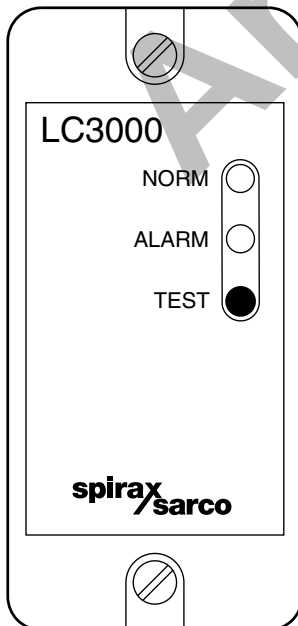


LC3000**Level Controller****Installation and Maintenance Instructions**

1. *General safety information*
2. *General product information*
3. *Installation*
4. *Setting up the controller*
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6. *Commissioning*
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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 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. If the high water alarm is a limiter, the relays must interrupt and lockout the energy supply at high water 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:

- EN 61326 : 1997 A1 + A2 Emissions Class A equipment Table 4.
- EN 61326 : 1997 A1 + A2 Immunity for Industrial locations Annex A1.

The following conditions should be avoided as they may create interference above the limits specified in EN 61326 (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.

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

2. General product information

The Spirax Sarco LC3000 is an advanced level controller with built in cyclic self-testing facilities. It is designed for use with high or low level, self-monitoring, high integrity level probes to provide water level alarms in steam and hot water boilers. The LC3000 is a dual voltage unit (UL /FM version 120 V only) with LED indication of the following conditions:-

Green	Normal	Level correct
Red	Level alarm	Boiler water low/high

An automatic cyclic test of the probe, probe cable and controller is carried out every few seconds by internally simulating a fault in the probe.

A test button is fitted so that a full test of the probe, controller, and associated circuits can be carried out. Provision is made for the wiring of a remote test button if required.

In most countries, steam boilers operating with limited supervision require two self-monitoring level probes and controllers to provide two independent low level alarms. A high level alarm is also advised, and is compulsory in some countries.

Minimum conductivity (when used with an LP30 probe)	30 μ S/cm or 30 ppm	
Maximum ambient temperature	55°C	(131°F)
Minimum ambient temperature	0°C	(32°F)
Pollution degree	2	
Overvoltage category	II	
Indoor use only		
Altitude up to	2 000 m (6 561.5 ft)	
Humidity	Maximum relative humidity 80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F).	
Protection rating	IP40	
Mains supply voltage	230 V setting (not available with UL/FM version) 198 V - 264 V	
	115 V setting (120 V UL/FM version) 99 V - 132 V	
Frequency	50 - 60 Hz	
Fuse type	20 mm cartridge, 100 mA anti-surge (T). For the UL/FM version, replacement fuses must be UL recognised to maintain the integrity of the approval.	
Maximum power consumption	6 VA	
Maximum cable length (controller to probe)	50 m	(164 ft)
Terminal torque rating	1 N m	(9 lbf in)

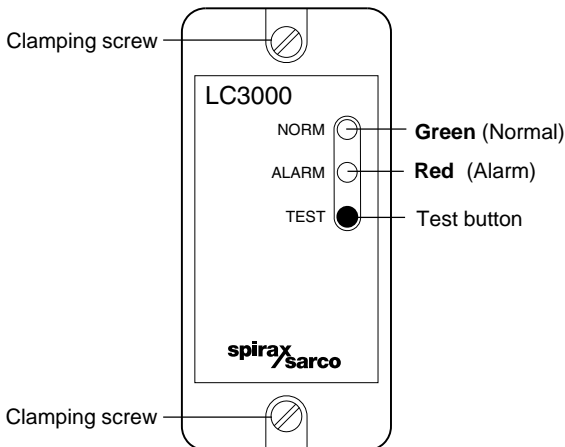


Fig. 1

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 must be installed in a suitable industrial control panel or fireproof enclosure to provide impact and environmental protection (pollution degree 2). Spirax Sarco can provide suitable metal or plastic enclosures (for standard controller only).

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. For the US and Canadian markets the controller must be wired in accordance with the National and Local Electrical Code (NEC) or Canadian Electrical Code (CEC). 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 3A external fuse must be fitted in all phases of the controller and relay supply. The relays must be on the same phase as the controller supply. See notes on wiring diagram.

Cabling should be installed in accordance with BS 6739 - Instrumentation in Process Control Systems: Installation design and practice or local equivalent.

