% relative humidity (non-condensing).

Before installing and connecting the power ensure there is no condensation within the unit.

Operator instructions

An alternative operator instruction manual, in place of this manual, for operating the equipment is required. This will avoid the commissioning menu passcode being disclosed to the operator. The alarm reset passcode may optionally be disclosed if this is deemed necessary.

3. System overview

3.1 Function

The product can be configured to control the level of a boiler, tank or vessel, by operating a pump, valve or solenoid. Typical applications:-

On / off control:

- Pump control.
- Two alarm outputs.
- 4 - 20 mA level retransmission output (isolated).

Note: A solenoid valve may be used instead of a pump.

Modulating control:

Modulating valve control using a valve motor drive or 4 - 20 mA control signals.

- Two alarm outputs.
- 4 - 20 mA level retransmission output (isolated).

Note: The 4 - 20 mA level output is only available when the product is configured for valve motor drive systems.

3.2 Inputs

The product has two inputs to accept the following signals:

- Level probe or transmitter 1 - 6 V or 4 - 20 mA.

Note: The level probe must be long enough to sense over the complete level range.

- A 1 K potentiometer input ~ for Valve Motor Drive (VMD).

3.3 Outputs

The output control signal can be configured /wired to work with a pump or a modulating control valve. It also provides relay outputs for high or low level alarms and can provide an isolated 4 - 20 mA retransmission output.

3.4 Other features

An additional filter can be selected to increase the damping effect for turbulent conditions.

To prevent unwanted or inadvertent changes being made, all commissioning parameters are protected with a pass code.

The product can communicate via an infrared link between adjacent boiler house controllers (Spirax Sarco products only). It is designated as a slave unit only - see Section 7 - Communications.

4. Mechanical installation

Note: Read the 'Safety information' in Section 1 before installing the product.

The product must be installed in a suitable industrial control panel or fireproof enclosure to provide impact and environmental protection. A minimum of IP54 (EN 60529) or Type 3, 3S, 4, 4X, 6, 6P and 13 (UL50/NEMA 250) is required. If installed in a harsh environment (conductive dust and/or wet conditions), extra protection is required.

During installation or maintenance, the rear of the product **must** be protected from environmental pollutants entering the product. Alternatively, the tasks can be performed in a dry clean environment.

Caution 1: The product must only be installed in the vertical orientation.

Caution 2: Do not cover or obstruct the infrared beam between products.

Ensure that the display can be easily read by the operator.

Warning: The boiler control panel or enclosure doors must be kept closed at all times unless installation or maintenance work is being carried out.

4.1 Environmental conditions

Install the product in an environment that minimises the effects of heat, vibration, shock and electrical interference (see Section 1 – 'Safety information').

Do not install the product outdoors without additional weather protection.

Do not attempt to open the product – it is sealed and has no replaceable parts or internal switches.

4.2 Installation on a DIN rail

The product is provided with a clip and a set of self-tapping screws to secure it to a 35 mm DIN rail. On the rear of the enclosure, two sets of holes are provided to give two height positions. The clip can be adjusted to give further positions. Locate the clip onto one set of holes and secure it using the two screws provided. Ensure the spring clip is fully engaged with the rail.

Warning: Only use the screws provided with the product.

4.3 Installation on a chassis plate:

- Drill holes in chassis plate as shown in Figure 2.
- Fit unit to chassis plate and secure with 2 screws, nuts and washers, using the slots provided at the top and bottom of the case.

Warning: Do not drill the product case or use self-tapping screws.

4.4 Installation in a panel cutout:

(Minimum panel thickness 1 mm if the bezel is used).

- The product has integral threaded inserts (M4 x 0.7) at the top and bottom of the front panel.
- Two M4 x 25 mm screws are provided, together with fibre washers and a bezel.



Warning:

Do not use screws over 25 mm in length - danger of electric shock.

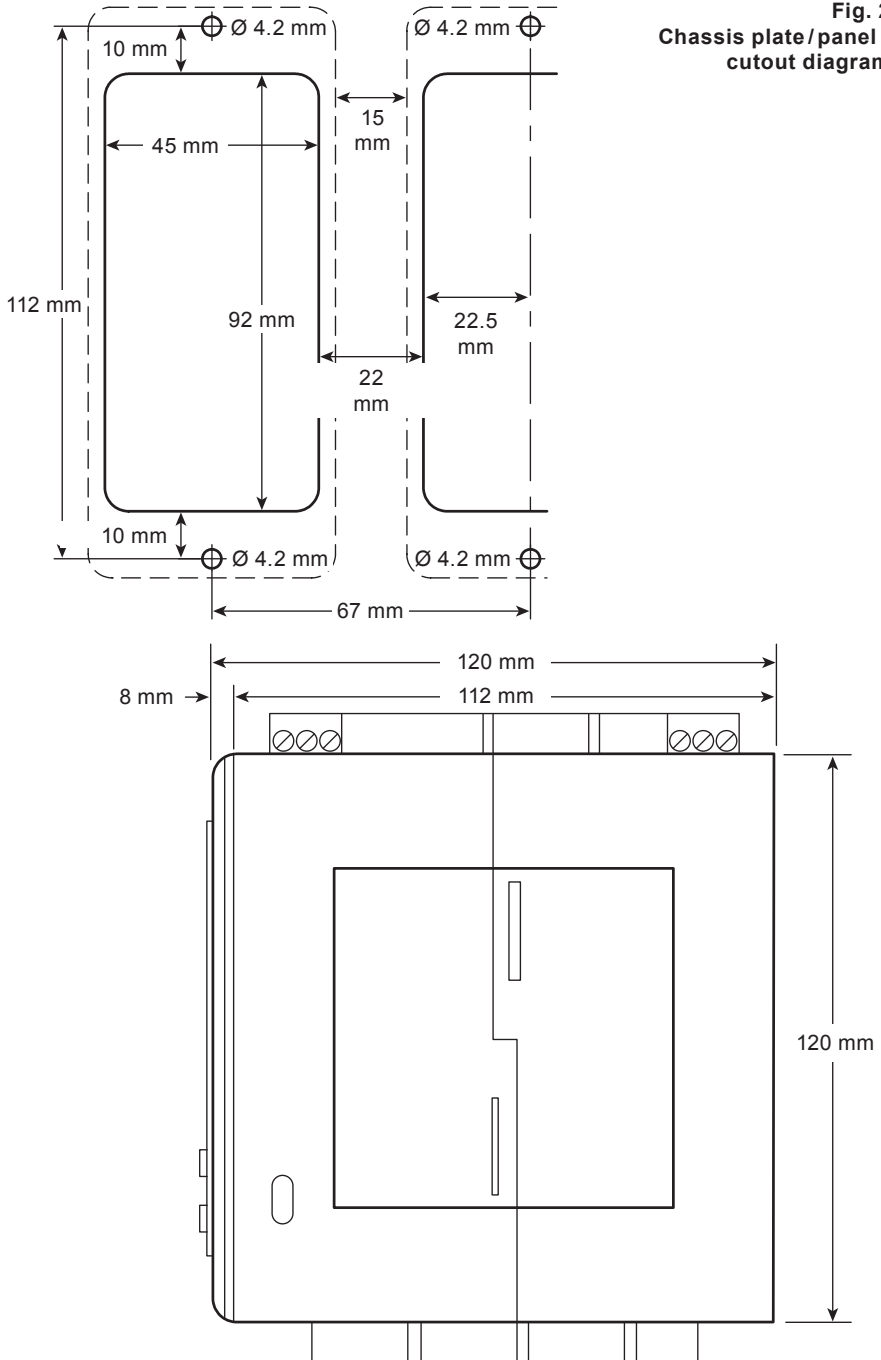
- Cut the panel to the dimensions given in Figure 2. Drill the screw holes in the panel in the positions indicated.
- Remove the backing from the gasket supplied and apply to front face of the product.
- The bezel can be used to enhance the appearance of the panel cutout. If required, fit this to the outside of the panel.
- Fit the unit from the rear of the panel, and secure using the screws, washers (and bezel) provided.
- Tighten the M4 screws to 1.0 - 1.2 Nm.

