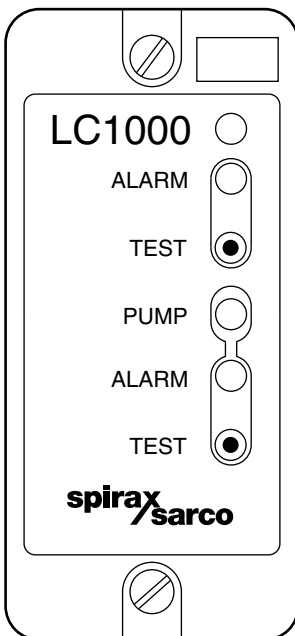


LC1000**Level Controller****Installation and Maintenance Instructions**

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1. General safety information

Your attention is drawn to the relevant Supplementary Safety Information sheet supplied with the product as well as to any National or local regulations.

Safe operation of the product depends on it being properly installed, commissioned and maintained by a qualified person in compliance with the operating instructions.

It is essential to comply with general installation and safety instructions for pipeline and plant construction, as well as to make proper use of tools and safety equipment.

The product is designed and constructed to withstand the forces encountered during normal use. Use of the product for any other purpose, or failure to install the product in accordance with these Installation and Maintenance Instructions, could cause damage to the product, will invalidate the CE marking, and may cause injury or fatality to personnel.

Additional Safety Notes:

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 PM5 in the UK).
- The requirements of Approvals Authorities.
- Boiler Insurance Companies and their Inspectors.
- 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. Circuitry must be designed and wired to 'fail-safe'.

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.

Warning

Isolate the mains supply before unplugging the controller since hazardous voltages will be exposed on the controller base. This product complies with the requirements of Electromagnetic Compatibility Directive 89/336/EEC by meeting the standards of:

- BS EN 50081-1 (Emissions) and
- BS EN 61000-6-2 (Immunity).

The following conditions should be avoided as they may create interference above the limits specified in BS EN 61000-6-2 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.

If this product is not used in the manner specified by this IMI, then the protection provided may be impaired.

2. Application

The LC1000 is a two channel level controller for use with conductivity level probes in conductive liquids. The controller is suitable for use with virtually all qualities of industrial waters from condensate or boiler water to salt solutions, and can be used in water with an electrical conductivity as low as 10 $\mu\text{S}/\text{cm}$.

The LC1000 has two sensitivity levels and a wave filter function which allow it to give a precise response under the very different conductivity and turbulence conditions found in tanks and high output boilers.

Both functions are switch selectable.

The controller needs to be set up before installation to suit the mains supply voltage and to provide the required level control and level alarm functions. See 'Setting up the Controller'. Configuration labels are provided for the controller front panel and enclosure chassis plate.

Probe tips are energised with a voltage of less than 3 Vac when exposed, almost zero when immersed.

3. Installation

WARNING:

Isolate the mains supply before unplugging the controller since hazardous voltages will be exposed on the controller base.

To unplug the controller from its base, undo the two retaining screws and pull the controller straight forwards. Rocking the controller in the vertical plane will ease removal.

The controller should be installed in an enclosure or control panel to provide environmental protection. Spirax Sarco can provide suitable metal or plastic enclosures.

The controller may be mounted on a 'top hat' DIN rail using the clip provided or the clip can be removed and the controller base screwed directly to a chassis plate.

Caution: Allow 15 mm spacing between multiple units for air circulation.

The controller is for installation category II (Overvoltage category) and must be installed in accordance with IEC 60364 or equivalent. The controller and all connected circuits must have a common isolation system which meets the relevant requirements of IEC 60947-1 and IEC 60947-3 or equivalent. This must be positioned close to the controller and clearly identified as the disconnect device.

A quick blow 3 amp external fuse must be fitted in all phases of the controller and relay supply. The relays are rated at 250 Vac 3 A and must be on the same phase as the controller supply.

Note:- the wiring diagrams (Section 5) show all relays in the power off position.

Screened cable is required for the probe. To comply with EMC requirements use Pirelli FP200 or Delta Crompton OHLS, 1 mm². The same type of cable may be used for the mains wiring. Connect the screens as shown in the wiring diagrams (Section 5).

If this product is not used in the manner specified in this IMI, then the protection provided may be impaired.