Note: Screened high temperature, 4 core, 1 mm² (18-16 AWG) cable is required for the probe wiring. For the UL/FM version, NEC class I wiring with a minimum temperature rating of 75°C (167°F) must be used. If the cable is to be exposed to a higher temperature, then a suitable temperature rating will need to be selected. For the standard version a suitable cable is Pirelli FP200 or Delta Crompton Firetuf OHLS. The same type of cable may be used for the mains wiring. Connect the screens as shown in the wiring diagrams (Section 5).

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

Relay rating table:

Version	Relay load type	Rating
Standard	Resistive at 250 Vac	2.5 A
	Inductive at 250 Vac	1 A
UL/FM version	Pilot duty at 120 Vac only	1 A

4. Setting up the controller

The controller is supplied with the mains selection switch set to 230 V for the standard version (UL/FM version 120 V only - The supply voltage is not selectable).

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.

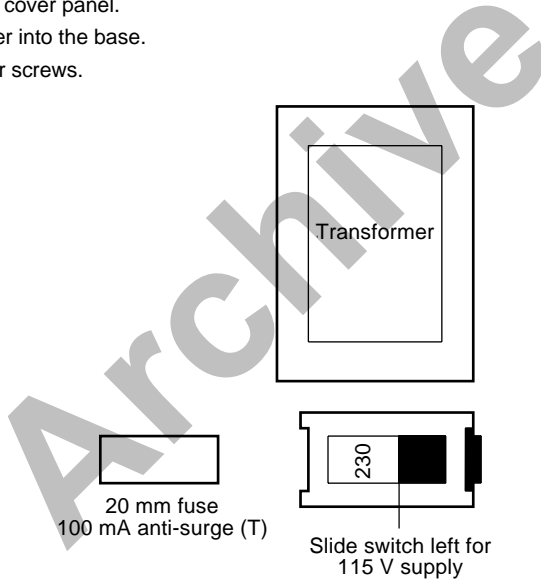


Fig. 2

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).

Spirax Sarco boiler controls do not have an internal connection to earth. The controller is connected to earth via the LP30/LP31. The screen and the earth wire are only connected at one end of the system, i.e. at the LP30/LP31 earth terminal.

Note: The LP30/LP31 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 (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 terminal 12 of the LC3000 and to the earth terminal of the LP30/LP31.

The LC3000 (terminal 12) is only earthed via the LP30/LP31.

CAUTION:

Do not connect terminal 12 of the controller to an earth. To do so may induce an earth current loop, which may reduce the performance or damage the product.

5.2 Wiring diagram notes

The controller should normally be powered through the boiler panel control fuse, so that terminal 1 is live whenever the boiler plant is switched on.

An optional test button may be wired in as shown. This is useful if the controller is installed in a locked enclosure and it is required to simulate a low or high water level condition for test purposes. All relays are shown in the power off position.

The terminals are suitable for two 1.5 mm² or 16 AWG cables (maximum).

LP30 and LP31 UL/FM probes only

The LP30 and LP31 UL/FM probes are supplied with four 18 AWG, 12" long colour coded flying leads. These are to be cut to length and connected to a suitable metal terminal box. A length of flexible metal conduit is required between the probe and the terminal box to provide environmental protection and easy electrical connection. The cable socket is provided with a 1/2" NPT conduit adaptor for this purpose. See LP30 and LP31 IMI for further details.