Warning: Do not drill the product case or use self-tapping screws.

Fixing template cutout notes:

- Solid line indicates cutout required for panel mounting.
- Broken line indicates product outline.
- A minimum gap of 15 mm between units must be provided for product cooling.
- Mounting hole dimensions are the same for both panel and wall mounting.

Fig. 2
Chassis plate/panel -
cutout diagram



5. Electrical installation

Note: Before installing read the 'Safety Information' in Section 1.



Warning:

Isolate the mains supply before touching any of the wiring terminals as these may be wired to hazardous voltages.

Use only the connectors supplied with the product, or spares obtained from Spirax-Sarco Limited. Use of different connectors may compromise product safety and approvals. Ensure there is no condensation within the unit before installing and connecting the power.

Connecting the mains supply incorrectly can cause damage and may compromise safety.

5.1 General wiring notes

Every effort has been made during the design of the product to ensure the safety of the user but the following precautions must be observed:

1. Maintenance personnel must be suitably qualified to work with equipment having hazardous live voltages.
2. Ensure correct installation. Safety may be compromised if the installation of the product is not carried out as specified in this IMI.
3. The design of the product relies on the building installation for overcurrent protection and primary isolation.
4. Overcurrent protection devices rated at 3 amps must be included in all phase conductors of the installation wiring. If overcurrent protection is included in both supply wires then the operation of one must also cause the operation of the other. Refer to IEC 60364 (Electrical Installations of Buildings) or National or Local standards for full details of requirements for overcurrent protection.
5. A 3 A quick-blow overcurrent protection device must be fitted to the relay circuit(s).
6. Relay contacts must be supplied on the same phase as the mains supply.
7. The product is designed as an installation category III product.
8. Install wiring in accordance with:
 - IEC 60364 - Low-voltage electrical installations.
 - EN 50156 Electrical Equipment for furnaces and ancillary equipment.
 - BS 6739 - Instrumentation in Process Control Systems: Installation design and practice or local equivalent.
 - National and Local Electrical Code (NEC) or Canadian code (CEC) for the US and Canadian markets. Note; use NEC Class 1 wire with a temperature rating greater than 75 °C. If the cable is to be exposed to a higher temperature, then a higher temperature rating needs to be selected.
9. It is important that the cable screens are connected as shown in order to comply with the electromagnetic compatibility requirements.

10. All external circuits must meet and maintain the requirements of double/reinforced installation as stated in IEC 60364 or equivalent.
11. Additional protection must be provided to prevent accessible parts (e.g. signal circuits) from becoming Hazardous Live if a wire or screw is accidentally loosened or freed. Ensure all wires are secured to at least one other wire from the same circuit. The attachment must be as close to the terminal block as possible but must not apply undue stress on the connection. Example: Use a cable tie to secure the live and neutral wire together. If one wire becomes loose the other wire will prevent it from touching accessible parts.
12. A disconnecting device (switch or circuit breaker) must be included in the building installation. It must:
- Have a rating with sufficient breaking capacity.
 - Be in close proximity to the equipment, within easy reach of the operator, but not fitted in a position that makes it difficult to operate.
 - Disconnect all phase conductors.
 - Be marked as the disconnecting device for the product.
 - Not interrupt a protective earth conductor.
 - Not be incorporated into a mains supply cord.
 - Comply with the requirements for a disconnecting device specified in IEC 60947-1 (Specification for low-voltage switchgear and control gear – General rules) and IEC 60947-3 (Switches, disconnectors, switch-disconnectors and fuse-combination units).
13. See Section 10 - 'Technical information' for terminal and cable specification.

5.2 Mains wiring notes:

1. Read Section 5.1 - 'General wiring notes', before attempting to wire the supply to the product.
2. The wiring connections are identified on the terminal plugs.
3. Fuses must be fitted in all live conductors.
4. Double or reinforced insulation must be maintained between:
 - Hazardous live conductors (mains and relay circuits) and
 - Safety extra low voltages (All other components / connectors / conductors).
5. The wiring diagrams show relays and switches in the **Power off** position.

