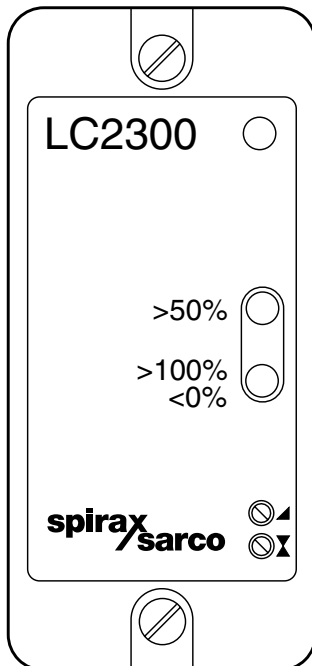


LC2300**Level Controller****Installation and Maintenance Instructions**

1. *General safety information*
2. *General product information*
3. *Installation*
4. *Setting up the controller*
5. *Wiring diagrams*
6. *Commissioning*
7. *Maintenance*
8. *Fault finding*

1. General safety information

Your attention is drawn to the Safety Information leaflet, IM-GCM-10, 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 any 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. 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. General product information —

The Spirax Sarco LC2300 is used to control the positioner of a pneumatic valve in response to a signal from a capacitance probe, providing proportional modulating control of liquid levels. The LC2300 can also be used with any two-wire 4 - 20 mA transmitter, for example for pressure, temperature, or level control using a pressure or differential pressure transmitter. Reverse acting or direct output can be selected.

The controller has a mains on LED, and two level indicators:-

The green LED (>50%)	Indicates that the output current is greater than 50%, i.e. above the set point output current.
The amber LED (>100% / < 0%)	Indicates that the output is greater than 20 mA or less than 0 / 4 mA.

A three stage wave filter gives an averaged output, maintaining a stable signal under the very wide variations in turbulence found in tanks and high output boilers.

The LC2300 is set up before installation to suit the mains supply voltage and to provide the required functions, using internal switches. See Section 4.1, 'Setting up the controller'. Calibration can be altered without removing or dismantling the unit, using the set point and proportional band potentiometers on the front panel.

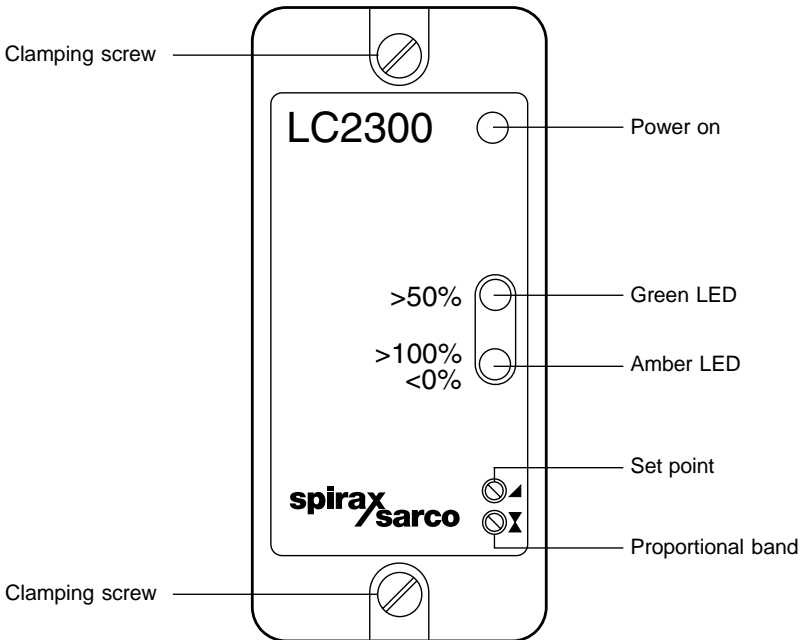


Fig. 1

Technical data

Maximum ambient temperature	55°C	(131°F)
Minimum ambient temperature	0°C	(32°F)
Pollution degree	2	
Overvoltage category	II	
Indoor use only		
Altitude	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	198 V - 264 V
	115 V setting	99 V - 132 V
Frequency	50 - 60 Hz	
Fuse type	20 mm cartridge, 100 mA anti-surge (T). For the UL version, replacement fuses must be UL recognised to maintain the integrity of the approval.	
Maximum power consumption	6 VA	
Selectable inputs		0 - 2 V
	Input 1	0 - 6 V
		0 - 20 mA
		4 - 20 mA
	Input 2 (opposite sense to input 1)	0 - 20 mA
		4 - 20 mA
Note: See separate literature for two element control.		
Output (isolated)		0 - 20 mA into 1 kΩ maximum
		4 - 20 mA into 1 kΩ maximum
		or
		20 - 0 mA into 1 kΩ maximum
		20 - 4 mA into 1 kΩ maximum
Wave filter - three stages	Filter 1 position (Minimum damping)	0.07 Hz
Response band width (designed for slowly varying signals)	Filter 2 position (Medium damping)	0.02 Hz
	Filter 3 position (Maximum damping)	0.01 Hz
Set point range	0% - 100% of input	
Proportional band range	5% - 100% of input	
Transducer supply	24 - 37 Vdc 20 mA maximum	
Maximum cable length (controller to probe)	100 m	(328 ft)
Terminal torque rating	1 N m	(9 lbf in)