Maximum ambient temperature	55°C	(131°F)
Minimum ambient temperature	0°C	(32°F)
Indoor use only		
Altitude up to	2 000 m	(6 561 ft)
Humidity	Maximum relative humidity 80% for temperature up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).	
Protection rating	IP40	
Maximum cable length (controller to probe)	30 m	(98 ft)

4. Setting up the controller

4.1 Setting up the controller

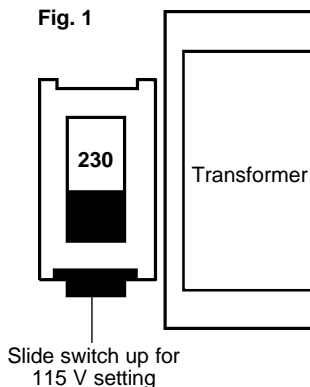
The controller is set up as follows:

- 230 V mains supply
- High water level alarm
- Low sensitivity
- Wave filter off
- Pumping-in control

4.2 To change the mains supply voltage:

- Loosen the two cover clamping screws.
- Unplug the controller from its base.
- Remove the rear cover panel.
- Slide out the printed circuit board assembly.
- Move the voltage selection switch to 115 V.
- Replace the printed circuit board assembly.
- Replace the rear cover panel.
- Plug the controller into the base.
- Tighten the cover screws.

Fig. 1



The controller is suitable for operations at the following voltages:

Mains supply voltage	230 V setting	198 V - 264 V
	115 V setting	99 V - 132 V
Frequency		50 - 60 Hz
Maximum power consumption		6 VA
Fuse type	20 mm Cartridge, 100 mA anti-surge (T)*	
	Earlier units - Plug in, TR5, 100 mA anti-surge (T)**	

* Spare 100 mA 20 mm cartridge fuses (set of 3) may be obtained from Spirax Sarco - quote Stock no. 4033380.

** Spare 100 mA TR5 plug-in fuses for earlier units are also obtainable - Stock No. 4025780 (set of 3).

4.3 To change the control and alarm functions:

- Unplug the controller from its base.
- Remove the rear cover panel.
- Slide out the printed circuit board.
- An 8-way switch on the printed circuit board determines the controller functions.
- Set the switches to the positions shown on the wiring diagrams for the chosen duties .
- Replace the printed board.
- Ensure that the LED's and test switches engage with the holes in the front panel.
- Replace the rear cover panel.

4.4 Probe sensitivity setting - switches 1 and 2

The controller is supplied set to low sensitivity, for steam boilers, with switches 1 and 2 ON. The controller will work with all conductivities down to 100 $\mu\text{S}/\text{cm}$ in this mode.

If it is thought that the conductivity could ever fall below this level, (e.g. for applications such as tanks, hot water boilers and condensate return), set switches 1 and 2 to OFF, as a higher sensitivity is required. The controller will operate correctly with a minimum water conductivity of 10 $\mu\text{S}/\text{cm}$ in this mode.

4.5 Wave filter - switches 5 and 6

This feature provides a delayed response for high output boilers where waves and high turbulence may otherwise cause over-frequent switching of the controller output relays. If the wave filter is required, set switches 5 and 6 to ON.