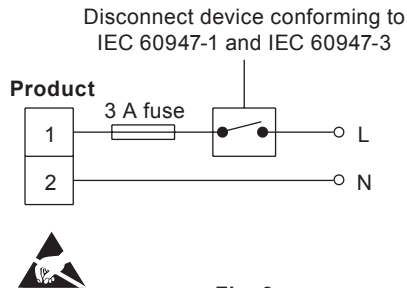


Fig. 3

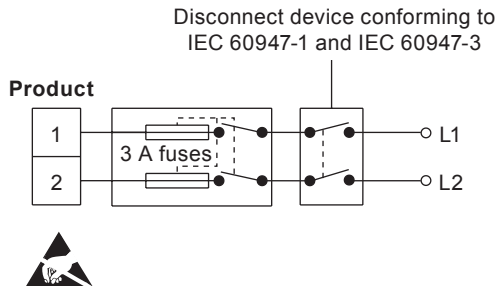


Fig. 4

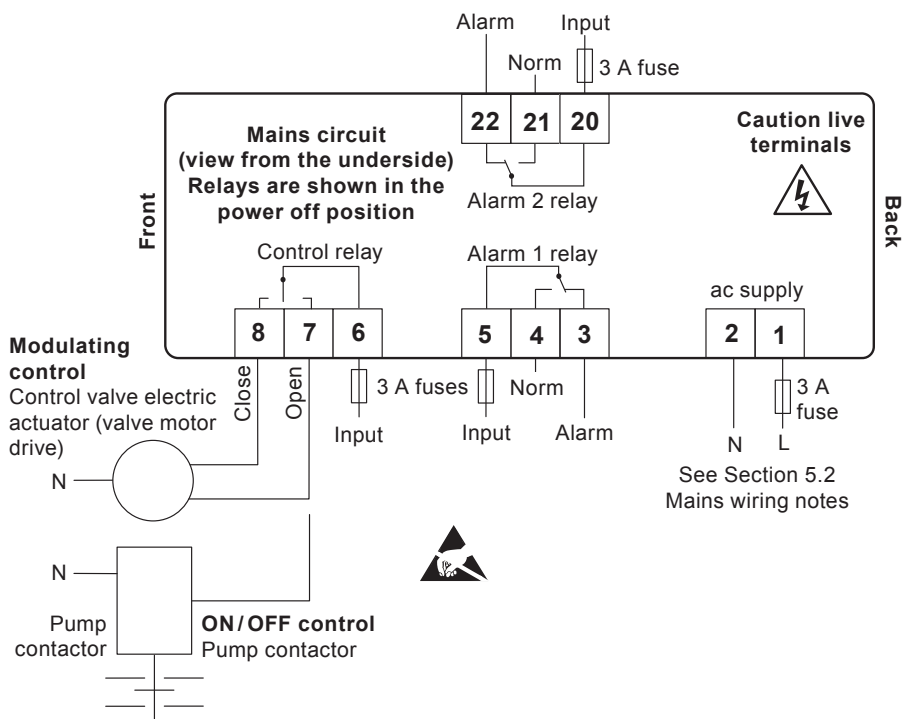


Fig. 5 Mains circuit

5.3 Signal wiring notes

An earth current loop is created if a wire or screen is connected between two earth points that are at different potential (voltage). If the wiring diagram is followed correctly, the screen will only be connected to the earth at one end.

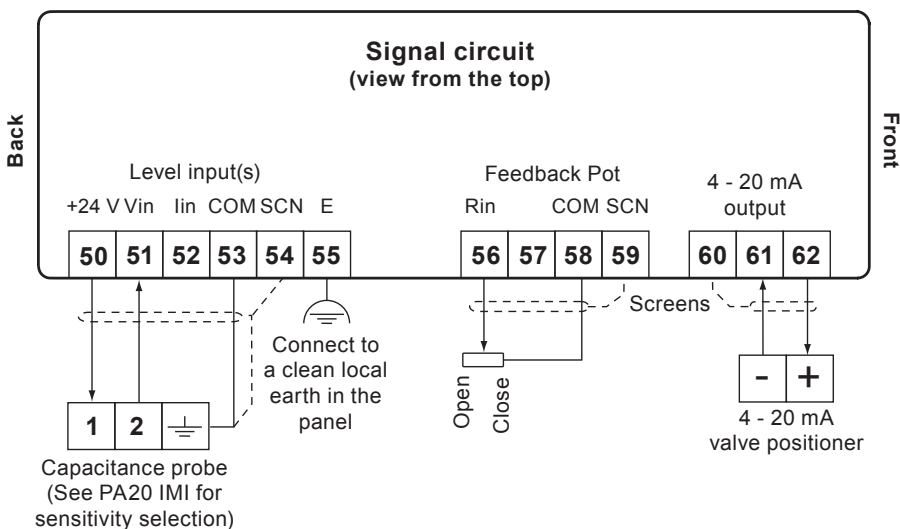
The earth terminal is a functional earth rather than a protective earth.

A protective earth provides protection from electric shock under a single fault condition. This product has double insulation and therefore does not require a protective earth. A functional earth is used in order for the product to operate. In this application, the earth is used as a sink or drain for any electrical interference. The earth terminal must be connected to a local earth in order to conform to the EMC directive.

5.4 Probe wiring

The maximum cable length for all transducers is 100 m (328 ft).

Note: It is essential to select the correct sensitivity on the PA20 preamplifier, (see the PA20 Installation and Maintenance Instructions for details).



Notes:

Do not connect terminal 54 to any other earth

Ensure that the resistance from the probe body to the pipework / boiler shell is less than 1 ohm.

E = Functional earth - connect these pins to a clean earth local to the panel.

Fig. 6 Signal circuit

5.5 Level input options

The level output from a PA20 preamplifier and LP20 capacitance level probe can be 'daisy chained' to more than one instrument (See Figure 7).

