



Conductivity Controller

LRR 1-50

LRR 1-51

EN (USA)
English

Original Installation &
Operating Manual

850702-01

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Content of this Manual

Product:

- Conductivity controller LRR 1-50
- Conductivity controller LRR 1-51

First edition:

BAN 850702-00/09-2021cm

Applicable documents:

You can find the latest Installation & Operating Manuals on our website:

<http://www.gestra.com>

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Scope of supply, product package

LRR 1-50

1 conductivity controller LRR 1-50
1 adhesive sign for ppm
1 Installation & Operating Manual

LRR 1-51

1 conductivity controller LRR 1-51
1 adhesive sign for ppm
1 Installation & Operating Manual

How to use this Manual

This Installation & Operating Manual describes the correct use of the LRR 1-50, LRR 1-51 conductivity controller. It applies to persons who integrate this equipment in control systems, install, bring into service, operate, maintain and dispose of this equipment. Anyone carrying out the above-mentioned activities must have read this Installation & Operating Manual and understood its contents.

- Read this Manual in full and follow all instructions.
- Please also read the instructions for use of any accessories.
- The Installation & Operating Manual is part of the product package. Keep it in an easily accessible location.

Availability of this Installation & Operating Manual

- Make sure this Installation & Operating Manual is always available to the operator.
- If you pass on or sell the equipment to a third party, please also hand over the Installation & Operating Manual.

Illustrations and symbols used

1. Action to be taken
- 2.

- Lists
 - ◆ Bullet points in lists

A Keys to illustrations



Additional information



Read the relevant Installation & Operating Manual

Hazard symbols in this Manual



Danger zone, dangerous situation



Danger of death from electric shock

Types of warning

DANGER

Warning of a dangerous situation that results in death or serious injury.

WARNING

Warning of a dangerous situation that may possibly result in death or serious injury.

CAUTION

Warning of a situation that may result in minor or moderate injury.

ATTENTION

Warning of a situation that results in damage to property or the environment.

Specialist terms, abbreviations

Here, we explain some abbreviations, specialist terms, etc., which are used in this Manual.

NRGT .. / NRR.. / NRS.. / URS .. / URB .. / SRL .. / etc.

Equipment and type designations of GESTRA AG.

SELV

Safety Extra Low Voltage

Operating point (of the plant)

The operating point describes the operating parameters within which a plant or boiler is operated in its nominal range. In a steam boiler, for example, these parameters would be output, pressure, and temperature.

The design data may be a lot more stringent, however.

A boiler that is operated at 145 psi (10 bar) and 356 °F (180 °C) may be designed to withstand a pressure of 870 psi (60 bar) and a temperature of 527 °F (275 °C), for example, which is therefore not necessarily its operating point.

Continuous blowdown

As the boiler water begins to evaporate, the concentration of non-volatile total dissolved solids (TDS) increases over time as a function of steam consumption. If the TDS concentration exceeds the limit defined by the boiler manufacturer, foaming occurs as the density of the boiler water increases, which is carried over into steam pipes and superheaters. The consequences are adversely affected reliability and severe damage to steam generating units and pipes. To keep the TDS concentration within admissible limits, a certain portion of boiler water must be removed continuously or periodically (by means of a continuous blowdown valve) and fresh feedwater must be added to the boiler feed to compensate for the water lost through blowdown. To determine the total dissolved solids in the boiler water, its electrical conductivity is measured in $\mu\text{S}/\text{cm}$, although some countries also use ppm (parts per million) as the unit of measurement. Conversion $1 \mu\text{S}/\text{cm} = 0.5 \text{ ppm}$.

Operating position of the continuous blowdown valve

It is common practice to use the continuous blowdown valve to remove a certain amount of water from the boiler in order to keep the TDS within the desired limits. This means that the valve must always be slightly open during operation so that this quantity of water can be discharged (valve in OPERATING position). This operating position can be adjusted and the blowdown volume can be determined using the capacity charts of the valve.

Switching hysteresis

The controller is a 2-position controller, i.e. the continuous blowdown valve moves to the OPEN position when the set point is reached. The conductivity must then decrease, and when it reaches a value that is lower than the set point by the set hysteresis HySt, the valve moves into the OPERATING position.

Temperature compensation

The conductivity of water changes as the temperature falls or rises. To obtain meaningful readings, it is therefore necessary to base the measurements on the reference temperature of 77 °F (25 °C) and to correct the measured conductivity using the temperature coefficient tC.