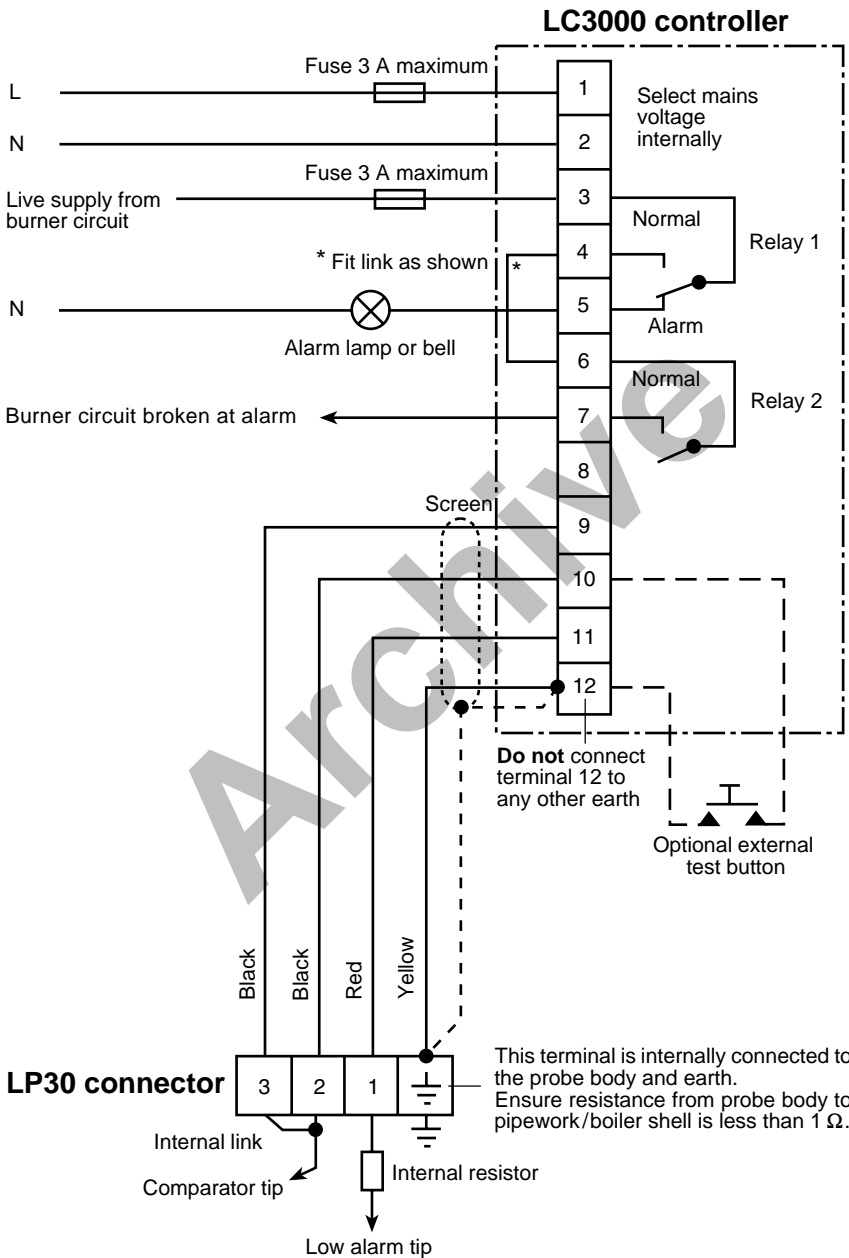


Fig. 3 See Page 8, Figures 4, 5 and 6 for other probe wiring details.