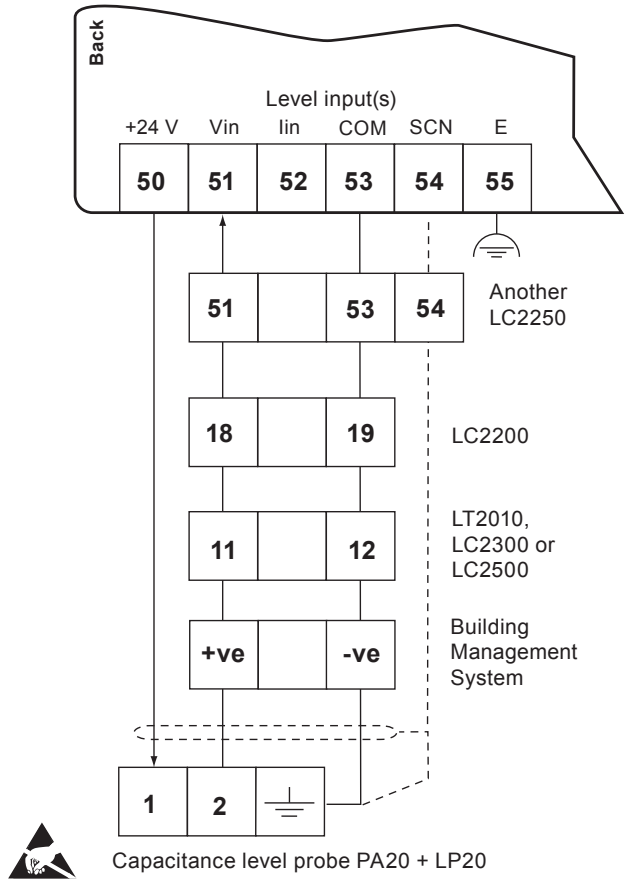


Fig. 7 Multiple controller connection to a PA20 (daisy chained)

Each instrument must be capable of receiving a 1 - 6 Vdc signal. Only one of the instruments needs to provide a 24 V nominal supply. In Figure 7, the product is supplying the power for the capacitance probe.

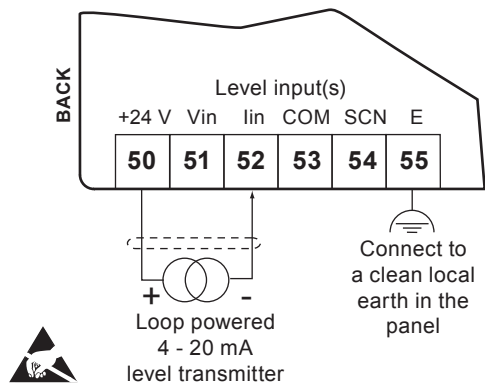


Fig. 8 PA420 4 - 20 mA level transmitter

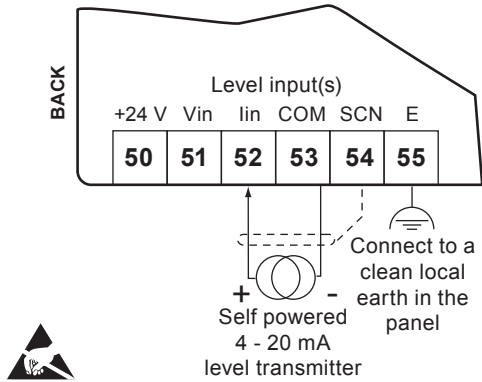


Fig. 9 4 - 20 mA level transmitter

5.6 Wiring diagram for UL version of PA20

For the PA20 preamplifier and the LP20 capacitance probe (see the PA20 and LP20 Installation and Maintenance Instructions).

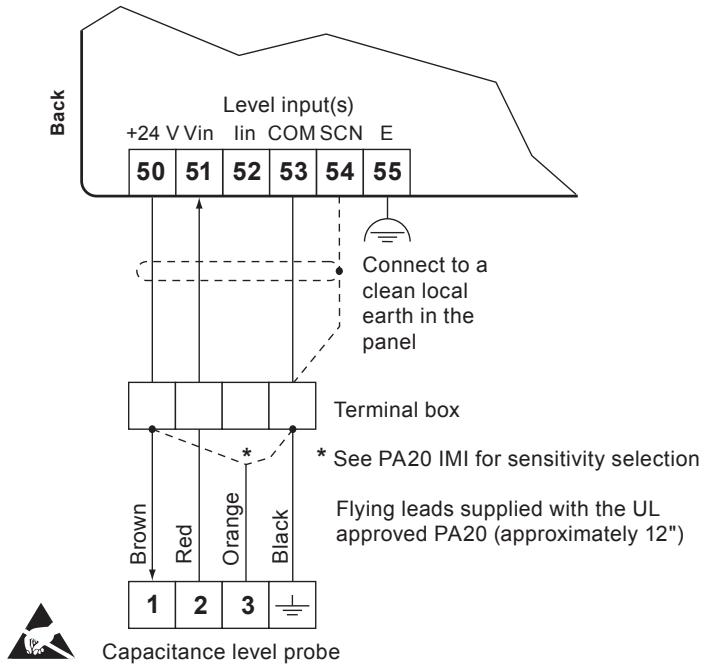


Fig. 10

6. Commissioning

6.1 General information

All commissioning for the product is carried out via the front panel.

WARNING: On entering the commissioning mode the product will cease normal control. The control relay (or 4-20 mA output) will stop the valve or switch off the pump. For safety, the alarm relay(s) will continue to operate as normal. To regain normal control, return to the run menu by selecting 'end'.

WARNING: If during commissioning, the buttons are not pressed for a period of greater than 5 minutes, the controller will revert back to run mode and an error will occur. If the calibration was incomplete the controller may not provide the correct control.