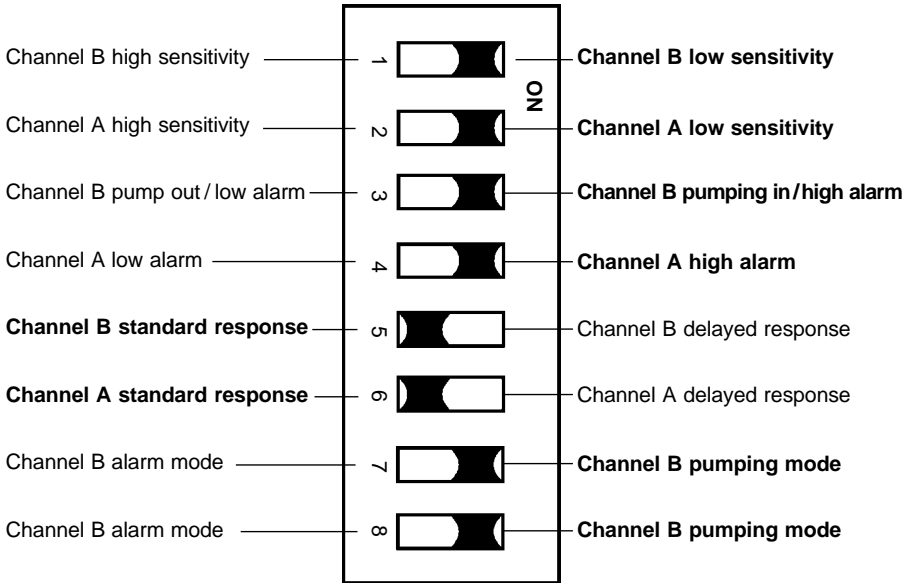


Fig. 2 The LC1000 is supplied with the switch settings set as shown in bold

5. Wiring diagrams

5.1 Screen connection

An earth current loop is created if a wire or screen is connected between two earth points, which are at different potential (voltage). If the instructions are followed correctly, then the probe and controller screen will only be connected to the earth at one end.

Note: 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 a 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 (tank/boiler shell) is used as the common of the probe. It also provides a sink/drain for any electrical interference.

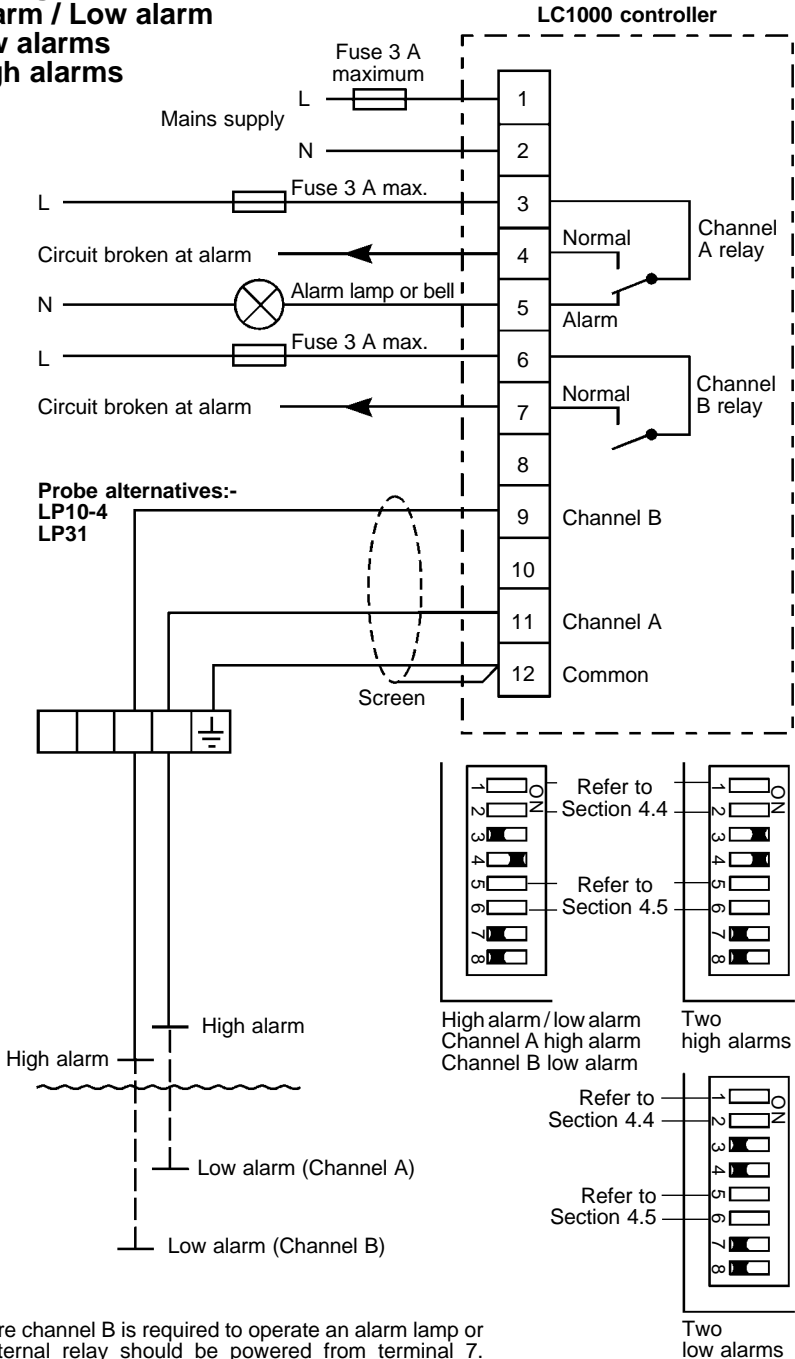
Ensure that the screen is connected to the earth terminal of the probe and to the common terminal of the controller.