Cell constant and correction factor

The geometric variable (cell constant) of the conductivity electrode is taken into account when calculating the conductivity. However, this constant may change during operation, e.g., due to dirt deposits on the measuring electrode. Correction is achieved by changing the correction factor CF.

Flushing the continuous blowdown valve

The continuous blowdown valve can be flushed automatically to prevent it from sticking. In this case, the continuous blowdown valve is actuated at intervals (flushing interval S_i) and opens for a certain time (flushing time S_d). After the flushing time, the valve is moved into the OPERATING position or into the required control position.

Usage for the intended purpose

The LRR 1-50, LRR 1-51 conductivity controller is used in combination with LRG 1-... conductivity electrodes and the LRGT 1-... conductivity transmitter as a conductivity controller and limit switch, e.g., in steam boilers and hot water installations or in condensate and feedwater tanks. The conductivity controller indicates when a MAX conductivity has been reached, and opens or closes a continuous blowdown valve.

When used as intended, conductivity controllers can be combined in a circuit with the following conductivity electrodes or transmitters: LRR 1-50 conductivity controller with LRG 16-4 and LRG 16-9 conductivity electrodes, LRR 1-51 conductivity controller with LRGT 16-3, LRGT 16-4 and LRGT 17-3 conductivity transmitters.

Improper use



There is a danger of death due to explosion if the equipment is used in potentially explosive atmospheres.

Do not use the equipment in potentially explosive atmospheres.



Do not bring any equipment into service that does not have its own specific rating plate.

The rating plate indicates the technical features of the equipment.

Basic safety information



There is a risk of electric shock during work on electrical systems.

- Always switch off the voltage to the equipment before performing work on the terminal strips.
- Check that the plant is not carrying live voltage before commencing work.



Faulty equipment is a danger to plant safety.

- If the LRR 1-50, LRR 1-51 conductivity controller does not behave as described on this page, it may be faulty.
- Perform failure analysis.
- Only replace faulty equipment with identical equipment from GESTRA AG.

Required personnel qualifications

Activity	Personnel	
Integration in control system	Specialist staff	Plant designer
Installation/electrical connection/ bringing into service	Specialist staff	Electrician/installer
Operation	Boiler service technician	Staff trained by the plant operator
Maintenance work	Specialist staff	Electrician
Setup work	Specialist staff	Plant construction

Notes on product liability

The manufacturer cannot accept any liability for damages resulting from improper use of the equipment.

Function

The **LRR 1-50 conductivity controller**, in conjunction with the LRG 1-... conductivity electrode, measures conductivity in conductive fluids. The conductivity electrode used is the LRG 16-4 or the LRG 16-9 with integrated resistance thermometer for monitoring the fluid temperature.

The **LRR 1-51 conductivity controller** processes the conductivity-dependent current signal from the LRGT 1-... conductivity transmitter. In the conductivity controller, this signal is standardized in line with the adjusted measuring range and indicated as an actual value on the 7-segment LED display.

Conductivity controller LRR 1-50: When the **LRG 1-... conductivity electrode** is connected, a reference measurement is taken and a correction factor CF is set to adapt the conductivity measurement to the specific conditions of the installation.

When a resistance thermometer is connected, the temperature of the water is measured as well as its conductivity. The conductivity reading is then automatically compensated in the conductivity controller as a function of the adjusted temperature coefficient **tC** (%/°C). If the temperature changes, thanks to linear temperature compensation the reading is referenced to 77 °F (25 °C) over the entire measuring range, and indicated as an actual value on the 7-segment LED display.

The **LRR 1-50, LRR 1-51 conductivity controller** is a **2-position controller**, i.e. the continuous blowdown valve moves to the OPEN position when the set point is reached. Once the conductivity has fallen by the set hysteresis, the valve returns to the OPERATING position, provided that the operating position is enabled. To prevent any loss of water from the boiler, the controller automatically closes 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 varied as desired within the measuring range.

If the MAX limit is reached, the MAX output contact is switched and the MAX LED lights up. It switches back when the value has fallen below the preset hysteresis.

Faults in the conductivity electrode, conductivity transmitter or electrical connection and setting errors are indicated as error codes on the 7-segment LED display. In the event of a fault, the MAX alarm is triggered and the continuous blowdown valve moves into OPERATING position.

If faults occur only in the **LRR 1-50, LRR 1-51 conductivity controller**, the MAX alarm is triggered, the continuous blowdown valve moves into OPERATING position and the system is restarted.