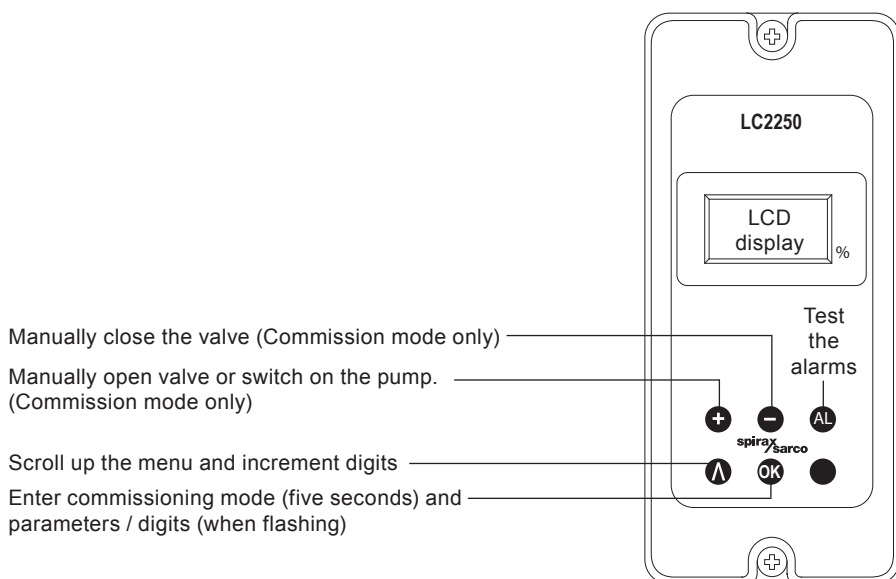


Fig. 11 Display screen and keypad

Please note that the LC2250 has no battery. The programmed settings are held in non-volatile memory (Flash) and are written to after changing a parameter and pressing the **OK** button.

6.2 Manual test buttons

Note: These buttons are not accessible if editing a parameter in commissioning mode. The product will return to the 'end' of the commissioning menu when these buttons are released.

Alarm button

In run mode or commissioning mode, this button can be used to test the alarm relays and the external circuits.

Valve close button

Commissioning mode only -
this button closes the valve (proportional control).

'Valve open' or 'pump on' button

Commissioning mode only -
this button opens the valve (proportional control) or switches on the pump (pump control).

6.3 Enter commissioning

Current legislation states that that in order to prevent tampering and potentially hazardous programming errors, access to the pass codes required to enter commissioning mode should only be available to qualified and trained personnel.

The pass code for commissioning mode is contained in the detachable section at the front of this manual. **This section must be removed after commissioning and kept in a safe, access controlled location.**

6.3.1 Commissioning - quick set-up

This section allows the user to carry out the minimum commissioning necessary to operate the system for two typical applications.

It accepts the defaults set in the factory, so will only work if the original default settings have not been altered. See default settings in Section 10, Technical information, to confirm.

Settings can then be tailored to suit the individual requirements of the customer/application if required.

WARNING: It is essential that you comply with National / local regulations and Guidance notes, and the boiler manufacturer's recommendations. It is imperative that the settings you have accepted will allow the boiler to operate in a safe manner.

Quick set-up

Commissioning examples of two typical steam boiler applications:

Parameter	Action
Lhi	Set water level to top of gauge glass (100%) and press the OK button.
Llo	Set water level to bottom of gauge glass (0%) and press the OK button.
WARNING – WATER LEVEL MUST STILL BE VISIBLE IN THE GAUGE GLASS	

Note: For correct operation level the input and feedback potentiometer should be calibrated.

- **ON /OFF control (pumping in), using an LP20 / PA20.**

High and Low level alarm

CtL	Select on/oFF and press the OK button.
-----	---

- **Modulating control (pumping in) using an LP20 / PA20 and a VMD actuator.**

High and Low level alarm

CtL	Select PrO and press the OK button.
PhI	Potentiometer High – Calibrates the valve to the open position. The valve will open automatically. Press OK when fully open.
PLo	Potentiometer Low – Calibrates the valve to the closed position. The valve will close automatically. Press OK when fully closed.

Test the system is working correctly

6.4 Commissioning - Full

Enter 'commissioning' as stated in Section 2, and follow the main menu structure to make the changes required.

Warning:

The minimum conductivity when used with the LP20/PA20 or PA420 is 5 $\mu\text{S}/\text{cm}$ or 5 ppm.

6.4.1 Main menu structure

INS

Input Select – Selects input for the type of level transducer i.e.:
1 - 6 V (PA20) or 4 - 20 mA (PA420).

INF

Input Filter – 3 settings of water level signal damping to suit turbulent conditions.
Note: excessive delays can cause system instability. 2 seconds, 8 seconds or 16 seconds.

INR

Input Alarm – to warn that the input is out-of-range i.e.:
1 - 6 V (PA20) or 4 - 20 mA (PA420).
Off or On.

AS1

Alarm 1 - Alarm Select – sets the alarm to be a low alarm or a high alarm. hi or Lo.

AP1

Alarm 1 - Alarm level Percentage – Sets the alarm level as a percentage of gauge glass. The hysteresis is fixed at 5%.

AS2

Alarm 2 - Alarm Select – sets the alarm to be a low alarm or a high alarm. hi or Lo.

AP2

Alarm 2 - Alarm level Percentage – Sets the alarm level as a percentage of gauge glass. The hysteresis is fixed at 5%.

ALF

ALarm Filter – Select 'on' to enable an 8 second delay option to avoid over-frequent switching in turbulent conditions.

ALL

ALarm Latch –
Latch Off – alarm will operate only until the level recovers.
Latch On – alarm will continue to operate until reset by entering the alarm reset, passcode or the commissioning menu passcode.
Off or On.

RET

Retransmit – selects 4 - 20 mA or 0 - 20 mA retransmit output signal.
4.20 or 0.20.

dr

drive type – **rel**ay for Valve Motor Drive or **rEt**ransmit for 4 - 20 mA.
rel or rEt (only available when proportional control is selected).

Act

Drive Action – Inverts the output to the actuator, positioner or pump.
Select **In** for fill control, e.g. boiler feedtank.

Select **Out** for empty control, e.g. condensate tank. In proportional mode, whether VMD or 4 - 20 mA, a rising input will give:

If **In** selected – a falling output.

If **Out** selected – a rising output.

Lh I

Level High - Calibrates the unit to 100% of the gauge glass. Set the water level in the boiler or tank to the top of the gauge glass and press the **OK** button. See Figure 11. (On entering the sub-menu the level transducer voltage/current is displayed). To exit without saving the calibration level, press the **▲** button.

LLO

Level Low - Calibrates the unit to 0% of the gauge glass. Set the water level in the boiler or tank to the bottom of the gauge glass and press the **OK** button. See Figure 11. (On entering the sub-menu the level transducer voltage/current is displayed). To exit without saving the calibration level, press the **▲** button.

SP

Set Point – the point from which the control band is generated. It is commonly (though not always) set halfway between the minimum and maximum gauge glass levels.