3. Installation

WARNING

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

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

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

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

Caution: Allow 15 mm ($\frac{5}{8}$ ") 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 3 amp external fuse must be fitted in all phases of the controller supply.

Screened high temperature, 3 core, 1 mm² (18 - 16 AWG) copper cable is required for the probe wiring. The maximum permitted length is 100 metres (328 ft). Use cable with a suitable temperature rating for the installation. Pirelli FP200 or Delta Crompton Firetuf OHLS are suitable cables for the standard version. Use NEC Class 1 wiring for UL version.

Connect the screens as shown in the wiring diagrams (Section 5).

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

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

4. Setting up the controller

4.1 Setting up the controller

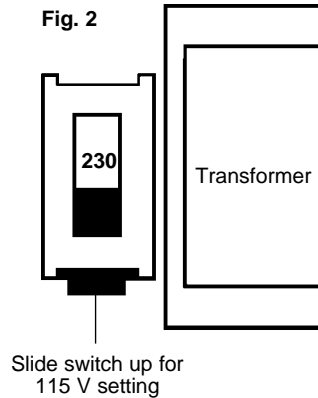
The controller is supplied set up as follows:

- 230V mains supply.
- Capacitance probe input (voltage).
- Reducing output with increasing input.
- 4 - 20mA output.
- Wave filter position 1 (minimum damping).

4.2 To change the mains supply voltage:

- Unplug the controller from its base.
- Remove the rear cover panel.
- Slide out the printed circuit board.
- Slide the voltage selector switch to the 115 V setting.
- Replace the printed circuit board.
- Ensure that the LEDs engage with the holes in the front panel.
- Replace the rear cover panel.

Fig. 2



4.3 To change the function settings:

- 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 in Figure 3 for the chosen functions.
- Replace the printed circuit board.
- Ensure that the LEDs engage with the holes in the front panel.
- Replace the rear cover panel.

Note that Switches 4 and 5 are not used.

4.4 Current / voltage input - Switches 1 and 2

The controller is supplied set for use with a capacitance probe, (voltage input), with Switches 1 and 2 OFF.

If a current input is required, for use with a 4 - 20 mA transmitter for example, set Switches 1 and 2 to ON.

4.5 Reverse acting output - Switch 3

The controller is supplied set so that a rising level at the probe will give a falling output from the controller, with Switch 3 OFF.

If a rising controller output is required with a rising input, as when using a differential pressure transmitter for level monitoring, set Switch 3 to ON.

4.6 4 - 20 mA / 0 - 20 mA - Switch 6

The controller is supplied set for 4 - 20 mA output, with Switch 6 OFF.

Set this Switch to ON for 0 - 20 mA output.

4.7 Wave filter - Switches 7 and 8

This feature averages the signal over a longer period for conditions where waves and high turbulence may otherwise cause continuous oscillation of the output signal, giving over-frequent valve movement.

The unit is supplied set to Filter 1 position, the least damped response, with Switches 7 and 8 OFF. This position is generally suitable for tanks and small to medium output boilers with a reasonably steady steam demand.

For Filter 2 position, medium damped response, set Switches 7 to ON and Switch 8 to OFF. This position should be selected if turbulence is causing the output signal to oscillate, causing over-frequent valve actuation.

For very turbulent conditions (High output boilers subject to wide variations in steam demand), set Switches 7 and 8 to ON.