Parameters can be changed or the MAX alarm simulated by turning the rotary knob.

Electrical conductivity is measured in $\mu\text{S}/\text{cm}$. In some countries, ppm (parts per million) is used as well. Conversion $1 \mu\text{S}/\text{cm} = 0.5 \text{ ppm}$. You can set the conductivity controller to the required unit.

Safety information

The equipment may only be installed, wired and brought into service by qualified and competent staff.

Fitting and maintenance work may only be performed by authorized staff who have undergone specific training.

Technical data

LRR 1-50, LRR 1-51

Supply voltage

24 VDC +/- 20%; PELV / CLASS2

Fuse

External M0.5A (medium time-lag)

Power consumption

4 W

Reset hysteresis

MAX limit: -3% of set MAX limit, factory default.

Outputs

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

1 volt-free relay contact, 8 A 250 V AC / 30 V DC $\cos \varphi = 1$
(MAX alarm, switch-selectable).

Inductive loads must have interference suppression (RC combination) as specified by the manufacturer.

1 analog output 4-20 mA, max. output load 500 ohms, e.g., for an actual value display.

Indicators and controls

1 rotary knob with integrated push-button for testing the MAX alarm and setting the parameters,

1 4-digit 7-segment LED display,

1 red LED for MAX alarm,

2 yellow LEDs for continuous blowdown valve opening/closing

1 4-pole code switch for configuration.

Terminal box

Terminal box material: base of black polycarbonate, front of gray polycarbonate

Wire size: 1 x AWG12 (4.0 mm²) solid, or

1 x AWG14 (2.5 mm²) stranded with sleeve acc. to DIN 46228, or

2 x AWG16 (1.5 mm²) stranded with sleeve acc. to DIN 46228

Terminal strips can be removed separately

Terminal box attachment: Mounting clip on support rail TH 35, EN 60715

Electrical safety

Pollution degree 2, overvoltage category II according to UL 60730-1

Protection

Terminal box: IP40 according to EN 60529

Terminal strip: IP20 according to EN 60529

As a UL open type, the equipment must be installed in a control cabinet.

Weight

Approx. 0.44 lb (0.2 kg)

Other information

Incorporated type 1 action operating control

Pollution degree 2, impulse voltage DC supply = 500 V, AC output = 2500 V

Technical data

LRR 1-50 only

Connecting a conductivity electrode

- 1 input for LRG 16-4 conductivity electrode (cell constant 1 cm⁻¹), 3-pole with shield, or
- 1 input for LRG 16-9 conductivity electrode (cell constant 0.5 cm⁻¹), with integrated resistance thermometer Pt100, 3-pole with shield.

Measuring voltage

0.8 V_{ss}, pulse duty factor $t_v = 0.5$, frequency 20 – 10000 Hz.

Measuring range

1 to 10000 µS/cm at 77 °F (25 °C) or 1 to 5000 ppm at 77 °F (25 °C).

LRR 1-51 only

Connecting a conductivity transmitter

1 analog input 4-20 mA, e.g., for the LRGT 1-.. conductivity transmitter, 2-pole with shield.

Lower end of measuring range SinL

0 - 0.25 - 25 - 50 ppm (0 - 0.5 - 50 - 100 µS/cm), adjustable.

Upper end of measuring range SinH

10 - 50 - 100 - 250 - 500 - 1000 - 1500 - 2500 - 3000 - 3500 - 5000 - 6000 ppm
(20 - 100 - 200 - 500 - 1000 - 2000 - 3000 - 5000 - 6000 - 7000 - 10000 - 12000 µS/cm), adjustable.

LRR 1-50, LRR 1-51

Ambient temperature

at power-on 32 ° ... 131 °F (0 ° ... 55 °C)
in operation 14 ° ... 131 °F (-10 ° ... 55 °C)

Transport temperature

-4 ° ... 176 °F (-20 ° ... +80 °C) (<100 hours),
only switch on after a defrosting period of 24 hours.

Storage temperature

-4 ° ... 158 °F (-20 ° ... +70 °C), only switch on after a defrosting period of 24 hours.