Cb

Control band - Sets the width of the control band as a percentage of the gauge glass. This is the percentage of the gauge glass over which you wish to control the level – e.g. 20%, as shown in Figure 11.

CtL

Control – **PrO** or on/off (**OI**) ~ On/off or proportional control.

Ph I

Potentiometer High – Calibrates the valve to the open position.

Press **OK** to select the sub-menu. The valve will automatically open.

When fully open press **OK** again to enter the value*.

PLO

Potentiometer Low – Calibrates the valve to the closed position.

Press **OK** to select the sub-menu. The valve will close automatically.

When fully closed, press **OK** again to enter the value*.

End

End – Press the **OK** button to end the commissioning menu.

* **Note:** Only available when proportional control is selected. The valve has a feedback potentiometer that allows the controller to sense the valve position.

PhI and PLO enables calibration of the feedback potentiometer's MIN and MAX position to match the valve.

Note: In the run mode, the end menu does not appear. It may be replaced by an error menu.
See LCD display - Section 2.4.

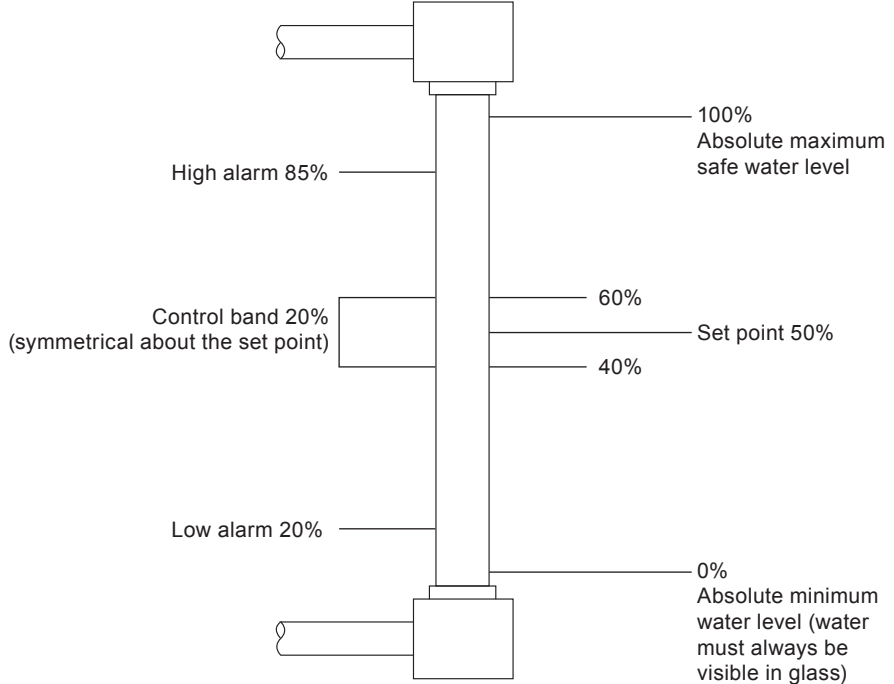


Fig. 12
Typical percentages of level settings in a gauge glass - Consult the boiler manufacturer for their recommendations

6.5 Main menu commissioning notes

6.5.1 Lhi - Level Hi

Calibrates the unit to 100% of the gauge glass.

Set the water level in the boiler or tank to the top of the gauge glass.

Press the  button to select Lhi.

Press the  button to enter the sub-menu.

Press the  button for 3 seconds to enter the value.

6.5.2 LLo - Level low

Calibrates the unit to 0% of the gauge glass.

Set the water level in the boiler or tank to the bottom of the gauge glass.

WARNING: WATER LEVEL MUST STILL BE VISIBLE IN THE GAUGE GLASS.

Press the  button to select LLo

Press the  button to enter the sub-menu.

Press the  button for 3 seconds to enter the value.

7. Communications

Infrared (IR)

All products in the range can communicate via an infrared link between adjacent controllers. It enables the parameters of this product (OEM) to be passed to a product fitted with RS485 (USER).

USER products are fitted with a graphics display and OEM products either have LED's, or three digit displays.

This unit is always an IR slave – no set-up or adjustment is needed.

For further information on Infrared and RS485 communication, see User Installation and Maintenance Instructions.

Important: Do not cover or obstruct the infrared beam between products.

See appendix for further details.

8. Maintenance

Note: Read the 'Safety information' in Section 1 before starting any maintenance.

No special servicing, preventative maintenance or inspection of the product is required.

During installation or maintenance, the rear of the product **must** be protected from environmental pollutants entering the product. Alternatively, the tasks can be performed in a dry clean environment.

Level controls

Boiler water level controls and level alarms, however, do require testing and inspection. General guidance is given in Health and Safety Executive Guidance Notes BG01 and INDG436.

For specific instructions for the Spirax Sarco system please see separate literature.

Cleaning instructions

Use a cloth dampened with tap / de-ionised water or isopropyl alcohol. Use of other cleaning materials could damage the product and invalidate the warranty.

9. Fault finding

WARNING:

Before fault finding read the Safety information in Section 1 and the General wiring notes in Section 5.1.

Please note that there are hazardous voltages present and only suitably qualified personnel should carry out fault finding.

The product must be isolated from the mains supply before touching any of the wiring terminals.

Safety may be compromised if the fault finding procedures are not carried out in line with this manual.

Relay fuses to be replaced by manufacturer or accredited service department.

During installation or maintenance, the rear of the product **MUST** be protected from environmental pollutants entering the product. Alternatively, the tasks can be performed in a dry clean environment.

9.1 Introduction

If for any reason a fault occurs on the product, the instructions in this section will allow the fault to be isolated and corrected. The most likely time for faults to occur is during installation and commissioning. The most common type of fault is wiring.

9.2 System faults

Symptom	Action
1 Display not illuminating	1. Switch off the mains supply to the product. 2. Check all wiring is correct. 3. Check external fuse(s) are intact. Replace if necessary. 4. Check the mains voltage is within specification. 5. Switch on mains supply. If symptoms are still present return the product for examination. Consider the likelihood that the product has been damaged from mains borne surges/spikes. Consider installing an additional ac power line protector between the product and the mains supply. The protector needs to be positioned close to the product to gain full protection.

