

LRR 1-50, LRR 1-51

Directives and standards

EC Pressure Equipment Directive 97/23/EC

The conductivity control & monitoring equipment LRG 1-..., LRG 1-..., LRS 1-5..., LRR 1-5... meets the safety requirements of the Pressure Equipment Directive (PED). The conductivity control & monitoring equipment is EC type approved according to EN 12952/EN 12953. These Directives state, among other things, the requirements made on limiting systems and equipment for steam boiler plants and (pressurised) hotwater installations.

VdTÜV Bulletin "Water Monitoring 100"

The conductivity controller LRR 1-50, LRR 1-51 in conjunction with conductivity electrode LRG 1-... and conductivity transmitter LRGT 1-... is type approved according to VdTÜV Bulletin "Wasserüberwachung (= Water Monitoring) 100".

Type approval no. TÜV · WÜL · 12-018 (see name plate).

The VdTÜV Bulletin "Water Monitoring 100" states the requirements made on water monitoring equipment.

LV (Low Voltage) Directive and EMC (Electromagnetic Compatibility)

The equipment meets the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC.

ATEX (Atmosphère Explosible)

According to the European Directive 94/9/EC the equipment must not be used in potentially explosive areas.

Note:

The conductivity electrodes LRG 12-1, LRG 16-4, LRG 16-9, LRG 17-1 and LRG 19-1 are simple items of electrical equipment as specified in EN 60079-11 section 5.7. According to the European Directive 94/9/EC the equipment must be equipped with approved Zener barriers if used in potentially explosive areas. Applicable in Ex zones 1, 2 (1999/92/EC). The equipment does not bear an Ex marking. The suitability of the Zener barriers is certified in a separate wiring diagram provided by the manufacturer.

UL/cUL (CSA) Approval

The equipment meets the requirements of: UL 508 and CSA C22.2 No. 14-13, Standards for Industrial Control Equipment. File E243189

Conductivity Controller LRR 1-50, LRR 1-51

Description

The conductivity controller LRR 1-50, LRR 1-51 in conjunction with conductivity electrodes LRG 1-... and conductivity transmitter LRGT 1-... is used as conductivity controller and limit switch, for instance in steam boilers, (pressurized) hot-water installations as well as condensate and feedwater tanks. The conductivity controller indicates when the MAX conductivity limit is reached and opens or closes a continuous blowdown valve.

The conductivity controller LRR 1-50, LRR 1-51 can be used together with conductivity electrodes and transmitters in the following equipment combinations: Conductivity controller LRR 1-50 together with conductivity electrodes LRG 12-2, LRG 16-4, LRG 16-9, LRG 17-1 and LRG 19-1;

Conductivity controller LRR 1-51 together with conductivity transmitters LRGT 16-1, LRGT 16-2 and LRGT 17-1.

Glossary

Continuous boiler blowdown

As the boiler water evaporates, the concentration of non-volatile dissolved solids (TDS) left behind in the boiler increases over time as a function of steam consumption. If the TDS (= total dissolved solids) concentration exceeds the limit defined by the boiler manufacturer, foaming and priming occurs as the density of the boiler water increases, resulting in a carry-over of solids with vapour into steam lines and superheaters. As a consequence, the operational safety is impaired and severe damage to boiler and tubes may occur. To keep the TDS concentration within admissible limits, a certain portion of boiler water must be removed continuously or periodically (by means of a blowdown valve) and fresh make-up water must be added to the boiler feed to compensate for the water lost through blowdown. Electrical conductivity - here as a result of the TDS content of boiler water - is measured in microSiemens/cm ($\mu\text{S}/\text{cm}$). However, in some countries ppm (parts per million) is used for conductivity readings. Conversion: $1\mu\text{S}/\text{cm} = 0.5\text{ ppm}$.