The common terminal of the controller must only be earthed via the probe.

CAUTION:

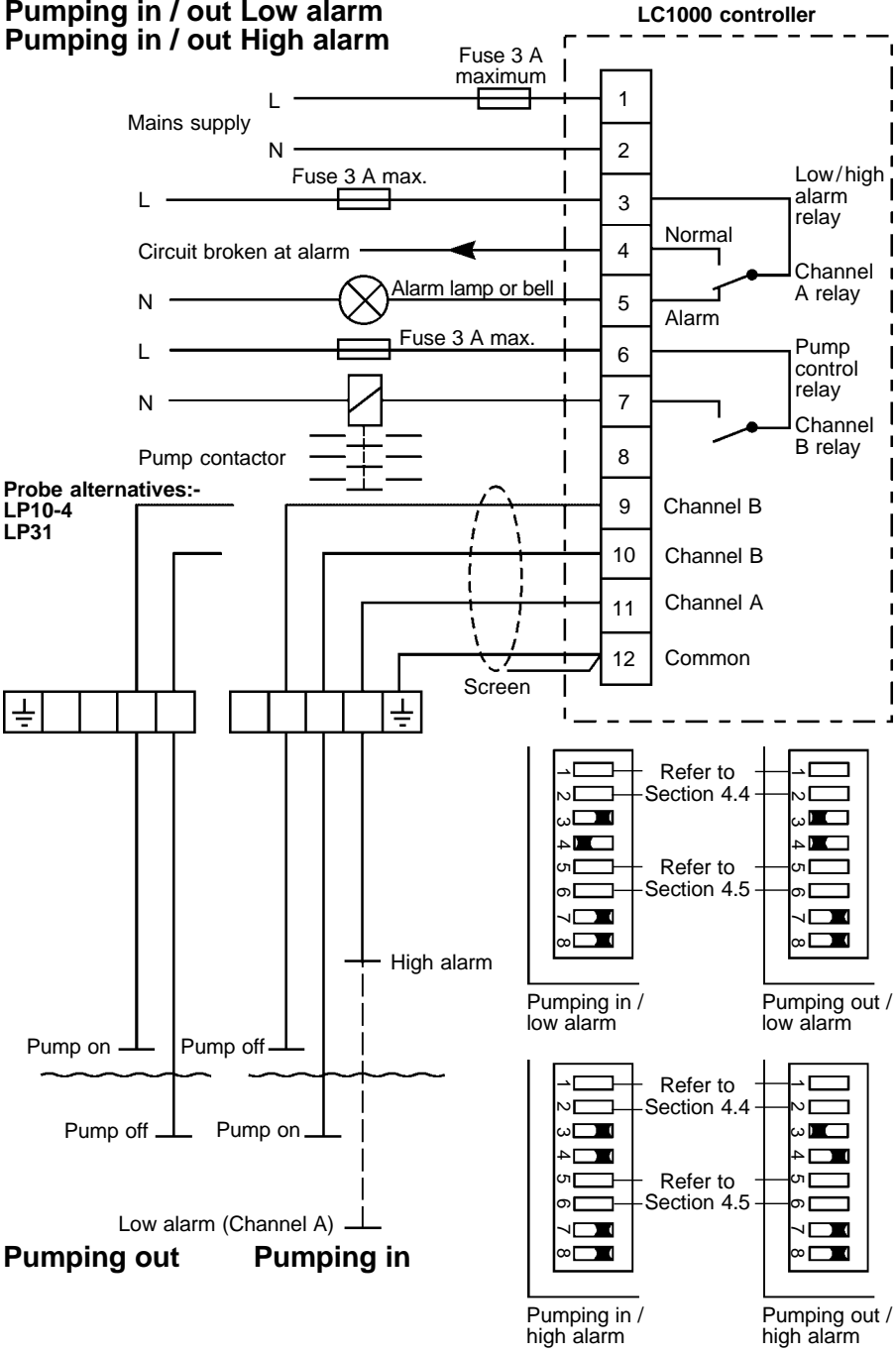
Do not connect the common terminal to an earth local to the controller. To do so may induce an earth current loop, which may reduce the performance or damage the product.