Symptom	Action
2 Display flashes on and off (1 second approx.)	1. Switch off the mains supply to the product. 2. Disconnect all signal wires. 3. Switch the mains supply on: If symptoms are still present, return the product for examination. 4. Replace each signal wire in turn until the fault occurs. 5. Investigate and rectify any faults in the wiring, external sensors / transducers and modules associated with that connection. Explanation The internal power supply is unable to power up. If the voltages cannot be generated, the power supply switches off for approx. 1 second. The power supply then attempts to power up again. If the fault is still present, the cycle is repeated until the fault is removed. This is a safety feature and does not damage the product.
3 Product powers up for a period of time (greater than 1 minute), then switches off	1. Monitor the mains supply and ensure it is continuous and within the specification limits. 2. Measure the ambient temperature and ensure it less than specified. 3. Investigate symptom 2. Explanation: A re-settable thermal cut - out device will operate if one or more of the following occurs: - The power drawn exceeds the specification. - The input mains voltage is less than specified. - The ambient temperature is more than specified. - The internal power supply will switch off until the products temperature drops below 65 °C. This is a safety feature and does not damage the product.
4 Controller not responding to changes in level	1. LLO-LHI have been set to 100%(causing 0% Pv to be displayed.2) reset level inputs
5 Incorrect number / letter / symbol displayed	1. Press 'OK' for 5 seconds 2. '888' should be displayed 3. Press 'OK' again Explanation: Missing lines indicate a segment failure. This may make readings difficult to interpret or for them to be interpreted incorrectly.

9.3 Operational error messages

Any operational errors that occur will be displayed in the run mode, on the alarms and errors screen.

Error message	Cause	Action
1 Power out	There has been a loss of power to the product during operation.	1. Remove power from product. 2. Check that all wiring is correct. 3. Check that the power supply is secure i.e. does not suffer from 'brown outs'. 4. Reapply power.
2 Set up menu timed out	The operator has entered the commissioning mode and has not pressed a button for 5 minutes or more.	1. Re-enter the commissioning mode if required.
3 Outrange high	The level input signal has increased to above the product specifications.	1. Use a multimeter to check the input currents or voltages do not exceed the product specifications. See input technical data.
4 Outrange low	The level input signal has decreased to below the product specifications.	1. Use a multimeter to check the input currents or voltages do not exceed the product specifications. See input technical data.
5 Alarm 1	A high or low water alarm has occurred.	1. Check the boiler set-up and operation of alarm and boiler water supply systems.
6 Alarm 2	A high or low water alarm has occurred.	1. Check the boiler set-up and operation of alarm and boiler water supply systems.
7 Alarm is latched!	Some errors latch the alarm relay for safety.	1. Enter the commissioning (setup) mode. If the correct password or alarm reset code is entered all the latched alarms will be cleared.

10. Technical information

10.1 For technical assistance

Contact your local Spirax Sarco representative. Details can be found on accompanying order/delivery documentation or on our web site: **www.spiraxsarco.com**

10.2 Returning faulty equipment

Please return all items to your local Spirax Sarco representative. Please ensure all items are suitably packed for transit (preferably in the original cartons).

Please provide the following information with any equipment being returned:

1. Your name, company name, address and telephone number, order number and invoice and return delivery address.
2. Description and serial number of equipment being returned.
3. Full description of the fault or repair required.
4. If the equipment is being returned under warranty, please indicate:
 - Date of purchase.
 - Original order number.

10.3 Power supply

Mains voltage range	110 V to 240 V at 50/60 Hz
Power consumption	7.5 W maximum

10.4 Environmental

General	Indoor use only	
Maximum altitude	2 000 m (6 562 ft) above sea level	
Ambient temperature limits	0 - 55 °C (32 - 131°F)	
Maximum relative humidity	80% up to 31 °C (88°F) decreasing linearly to 50% at 40 °C (104°F)	
Overvoltage category	III	
	2 (as supplied)	
Pollution degree	3 (when installed in an enclosure) - Minimum of IP54 or UL50 / NEMA Type 3, 3S, 4, 4X, 6, 6P or 13. See Section 4, Mechanical installation.	
Enclosure rating (front panel only)	NEMA type 4 hose down only (UL approval), and IP65 (verified by TRAC Global)	
Torque rating for panel screws	1 - 1.2 Nm	
LVD (safety)	Electrical Safety EN 61010-1 UL61010-1, 3rd Edition, 2012-05 CAN/CSA-C22.2 No. 61010-1, 3rd Edition, 2012-05	
EMC	Immunity/ Emissions	Suitable for heavy industrial locations
Enclosure	Material	Polycarbonate
Front panel	Material	Silicone rubber, 60 shore.
Solder	Tin/lead (60/40%)	

10.5 Cable/wire and connector data

Mains and signal connector

Termination	Rising clamp plug-interterminal blocks with screwed connectors
Cable size	0.2 mm ² (24 AWG) to 2.5 mm ² (14 AWG)
Stripping length	5 - 6 mm

Caution: use only the connectors supplied by Spirax Sarco Ltd. Safety and Approvals may be compromised otherwise.

Level probe and feedback cable / wires

Type	High temperature
Shield type	Screened
Number of cores	3
Gauge	1 - 1.5 mm ² (18 - 16 AWG)
Maximum length	100 m (328 ft)
Recommended type	Pirelli (Prysmian) FP200, Delta Crompton Firetuf OHLS

4 - 20 mA output cable / wires

Type	Twisted pair
Shield type	Screened
Number of pairs	1
Gauge	0.23 - 1 mm ² (24 - 18 AWG)
Maximum length	100 m (328 ft)
Recommended type	Various

10.6 Input technical data

Level voltage

Minimum voltage	0 Vdc or 1 V (with OUTRANGE function selected)
Maximum voltage	6 Vdc (absolute maximum = 7 Vdc)
Input impedance	28 k Ω
Accuracy	5% FSD over operating range
Repeatability	2.5% FSD over operating range
Resolution	14 bit (0.15 mV approx)
Sample time	260 Hz

4-20 mA(s)