Operating position of the continuous blowdown valve

Continuous blowdown (also known as top blowdown) is the process where boiler water is removed from the water's surface in order to reduce the concentration of dissolved solids. As the name implies, continuous or top blowdown is done on a continuous basis, which means that the blowdown valve remains in a slightly open position (valve position "OPERATING") in order to allow the required amount of boiler water to be discharged. For close control and accurate regulation this operating position must be adjusted in the continuous blowdown valve. The amount of boiler blowdown can be determined by using the capacity charts for the valve.

Switching hysteresis

The controller works as 2-position controller, which means that the continuous blowdown valve is motored into the OPEN position when the setpoint is reached. The conductivity must then decrease until a new value that is lower than the setpoint minus the adjusted hysteresis HySt is reached. Once this value is reached the valve will be motored into the operating position.

Temperature compensation

The electrical conductivity changes as the temperature falls or rises. To obtain meaningful readings it is therefore necessary that the measurements are based on the reference temperature of 25°C and that the measured conductivity values are corrected by the temperature coefficient factor tC.

Glossary - continued -

Cell constant and correction factor

The cell constant is a geometric quantity characteristic of the conductivity electrode and is taken into account when calculating the conductivity. However, in the course of time this constant may change, e.g. due to dirt deposits accumulated on the measuring electrode. Deviations can be compensated by changing the correction factor CF.

Purging of the continuous blowdown valve

To prevent the continuous blowdown valve from getting stuck the valve can be rinsed automatically. At regular intervals (purging pulse S1) the continuous blowdown valve is motored into the open position and rinsed (purging time Sd). When the purging time is over, the valve is motored into the OPERATING position or into the required control position.

Function

The conductivity controller LRR 1-50 in conjunction with the conductivity electrode LRG 1-... measures the electrical conductivity in conductive liquids. The LRG 1-... is used as conductivity electrode or the LRG 16-9 with integrated resistance thermometer for detecting the fluid temperature.

The conductivity controller LRR 1-51 processes the conductivity-dependent current signal of the conductivity transmitter LRGT 1-... This signal is then standardized in the conductivity controller according to the adjusted measuring range and indicated by the 7-segment LED display.

Conductivity controller LRR 1-50: When connecting the conductivity electrode LRG 1-... a reference measurement is taken and by setting the correction factor CF accordingly the conductivity readings are adapted to the specific conditions of the installation. If the conductivity electrode LRG 16-9 is used, not only the electrical conductivity but also the water temperature will be measured. The conductivity reading is automatically compensated in the conductivity controller as a function of the adjusted temperature coefficient tc (%/°C). Even if the temperature changes, thanks to the adjusted linear temperature compensation, the measured value is referenced to 25 °C over the whole measuring range and indicated on the 7-segment LED display.

The conductivity controller LRR 1-50, LRR 1-51 works as 2-position controller, which means that the continuous blowdown controller is motored into the OPEN position when the setpoint is reached. Once the conductivity has fallen below the adjusted hysteresis, the valve is motored into the OPERATING position. To avoid loss of boiler water, the controller will automatically close the valve when the boiler is shut down. Two flashing LEDs indicate whether the continuous blowdown valve is opening or closing.

The MAX limit can be variably adjusted within the measuring range. Once the MAX limit is reached, the MAX output contact is switched over and the LED indicating MAX limit is illuminated. The equipment will be reset once the value has fallen below the preset hysteresis.

Any faults or malfunctions in the conductivity electrode, the conductivity transmitter, the electrical connection or the settings will be indicated as error code by the 7-segment LED display. In the event of a malfunction a MAX alarm will be raised and the continuous blowdown valve is motored into the OPERATING position.

If the malfunction occurs only in the conductivity controller LRR 1-50, LRR 1-51, a MAX alarm will be raised, the continuous blowdown controller is motored into the OPERATING position and the system is re-started.

Parameter settings can be changed or a MAX alarm can be simulated by operating the rotary button.

Conductivity Controller

LRR 1-50, LRR 1-51

Technical data

Conductivity controller LRR 1-50, LRR 1-51

Supply voltage

24 VDC, + / - 20 %, 0.1 A

Fuse

external 0.5 A (semi-delay)

Power consumption

4 VA

Reset hysteresis

MAX limit: -3 % of the adjusted MAX limit, fixed setting

Outputs

2 volt-free change-over contacts,
8 A 250 V AC / 30 V DC $\cos \varphi = 1$
(continuous blowdown valve OPEN, OPERATING, CLOSED).