Relative humidity

Max. 95%, non-condensing

Factory default settings

Conductivity controller LRR 1-50

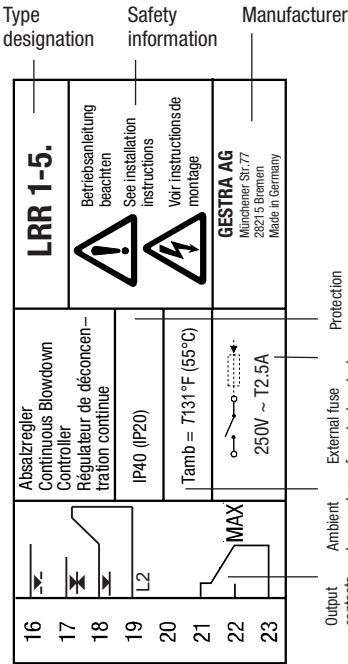
- MAX switchpoint AL.Hi = 3000 ppm (6000 μ S/cm)
- Set point SP = 1500 ppm (3000 μ S/cm)
- Dead band: +/- 5% of set point
- Reset hysteresis:
Set point: -10% of set point
MAX limit: -3% (fixed setting)
- Correction factor CF = 1
- Temperature compensation inP = No
- Temperature coefficient tC = 2.1% / °C
- Standardization of current output Sout = 3000 ppm (6000 μ S/cm)
- Operating position oPP = 5%
- Flushing interval Si = 0 h
- Flushing time Sd = 3 min (valve opens for 3 min and closes for 3 min)
- Damping FiLt: oFF
- Password PW: oFF
- **Code switch** 13:
S1: OFF, S2: ON, S3: OFF, S4: OFF

Conductivity controller LRR 1-51

- MAX switchpoint AL.Hi = 3000 ppm (6000 μ S/cm)
- Set point SP = 1500 ppm (3000 μ S/cm)
- Dead band: +/- 5% of set point
- Reset hysteresis:
Set point: -10% of set point
MAX limit: -3% (fixed setting)
- Lower end of measuring range Sin.L = 0.25 ppm (0.5 μ S/cm)
- Upper end of measuring range Sin.H = 3000 ppm (6000 μ S/cm)
- Standardization of current output Sout = 3000 ppm (6000 μ S/cm)
- Operating position oPP = 5%
- Flushing interval Si = 0 h
- Flushing time Sd = 3 min (valve opens for 3 min and closes for 3 min)
- Damping FiLt: oFF
- Password PW: oFF
- **Code switch** 13:
S1: OFF, S2: ON, S3: OFF, S4: OFF

Example rating plate/identification

Rating plate of the LRR 1-50, LRR 1-51, top



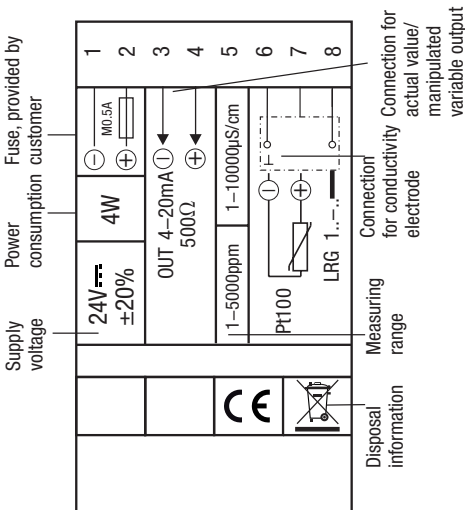
UL sign of LRR 1-50

	Input rating: 24VDC, 4W
	Output rating : Pilot duty B300 / R300
	Ambient temperature: 32–131°F (0–55°C)
	Wiring: Use Copper Conductors Only, Use 60/75°C Conductors, Use No. 18–16 AWG Wire Size Only, Tightening: Torque 0.79Nm or 7lb in. Use with accessory: LRG 16–4, LRG 16–9

UL sign of LRR 1-51

	Input rating: 24VDC, 4W
	Output rating : Pilot duty B300 / R300
	Ambient temperature: 32–131°F (0–55°C)
	Wiring: Use Copper Conductors Only, Use 60/75°C Conductors, Use No. 18–16 AWG Wire Size Only, Tightening: Torque 0.79Nm or 7lb in. Use with accessory: LRG 16–3, LRG 16–4, LRG 17–3