Detail showing wiring of the LP31 for high alarm

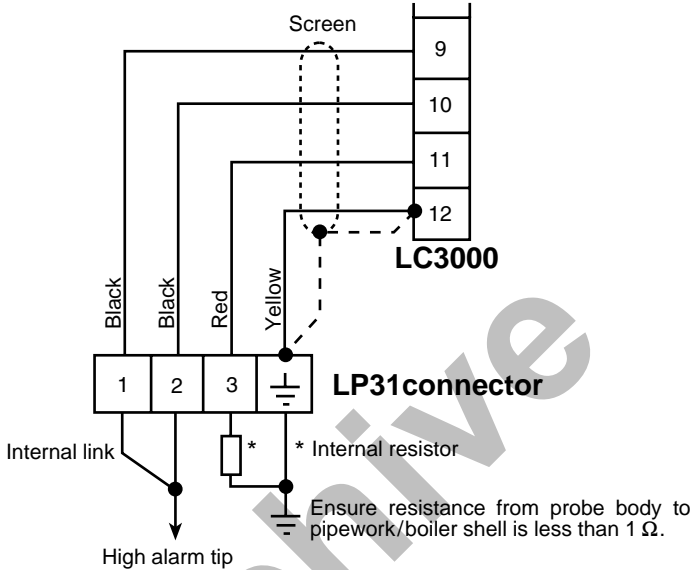


Fig. 4

Detail showing wiring of UL/FM LP30 and LP31

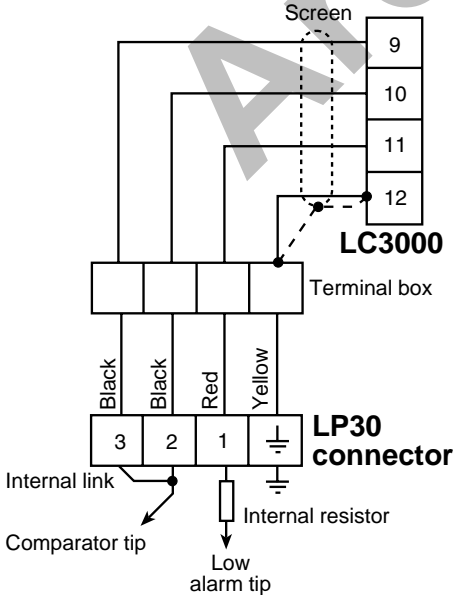


Fig. 5

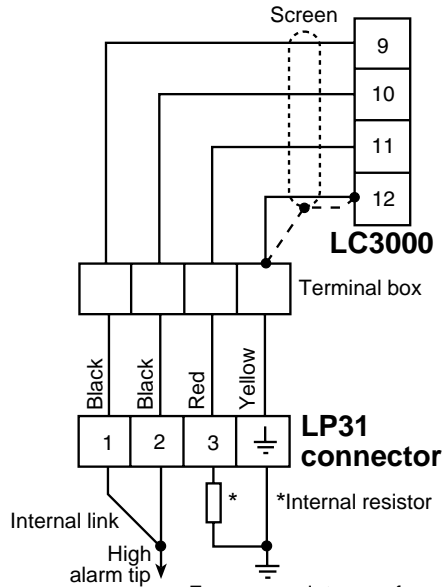


Fig. 6

6. Commissioning

With the water level normal the green LED should be on and the boiler panel should indicate normal water level. The green LED will briefly extinguish every few seconds showing that the automatic cyclic test is being carried out.

To carry out a manual test:-

- 1. With the water level normal, press and hold the test button until the green (normal) LED extinguishes and the red (alarm) LED lights (approximately 5 - 6 seconds).**
The boiler panel should signal alarm.
- 2. Release the test button.**
After a short delay, the green LED will light and the red LED will extinguish, showing that the internal checking circuits have been verified. The boiler panel will return to normal. If there is an external lockout circuit in the boiler panel this will need to be reset.
- 3. If the optional external test button has been connected, press and hold it until the same test sequence occurs. (approximately 5 - 6 seconds).**
- 4. Lower the boiler water level to below the low alarm level (low alarm), or raise the water level to above the high alarm level (high alarm).**
The green LED will extinguish and the red LED will light. The boiler panel will go to alarm.
- 5. Alter the water level to normal.**
The controller relays will re-energise and allow the burner to fire (after resetting any lockout).

7. Maintenance

No special servicing or maintenance of the controller is necessary. Clean and inspect the LP30/ LP31 annually. Boiler water level controls and alarms require regular testing and inspection. For specific testing instructions for the Spirax Sarco systems please see separate literature.

LP30

Clean and inspect the LP30 assembly annually, particularly the threaded contact surfaces between the tip extension and the probe central electrode. More regular cleaning is advised where the quality of boiler water might cause a build-up of insulative scale or oxide on the probe.

Spare parts

Spare fuses	Stock number 4033380	Set of 3
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8. Fault finding

Most faults which come to light during commissioning are caused by incorrect wiring, installation or setting up. If there are problems the following points should be checked:-

Diagnosis table

Symptom	Probable diagnosis LP30	Probable diagnosis LP31
Red LED on continuously	Probe cable to low alarm tip open circuit.	Probe cable to high alarm tip (terminals 1 or 2) shorted to earth.
	Comparator tip shorted to earth.	Probe cable to probe terminal 3 open circuit.
	Earth open circuit.	Earth open circuit.
	Probe wires crossed.	Probe wires crossed.
Red and green LED's both on continuously	Low alarm tip shorted to comparator tip.	
	Probe cable to low alarm tip shorted to earth.	Probe cable to high alarm tip open circuit (Probe terminals 1 or 2).
	Probe wires crossed.	Probe wires crossed.
Green LED flashes quickly on start-up, then red LED lights for about 12 seconds. Green LED then flashes at normal speed (every 4 seconds).	Comparator tip open circuit.	
	Controller self-checking circuitry has simulated a fault at the moment it was switched on, but is working normally. No fault is present.	

Check:

Mains on LED not lit:

- No live supply.
- Neutral not connected.
- Controller internal fuse blown.

Controller internal fuse blown:

- 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 controller internal thermal fuse has blown, and that the controller will need to be replaced.
- Ensure that the probe supply voltage is approximately 2 - 2.5 Vac between terminals 10 and 12 of the controller, or terminals 1 and earth of the probe.

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