Minimum current	0 mA
Maximum current	22 mA
Input impedance	110 Ω
Accuracy	5% FSD over operating range
Repeatability	2.5% FSD over operating range
Resolution	14 bit (1 μ A approx)
Sample time	260 Hz

Level 'out of range' alarm - voltage

Minimum alarm level	< 0.2 Vdc
Minimum recovery level	> 1 Vdc
Maximum alarm level	> 6.5 Vdc
Maximum recovery level	< 6 Vdc

Level 'out of range' alarm - current

Minimum alarm level	< 2.5 mA
Minimum recovery level	> 4 mA
Maximum alarm level	> 21 mA
Maximum recovery level	< 20 mA

10.7 Output technical data

24 Vdc supply

Maximum voltage	26.4 Vdc
Maximum current	25 mA
Ripple voltage	10 mV @ 264 V, full load

4 - 20 mA

Minimum current	0 mA
Maximum current	20 mA
Open circuit voltage (maximum)	19 Vdc
Resolution	0.1% FSD
Maximum output load	500 ohm
Isolation	100 V
Output rate	10 / second

Relay(s)

Contacts	2 x single pole changeover relays (SPCO)
Voltage ratings (maximum)	250 Vac
Resistance load	3 amp @ 250 Vac
Inductive load	1 amp @ 250 Vac
ac motor load	¼ HP (2.9 amp) @ 250 Vac
	1/10 HP (3 amp) @ 120 Vac
Pilot duty load	C300 (2.5 amp) - control circuits / coils
Electrical life (operations)	3 x 10 ⁵ or greater depending on load
Mechanical life (operations)	30 x 10 ⁶

Infrared

Physical layer	IrDA
Baud	38400
Range	10 cm
Working angle	15°
Eye safety information	Exempt from EN 60825-12: 2007 safety of laser products - does not exceed the accessible emission limits (AEL) of class 1

10.8 Programming parameters/default settings

The default settings in this table are used in the 'quick start' guide - See Section 6.3.1.

InS - Input Select

Ranges	1-6 or 4.20
Default	1-6
Units	Vdc or mA

InF - Input Filter

Ranges	2, 8 or 16
Default	2
Units	Seconds

InA - Input Alarm (Out-of-range)

Ranges	OFF or ON
Default	OFF

AS1 - Alarm 1 select

Ranges	Hi or Lo
Default	Hi

AP1 - Alarm 1 percentage (of gauge glass)

Ranges	5 – 100 (high alarm) or 0 – 95 (low alarm)
Default	85 (high alarm) or 20 (low alarm)
Resolution	1
Units	%

AS2 - Alarm 2 select

Ranges	Hi or Lo
Default	Lo

AP2 - Alarm 2 percentage (of gauge glass)

Ranges	5 – 100 (high alarm) or 0 – 95 (low alarm)
Default	85 (high alarm) or 20 (low alarm)
Resolution	1
Units	%

ALF - Alarm Filter - Applies to Alarm 1 and Alarm 2

Ranges	OFF or ON
--------	-----------

Default	OFF
---------	-----

ALL - Alarm Latch - Applies to Alarm 1 and Alarm 2

Ranges	OFF or ON
--------	-----------

Default	OFF
---------	-----

rEt - Retransmit

Ranges	4 - 20 mA or 0 - 20 mA
--------	------------------------

Default	4 - 20 mA
---------	-----------

dr - Drive

Ranges	rel (relay) or ret (retransmit)
--------	---------------------------------

Default	rel (relay)
---------	-------------

ACt - Action

Ranges	In (reducing) or Out (incrementing)
--------	-------------------------------------

Default	In (reducing) with rising level
---------	---------------------------------

SP - Set Point

Ranges	3 – 97 (Interactive with control band)
--------	--

Default	50
---------	----

Resolution	1
------------	---

Units	%
-------	---

Cb – Control band

Ranges	5 - 100 (Interactive with SP.)
--------	--------------------------------

Default	20
---------	----

Resolution	1
------------	---

Units	%
-------	---

CtL – Control

Ranges	On/Off or Pro (proportional)
--------	------------------------------

Default	Pro
---------	-----

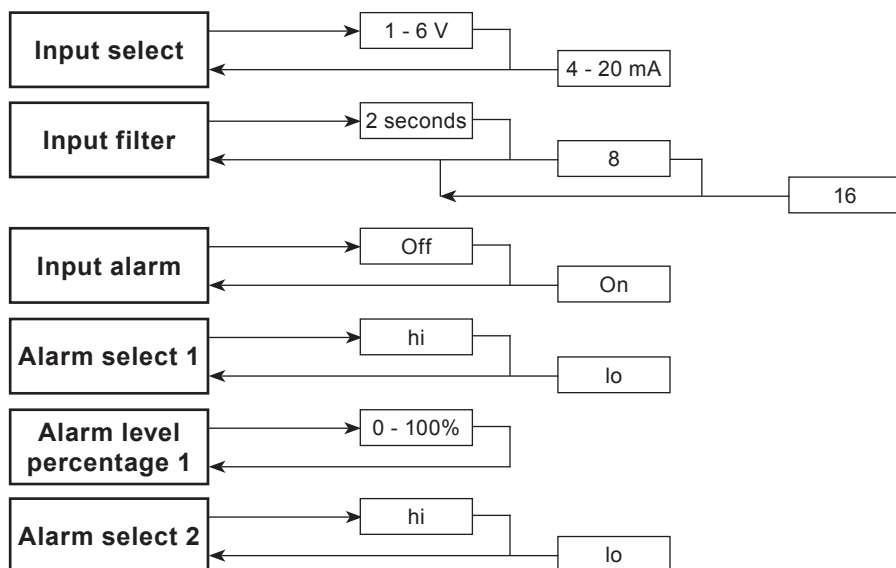
11. Appendix - Data Registers

Parameters and register data

Register	Level parameters
0	4 (Identity)
1	Process variable (PV) - Water Level (%)
2	Set point (SP)
3	Control band (CB)
4	Alarm 1
5	Alarm delay
6	Alarm 2
7	-
8	-
9	-

The format of the register data is 16 bit integer, with the most significant byte transmitted first.

12. Menu map



Continued on page 43

Continued from page 42