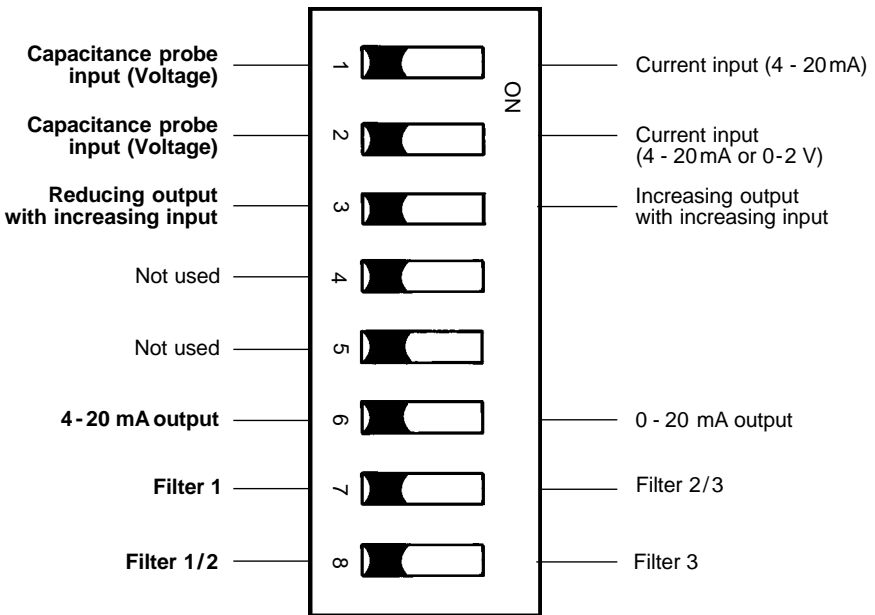


Fig. 3 Ex-works settings are as shown above (in bold text)

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 preamplifier and controller screen will only be connected to earth at one end.

Note: The PA20 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/preamplifier. It also provides a sink/drain for any electrical interference.

Ensure that the screen is connected to the earth terminal of the PA20 and to the common terminal of the controller.

Ensure the common terminal of the controller is not internally earthed. (All Spirax Sarco boiler controls are internally isolated from earth).

The common terminal of the controller must only be earthed via the PA20.

CAUTION:

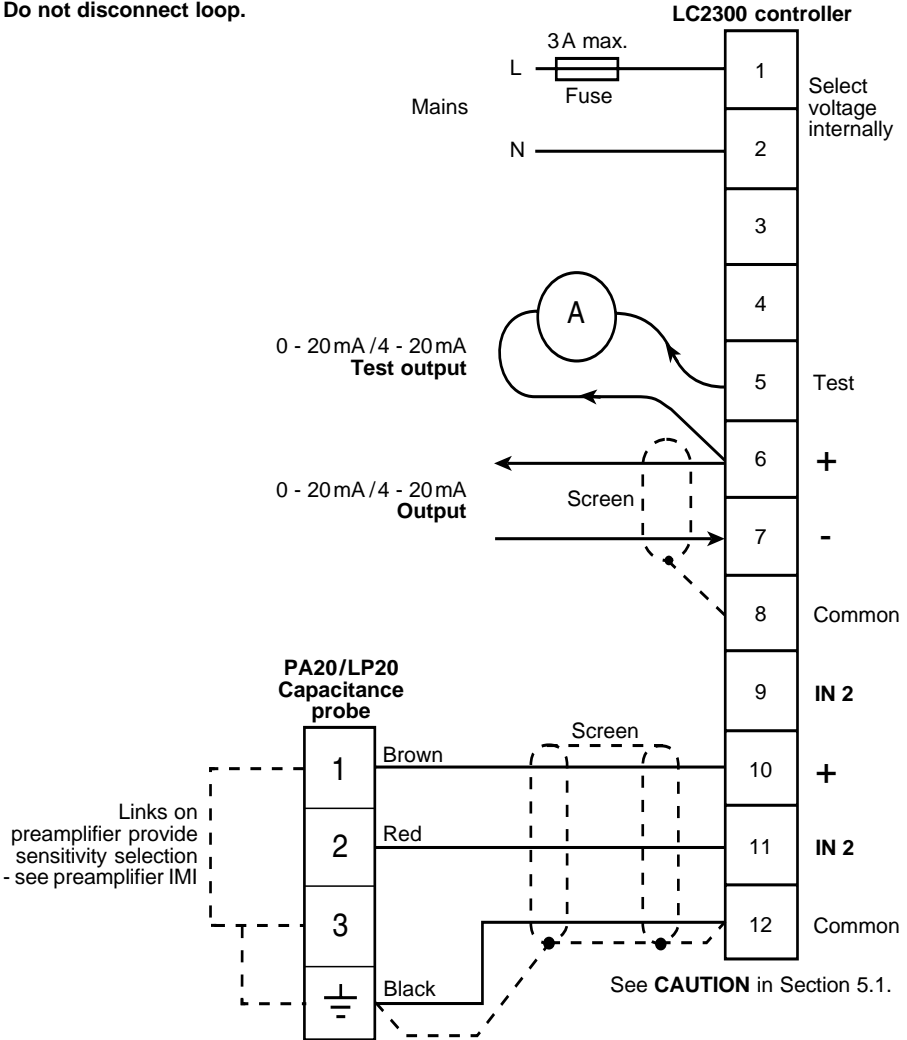
Do not connect the common terminal to an earth local to the controller. To do so may induce an earth current loop, which may reduce the performance or damage the product.