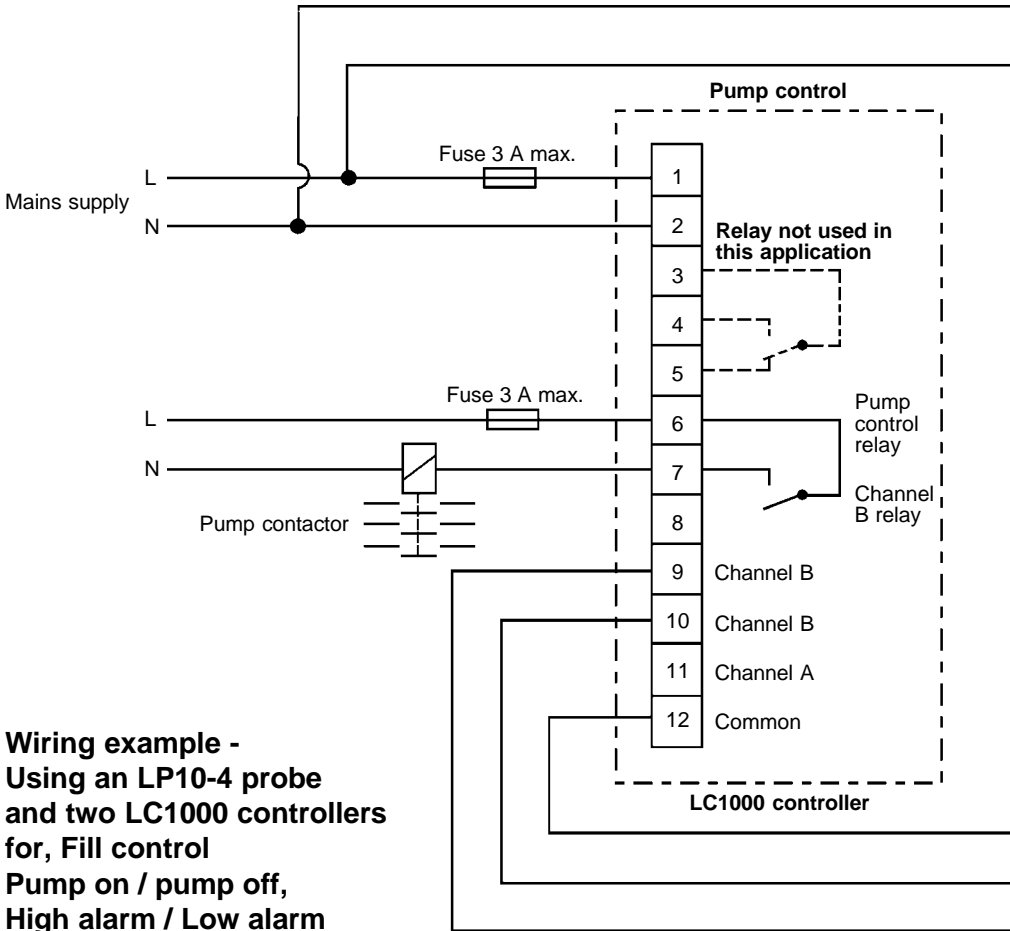
**Wiring diagram -
High alarm / Low alarm
Two low alarms
Two high alarms**



Note: Where channel B is required to operate an alarm lamp or bell an external relay should be powered from terminal 7.