Rating plate of the LRR 1-50, bottom



Rating plate of the LRR 1-51, bottom

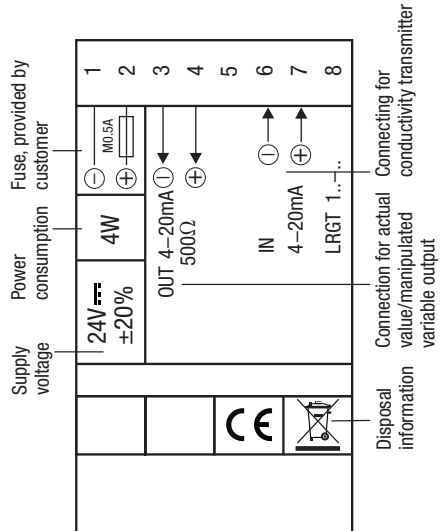


Fig. 1

Functional elements and dimensions of the LRR 1-50, LRR 1-51

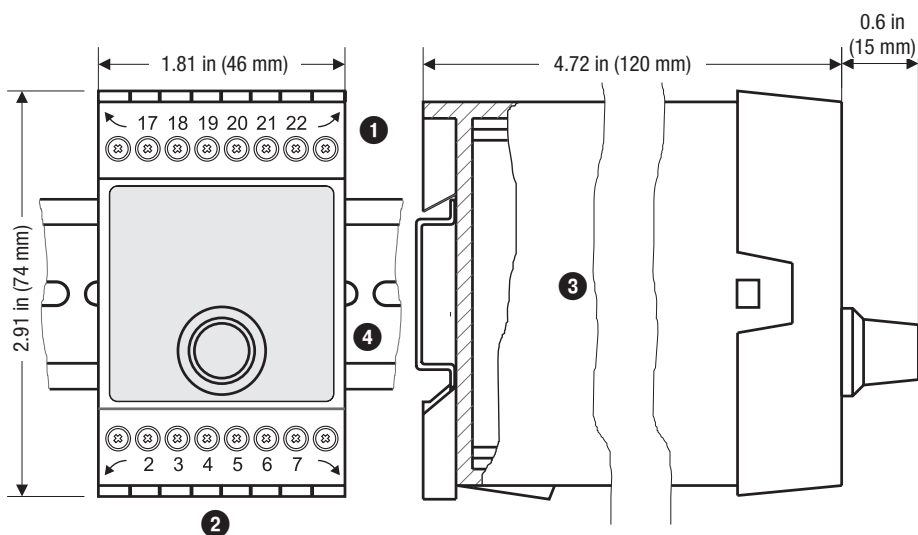


Fig. 2

Key

- | | |
|-------------------------------|---------------------------------------|
| 1 Upper terminal strip | 3 Terminal box |
| 2 Lower terminal strip | 4 Support rail TH 35, EN 60715 |

Preparing for installation




If the control cabinet is to be installed outdoors, outside the protection of a building, environmental influences may adversely affect function.

- Pay attention to the admissible ambient conditions in the technical data, siehe Seite 12.
 - Do not operate the equipment if the temperature is below freezing.
 - ◆ At temperatures below freezing, use a suitable heat source (e.g., control cabinet heater, etc.).
 - Connect all parts of the plant to a central grounding point to prevent equalizing currents.
 - Use UV-resistant cable ducts for routing the connecting cable.
 - Take further measures to protect the equipment from lightning, insects and animals, and salty air.
-

You will need the following tools:

- Screwdriver size 1/8 in (3.2 mm)

Installing the “LRR 1-52”50, “LRR 1-53”1 conductivity controller

The LRR 1-50, LRR 1-51 conductivity controller is clipped onto a type TH 35, EN 60715 support rail in the control cabinet. **Fig. 2** 

DANGER



There is a risk of electric shock during work on electrical systems.

- Switch off the voltage to the plant before you install the equipment.
- Check that the plant is not carrying live voltage before commencing work.

1. Switch off the voltage to the plant and secure any surrounding equipment in the control cabinet that is live, so it cannot be touched.
2. Carefully press the unit onto the support rail until the holder clips into place.