5.2 Wiring diagram standard version

4-20 mA Test:-

Connect ammeter between Terminals 5 and 6.

Do not disconnect loop.



This earth terminal is internally connected to the PA20 body and earthed by the LP20 probe.

Do not connect this earth terminal or LC2300 terminal 20 to other earths.

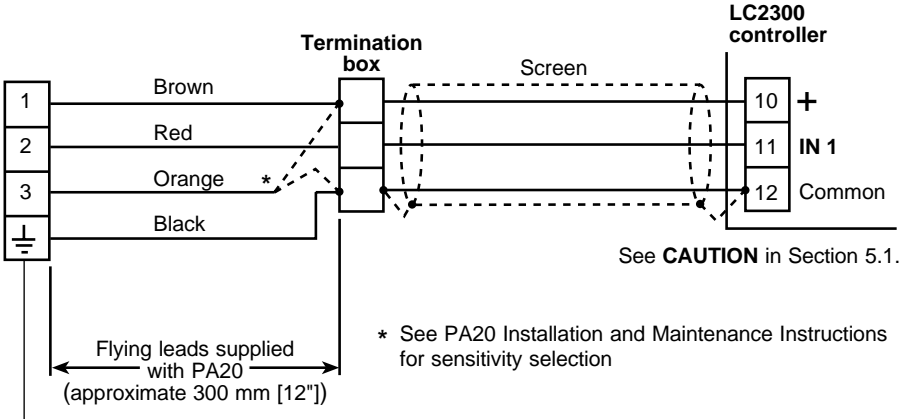
Ensure resistance from probe body to pipework/boiler shell is less than 1 Ω .

Fig. 4

5.3 Wiring diagram UL version

PA20 preamplifier and LP20 capacitance probe

(see PA20 and LP20 Installation and Maintenance Instructions)



Ensure resistance from probe body to pipework/boiler shell is less than 1 Ω.

Fig. 5

5.4 Connecting to a 4 - 20 mA level transducer

The controller can be connected to a self-powered or loop powered 4 - 20 mA level transducer instead of a capacitance probe.

Connect wiring as shown in the Figures 6 and 7.

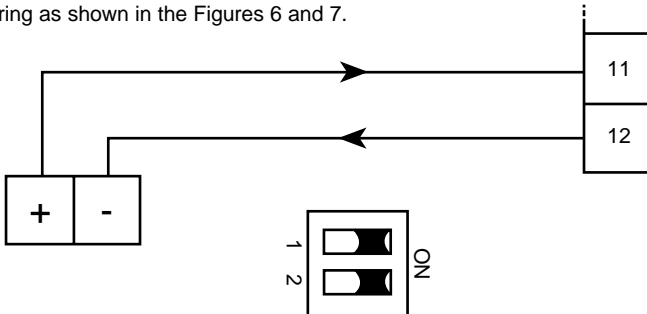


Fig. 6 Self-powered 4 - 20 mA input

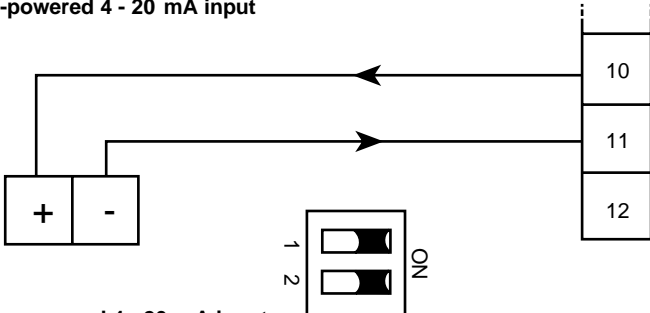


Fig. 7 Loop powered 4 - 20 mA input

5.5 Multiple controllers

Several controllers can be connected to a single capacitance probe or a 4 - 20 mA (self-powered or loop powered) source.

Connect wiring as shown in the Figures 8, 9 and 10.

Note: As an example, terminal numbers and switch positions of a second LC2300 are shown. Wiring connections for other Spirax Sarco controllers/transmitters are different, and are given in the individual Installation and Maintenance Instructions.