1 volt-free change-over contact,

8 A 250 V AC / 30 V DC $\cos \varphi = 1$

(MAX alarm, switch-selectable).

Provide inductive loads with RC combinations according to manufacturer's specification to ensure interference suppression.

1 analogue output 4-20 mA, max. load 500 ohm,

e. g. for actual-value indication

Indicators and adjusters

1 rotary button with integrated pushbutton for parameter setting and testing MIN / MAX alarm

1 seven-segment LED display, four digits, green

1 red LED for MAX alarm,

2 amber LEDs indicating continuous blowdown valve opens/closes

1 four-pole code switch for configuration settings

Housing

Housing material: base: polycarbonate, black

Front: polycarbonate, grey.

Terminal strips separately detachable.

Fixing of enclosure: Mounting clip on supporting rail TH 35, EN 60715

Electrical safety

Pollution degree 2.

Protection

Housing: IP 40 to EN 60529

Terminal strip: IP 20 to EN 60529

Weight

approx. 0.2 kg

Further conditions:

Ambient temperature

when system is switched on: 0 ... 55 °C,

during operation: -10 ... 55 °C

Transport temperature

-20 ... +80 °C (< 100 hours), defrosting time of the de-energized equipment before it can be put into operation: 24 hours.

Storage temperature

-20 ... +70 °C, defrosting time of the de-energized equipment before it can be put into operation: 24 hours.

Relative humidity

max. 95%, no moisture condensation

Dimensions

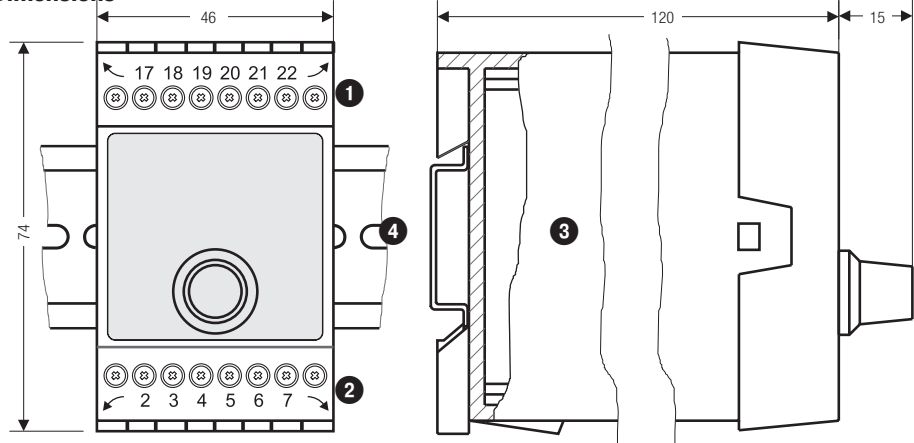


Fig. 1 LRR 1-50, LRR 1-51

Technical data - continued -

only conductivity controller LRR 1-50

Connection of conductivity electrode

1 input for conductivity electrode LRG 1.-..

(cell constant 1 cm-1), 3 poles with screen or

1 input for conductivity electrode LRG 16-9
(cell constant 0.5 cm-1), with integrated resistance thermometer Pt 100, 5 poles with screen

Measuring voltage

0.8 Vss, pulse duty factor $t_v = 0.5$, frequency 20-10000 Hz.

Measuring range

1 to 10,000 $\mu\text{S}/\text{cm}$ at 25 °C or 1 to 5,000 ppm at 25 °C.

only conductivity controller LRR 1-51

Connection of conductivity transmitter

1 analogue input 4-20 mA, e. g. for conductivity transmitter LRGT 1.-.., 2 poles with screen

Beginning of measuring range Si_{inL}

0.0 - 0.5 - 100.0 $\mu\text{S}/\text{cm}$, adjustable.