Wiring diagram - Pumping in / out Low alarm Pumping in / out High alarm

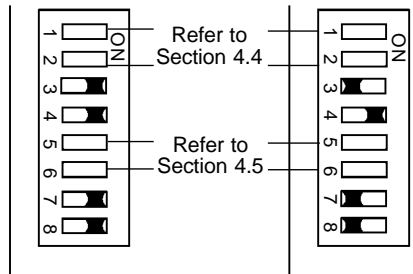


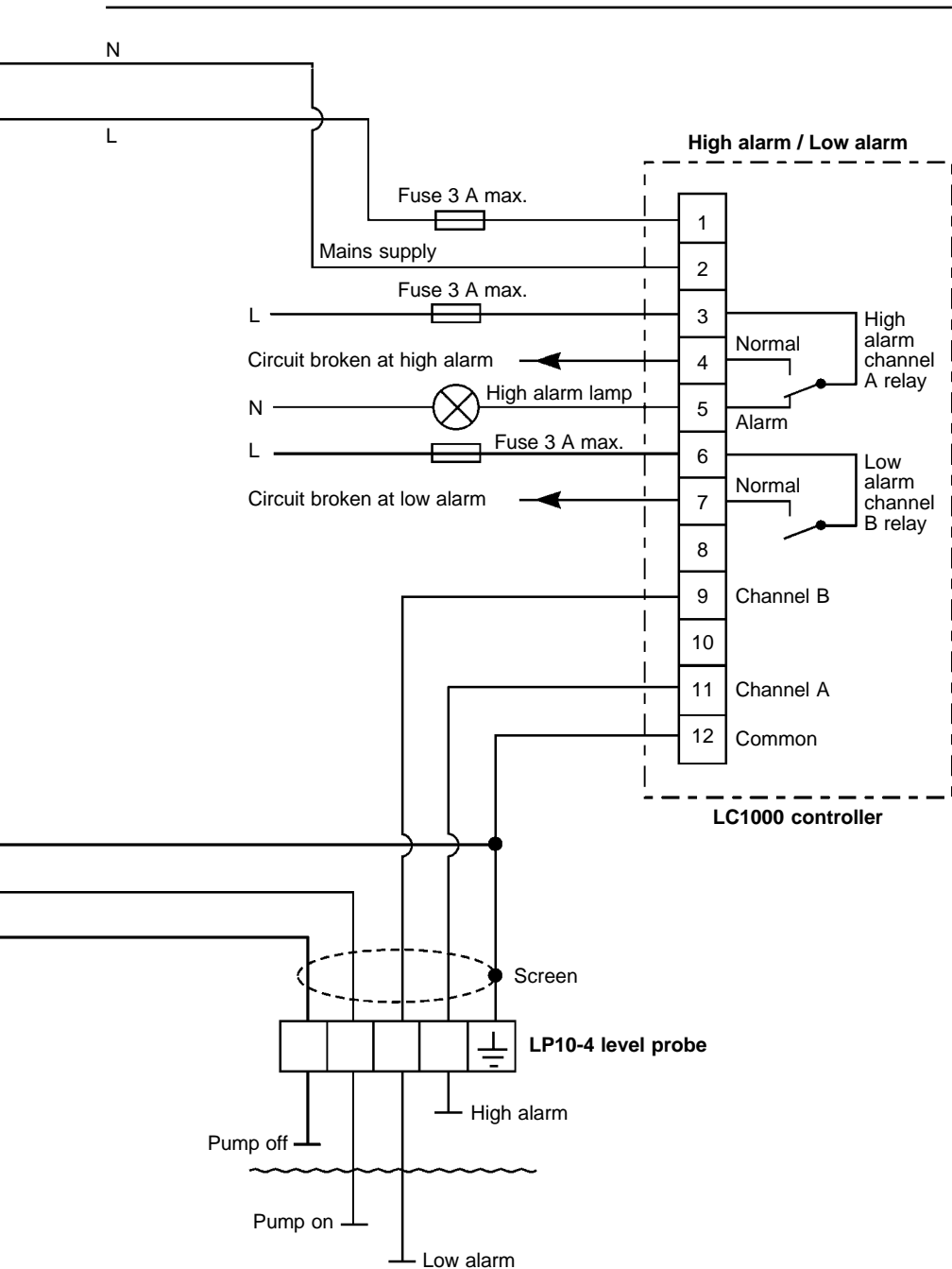


**Wiring example -
Using an LP10-4 probe
and two LC1000 controllers
for, Fill control
Pump on / pump off,
High alarm / Low alarm**

WARNING
Mains supply to both controllers must be on the same phase and wired live to live (terminals 1 and 1) and neutral to neutral (terminals 2 and 2). The connections must not be reversed.

Note: Pump controller Channel A must be set to 'High Alarm' (DIL switch 4 ON) in order to switch off the red LED.





6. *Wiring diagram note*

The wiring diagrams show water level control using a pump. Alternatively, a normally-closed solenoid valve could be used, wired to controller terminal 7.