In the control cabinet: Electrically connecting the conductivity controller

Wiring diagram of the LRR 1-50 conductivity controller

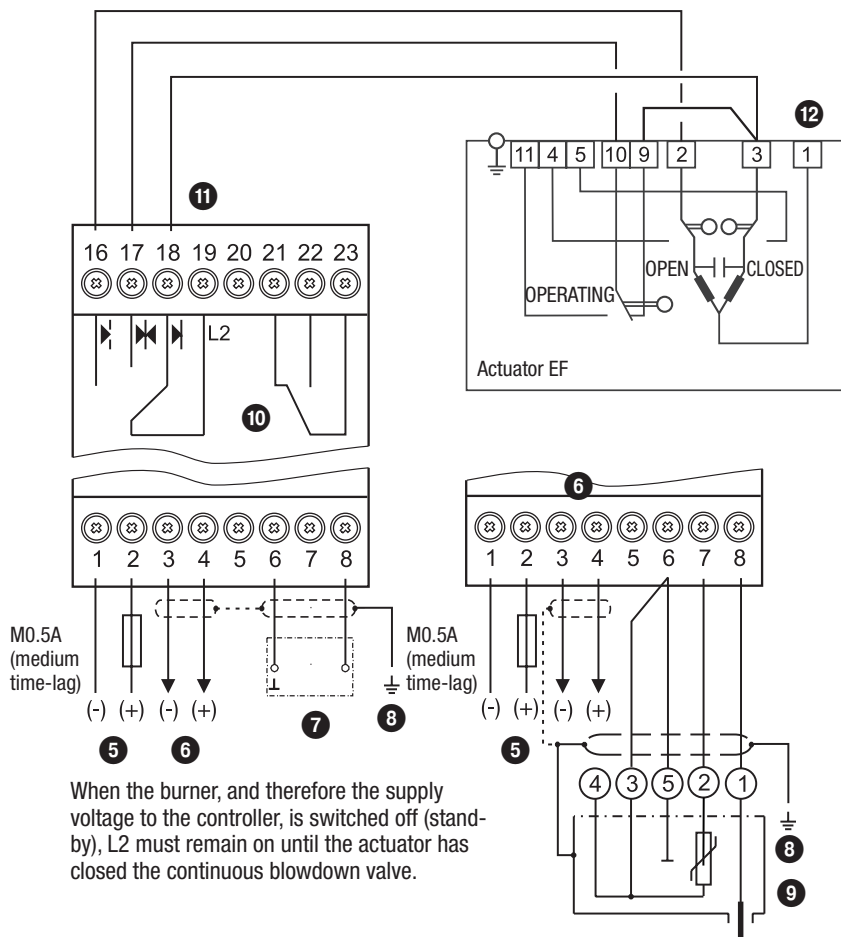


Fig. 3

Key

- 5** Connection of supply voltage 24 V DC with 0.5A medium time-lag fuse provided by customer
- 6** Actual value/manipulated variable output 4-20 mA (switch-selectable)
- 7** Conductivity electrode LRG 16-4 (terminal 6/7: a resistance thermometer can be connected)
- 8** Central grounding point (CGP) in control cabinet
- 9** Conductivity electrode LRG 16-9 with integrated resistance thermometer
- 10** MAX output contact
- 11** Supply voltage L2
- 12** Supply voltage N