End of measuring range Si_{inH}

20.0 - 100.0 - 200.0 - 500.0 - 1000.0 - 2000.0 - 3000,
0 - 5000.0 - 6000.0 - 7000.0 - 10000.0 $\mu\text{S}/\text{cm}$,
adjustable.

Order & Enquiry Specification

Level switch type LRR 1-50

GESTRA SPECTOR^{module}

Conductivity controller with MAX alarm

Input: 1 input for conductivity electrode

1 input for PT 100 sensor

Output: 1 volt-free change-over contact for MAX alarm

2 volt-free change-over contacts for valve

open / operating / closed

1 actual value 4 - 20 mA

1 seven-segment display

Measuring range can be switch-selected between

0.5 - 10,000 $\mu\text{S}/\text{cm}$

Supply voltage 24 V DC, 4 VA

Level switch type LRR 1-51

GESTRA SPECTOR^{module}

Conductivity controller with MAX alarm

Input: 1 input for conductivity transmitter LRGT (4-20 mA)

Output: 1 volt-free change-over contact for MAX alarm

2 volt-free change-over contacts for valve open / closed

1 actual value 4 - 20 mA

1 seven-segment display

Measuring range can be switch-selected between

0.5 - 10,000 $\mu\text{S}/\text{cm}$

Supply voltage 24 V DC, 4 VA

Important Notes

The conductivity controller LRR 1-50, LRR 1-51 is clipped onto the support rail in the control cabinet.

The equipment is supplied with 24 V DC and fused with an external semi-delay fuse 0.5 A.

The power supply unit must be electrically isolated from dangerous contact voltages and must meet at least the requirements on double or reinforced isolation according to one of the following standards: DIN EN 50178, DIN EN 61010-1, DIN EN 60730-1 or DIN EN 60950.

To prevent the welding together of contacts provide an external slow-blow fuse T 2.5 A or 1.0 A (TRD 604, 72 hrs. operation) for the output contacts.

When switching off inductive loads, voltage spikes are produced that may impair the operation of control systems. Connected inductive loads must be provided with suppressors such as RC combinations as specified by the manufacturer.

To connect the conductivity electrode LRG 12-1, LRG 16-4, LRG 17-1 and LRG 19-1 use screened multi-core control cable with a min. conductor size of 0.5 mm², e. g. LiYCY 3 x 0.5 mm².

For connecting the conductivity electrode LRG 16-9 control cable assemblies of various lengths are available as optional extra.

Note that the recommended control cable is not UV-resistant and, if installed outdoors, must be protected by a UV-resistant plastic tube or cable duct.

If you do not use the above-mentioned control cable assembly, use screened five-core control cable, e. g. LiYCY 5 x 0.5 mm², for connecting the equipment. In addition, connect at the electrode end a screened jack to the control cable.

Max. cable length between conductivity electrode and controller: 30 m, with conductivities from 1 to 10 $\mu\text{S}/\text{cm}$: max. 10 m.

Make sure that connecting cables between the equipment are segregated and run separately from power cables.

When used as conductivity limiter, the conductivity switch LRS 1-50 does not interlock automatically when readings fall below the MAX limit.

If an interlock function is required for the installation it must be provided in the follow-up circuitry (safety circuit). The circuitry must meet the requirements of the EN 50156.

Conductivity Controller LRR 1-50, LRR 1-51

Key

- 1 Upper terminal strip
- 2 Lower terminal strip
- 3 Housing
- 4 Supporting rail type TH 35, EN 60715
- 5 Connection of supply voltage **24 V DC** with fuse 0.5 A (semi-delay), provided on site
- 6 Actual value output 4-20 mA
- 7 Conductivity electrode LRG 1-...
- 8 Central earthing point (CEP) in control cabinet
- 9 Conductivity electrode LRG 16-9 with integrated resistance thermometer
- 10 MAX output contact
- 11 Supply voltage L 2
- 12 Supply voltage N
- 13 Conductivity transmitter LRGT 1-..., 4-20 mA, with earthing point

Note:

L2 must remain live after the burner (stand-by operation) - and therefore also the supply voltage for the controller - is shut down until the actuator has closed the continuous blowdown valve.