WARNING

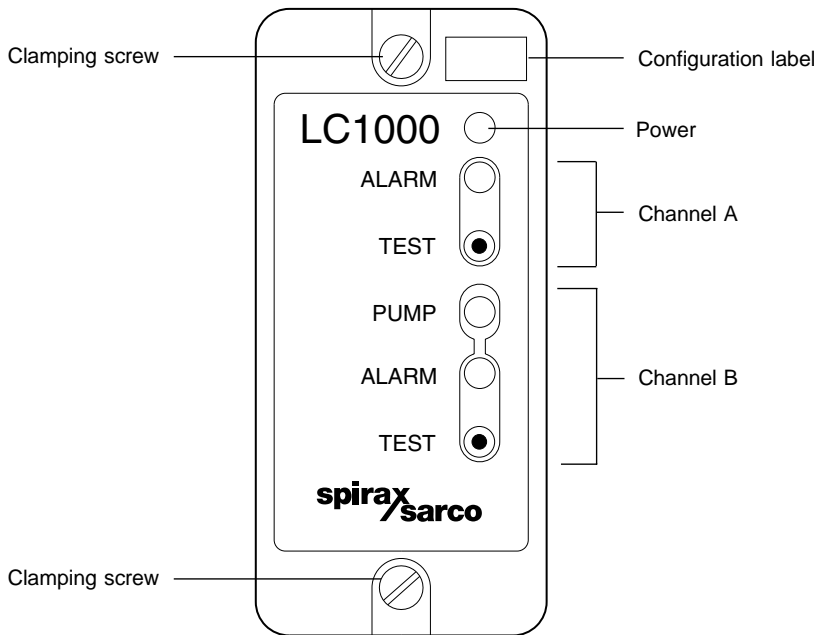
When two LC1000 controllers are connected to an LP10-4, it is essential that not only the mains wiring is on the same phase, but that live is wired to live (terminals 1 and 1) and neutral to neutral (terminals 2 and 2) on both controllers.

7. *Commissioning*

Control and alarm levels are set by cutting the probe tips to length. For details see the probe instructions.

To commission the controller proceed as follows:-

1. Ensure the controller is set up for the correct functions and mains supply voltage.
2. Alter the water level in the tank or boiler so that it is at a normal level.
No alarms should be indicated.
3. Press and hold in the test button for each alarm channel in turn.
The test button simulates an alarm condition.
Check that the relevant LED lights on the controller and that any associated alarm or control circuit operates correctly.
4. Alter the water level to the high and/or low level condition(s).
Check that the associated alarm circuit operates.
5. Alter the water level to the pump-on level.
Check that the pump starts and continues to run until the pump-off level is reached.



8. Maintenance

No special servicing or maintenance of the controller is necessary. Boiler water level controls and level alarms, however, do require regular testing and inspection. General guidance is given in Health and Safety Executive Guidance Note PM5. For specific instructions for the Spirax Sarco system please see separate literature.

9. Fault finding

9.1 Check the controller as follows:-

- a. An immersed tip may be simulated by shorting its controller terminal (9, 10 or 11) to the earth terminal (12). This should cause a high alarm to be signalled or a low alarm to go to normal.
- b. An exposed tip may be simulated by ensuring that its controller terminal (9, 10 or 11) is open circuit, i.e. not shorted to the earth terminal (12). Open circuit should cause a low alarm to be signalled or a high alarm to go to normal.

Note: When a low alarm tip is exposed, or a high alarm tip is immersed there will be a short delay before the alarm is signalled.

9.2 In the case of problems the following checklist may be helpful:-

- a. **Mains-on lamp not lit:**
 - No live supply.
 - Neutral not connected.
 - Internal controller fuse blown, or not plugged in correctly.
- b. **High alarm on continuously or low alarm will not come on:**
 - Probe cable short to earth.
 - Internal short to earth in probe.
 - Insulation resistance breakdown in probe.
Insulation resistance should be greater than 1 M Ω .
 - Probe tip touching earth.
- c. **Low alarm on continuously or high alarm will not come on:**
 - Probe cable open circuit.
 - Internal open circuit in probe.
 - Probe tip insulated by coating.
 - Tip sleeving not cut back.
 - Water conductivity too low .
 - Probe body not properly earthed to tank.
 - Earth return to controller open circuit.
- d. **Pump controlling on a single tip:**
 - Probe cables shorted together.
 - Internal short in probe.
 - Probe tips touching.
 - Long and short tips wired incorrectly.
 - Probe body not earthed to tank.

Check the mains supply voltage is lower than 264 V, and that the ambient temperature inside the control panel is less than 55°C (131°F). If either of these limits has been exceeded, it is possible that the transformer internal thermal fuse has blown, and that the transformer will need to be replaced.