In the control cabinet: Electrically connecting the conductivity controller

Wiring diagram of the LRR 1-51 conductivity controller

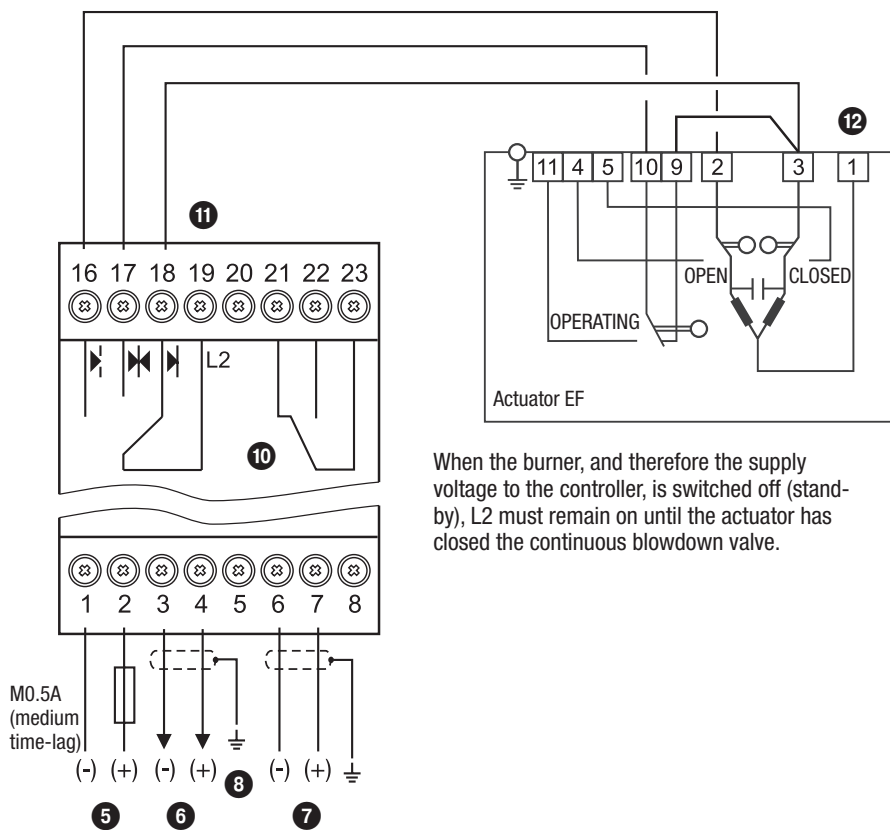


Fig. 4

Key

- ⑤ Connection of supply voltage 24 V DC with 0.5A medium time-lag fuse provided by customer
- ⑥ Actual value/manipulated variable output 4-20 mA (switch-selectable)
- ⑦ Conductivity transmitter LRGT 1-..., 4-20 mA, with grounding point
- ⑧ Central grounding point (CGP) in control cabinet
- ⑩ MAX output contact
- ⑪ Supply voltage L2
- ⑫ Supply voltage N

In the control cabinet: Electrically connecting the conductivity controller

Supply voltage connection

The equipment is supplied with 24 V DC (PELV / CLASS2) and has an external 0.5A medium time-lag fuse. Please use a safety power supply unit with protective electrical isolation.

This power supply unit must provide a level of isolation against dangerous contact voltages that at least meets the requirements for double or reinforced insulation in accordance with the following standard:
UL 60730-1.

Connecting the output contacts

Connect the upper terminal strip ❶ (terminals 16-23) according to the desired switching functions.

Provide an external 2.5A slow-blow fuse for the output contacts.

When inductive loads are switched off, voltage spikes are produced that may have a major adverse effect on the operation of control and measuring systems. Connected inductive loads must therefore have interference suppression (RC combination) as specified by the manufacturer.

If used as a conductivity limiter, the LRR 1-50, LRR 1-51 conductivity controller does not interlock automatically when the MAX limit is exceeded.

If the installation requires an interlock, this must be implemented in the downstream (safety) circuit.

Connecting the LRG 16-4 conductivity electrode

Please use a shielded, multi-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, to connect the equipment. Max. length 328 ft (100 m).

Connect the terminal strip as shown in the wiring diagram in **Fig. 3**.

Connect the shield to the central grounding point (CGP) in the control cabinet.

Route the connecting cable between items of equipment separately from power lines.

Connecting the LRG 16-9 conductivity electrode

The LRG 16-9 conductivity electrode is equipped with an M12 A-coded, 5-pole sensor connector, see **Fig. 3** for assignment. A pre-wired control cable (with connector and socket) is available in various lengths as an accessory for connecting the equipment.

To connect the LRR 1-50 conductivity controller, please remove the connector and wire the terminal strip as shown in the wiring diagram in **Fig. 3**.

Connect the shield to the central grounding point (CGP) in the control cabinet.

If you are not using the pre-wired control cable, lay a shielded 5-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, as the connecting cable. In addition, connect a socket, e.g., Binder series 713 99-0436-58-05, to the control cable at the electrode end.

Route the connecting cable between items of equipment separately from power lines.

In the control cabinet: Electrically connecting the conductivity controller

Connecting the LRGT 1.-... conductivity transmitter

Please use a shielded, multi-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, to connect the equipment. Max. length 328 ft (100 m).

Connect the terminal strip as shown in the wiring diagram. **Fig. 4**

Connect the shield as shown in the wiring diagram.

Route the connecting cable between items of equipment separately from power lines.

Connecting the actual value/manipulated variable output (4-20 mA)

Please use a shielded, multi-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, for connection. Max. length 328 ft (100 m).

Please note the maximum output load of 500 ohms.

Connect the terminal strip as shown in the wiring diagram. **Figs. 3, 4**

Connect the shield **just once** to the central grounding point (CGP) in the control cabinet.

Route the connecting cable between items of equipment separately from power lines.

Any item of equipment that you wish to connect to the terminals for the actual value/manipulated variable output 4-20 mA must be certified as having at least double or reinforced insulation according to UL 60730-1 between the current loop and live parts of the equipment that are not supplied with safety extra-low voltage (SELV).



Attention

- Do not use unused terminals as support terminals.

Tools

- Screwdriver size 1/8 in (3.2 mm)

In the plant:

Electrically connecting the conductivity electrode/transmitter

Connecting the LRG 16-4 conductivity electrode

Please use a shielded, multi-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, to connect the equipment.