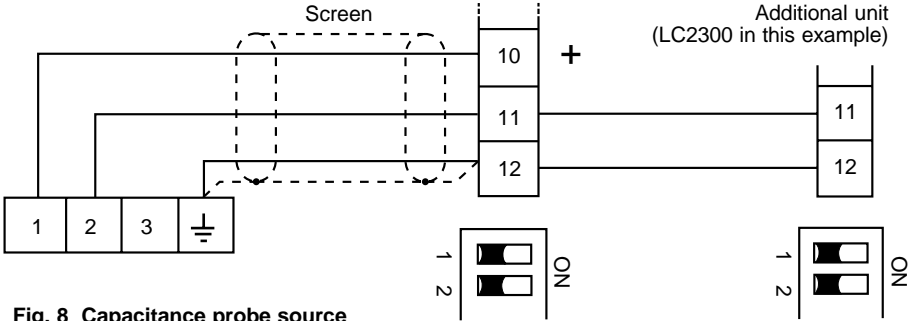


Fig. 8 Capacitance probe source

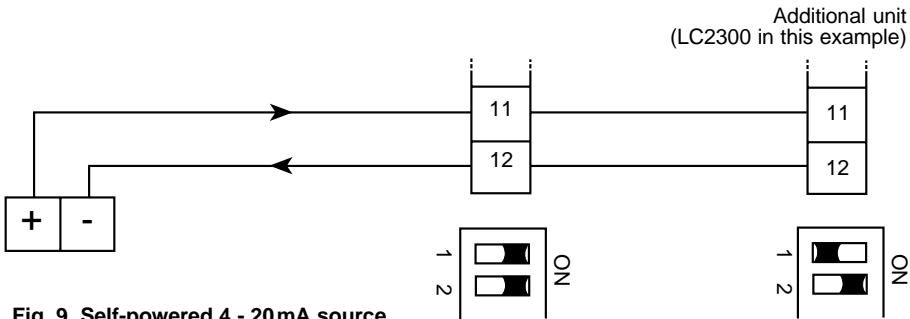


Fig. 9 Self-powered 4 - 20 mA source

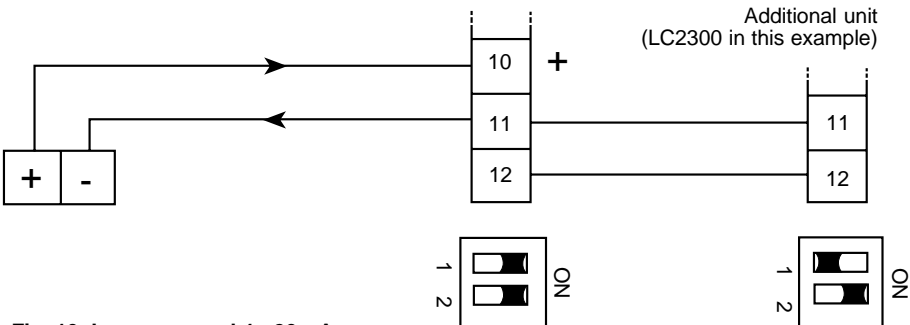


Fig. 10 Loop powered 4 - 20 mA source

6. Commissioning

In order to simplify the description these instructions refer to boiler water level control applications (fill control).

The set point is in the middle of the control band of a proportional controller.

The modulating control valve will be approximately half open when the level is at the set point, will be fully open when the level is at the bottom of the proportional band, and fully closed when the level is at the top of the band.

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 boiler to the desired set point.
3. Adjust the **set point** potentiometer until the green >50% LED just lights.
4. Alter the water level to either the top or the bottom of the desired proportional band. This can be the top (valve fully closed), or bottom (valve fully open) position, whichever is most convenient.
5. Adjust the proportional band potentiometer until the amber >100% / <0% LED just lights.
6. The unit is now calibrated. Check that the valve is fully open/closed at the upper and lower limits of the proportional band.

7. Maintenance

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

Available spares

Spare fuses are available from Spirax Sarco	Stock No. 4033380	Set of 3
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8. Fault finding

Most faults which occur on commissioning are due to incorrect wiring or setting up. In the case of problems the following checklist may be helpful:-

Mains on LED not lit:

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

Transformer 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 transformer internal thermal fuse has blown, and that the transformer will need to be replaced.
- Ensure that the probe supply voltage is between 24 Vdc and 35 Vdc between terminals 10 and 12 of the controller, or terminals 1 and earth of the probe.
- The probe output voltage should be 1 Vdc to 6 Vdc between terminals 11 and 12 of the controller, or terminals 2 and earth of the probe, depending on the level.

This voltage increases with the level, even when reverse acting output has been selected.