Electrical connection LRR 1-50

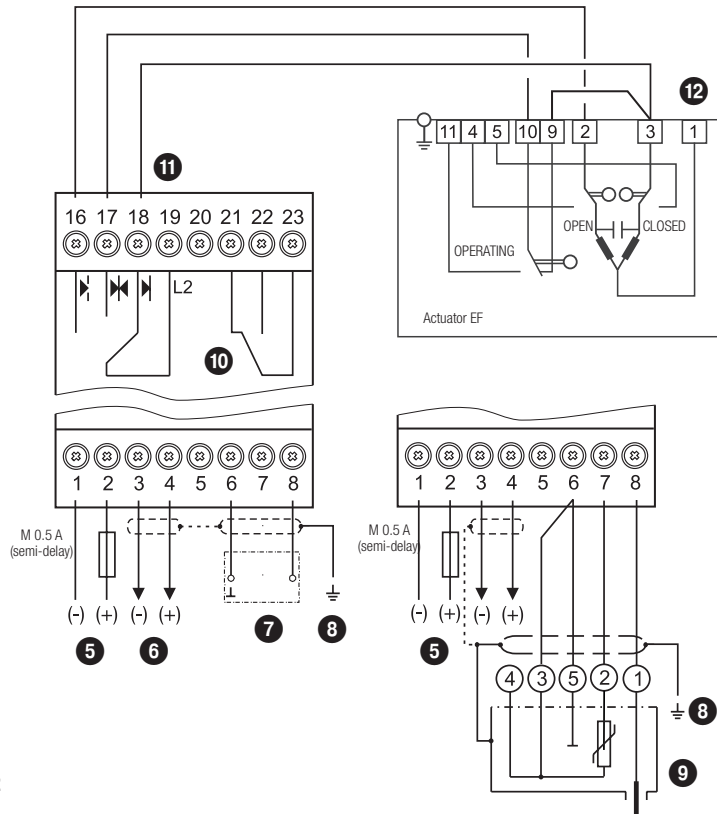


Fig. 2

Electrical connection LRR 1-51

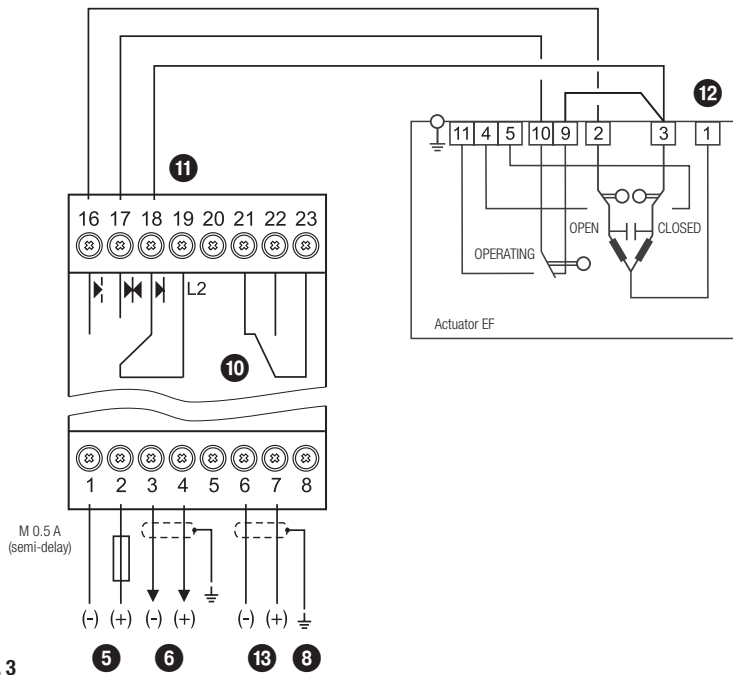


Fig. 3

Supply in accordance with our general terms of business.

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