Connect the terminal strip as shown in the wiring diagram. **Fig. 3**

Connect the shield to the central grounding point (CGP) in the control cabinet.

The cable length between the conductivity electrode/resistance thermometer and conductivity controller is max. 98 ft (30 m), or max. 32 ft (10 m) with a conductivity of 0.5 - 5 ppm (1 - 10 $\mu\text{S}/\text{cm}$).

Route the connecting cable between items of equipment separately from power lines.

Connecting the LRG 16-9 conductivity electrode

The LRG 16-9 conductivity electrode is equipped with an M12 A-coded, 5-pole sensor connector, see **Fig. 3** for assignment. A pre-wired control cable (with connector and socket) is available in various lengths as an accessory for connecting the equipment.

This control cable is not UV-resistant and must be protected with a UV-resistant plastic tube or cable duct if installation is outdoors.

For connection to the LRR 1-50 conductivity controller, please remove the connector and wire the terminal strip as shown in the wiring diagram. **Fig. 3**

Connect the shield to the central grounding point (CGP) in the control cabinet.

If you are not using the pre-wired control cable, lay a five-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, as the connecting cable. In addition, connect a socket, e.g., Binder series 713 99-0436-58-05, to the control cable at the electrode end.

The cable length between the conductivity electrode and controller is max. 98 ft (30 m), or max. 32 ft (10 m) with a conductivity of 0.5 - 5 ppm (1 - 10 $\mu\text{S}/\text{cm}$).

Route the connecting cable between items of equipment separately from power lines.

Connecting the LRGT 1-.. conductivity transmitter

Please use a shielded, multi-core TC-ER control cable with minimum wire size AWG18, e.g., OELFLEX CONTROL TM CY 5G1, to connect the equipment. Max. length 328 ft (100 m).

Connect the terminal strip as shown in the wiring diagram. **Fig. 4**

Connect the shield as shown in the wiring diagram.

Route the connecting cable between items of equipment separately from power lines.



Attention

- Please bring the equipment into service as described in the LRG 16-4, LRG 16-9 and LRGT 1-.. Installation & Operating Manuals.
- Route the connecting cable between items of equipment separately from power lines.
- Check the connection of the shield to the central grounding point (CGP) in the control cabinet.
- The conductivity transmitter must be connected to its own dedicated supply voltage.

Changing the equipment settings



Danger

The upper terminal strip of the equipment is live during operation.

There is a risk of serious injury due to electric shock.

Always **cut off power** to the equipment before working on the terminal strip (installation, removal, connecting cables).

Switching the unit of measurement/changing the function

Electrical conductivity is measured in $\mu\text{S}/\text{cm}$. In some countries, ppm (parts per million) is used instead. Conversion $1\mu\text{S}/\text{cm} = 0.5\text{ ppm}$. Set the desired unit using code switch 13. This setting will then apply to all conductivity readings and set values. If you set the equipment to ppm, please stick the supplied adhesive sign over the unit on the terminal box.

To change the setting, proceed as follows:

- Insert a screwdriver between the terminal strip and the front frame, at the arrow markings on the right and left.
- Release the terminal strip on the right and left by turning the screwdriver in the direction of the arrow.
- Detach the terminal strip.
- Set code switch 13 as shown in the table below.
- Insert the lower terminal strip.
- Switch the supply voltage back on. The equipment restarts.

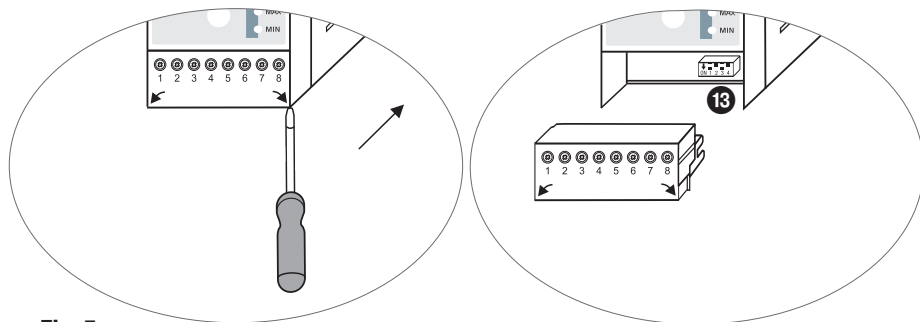


Fig. 5

Changing the equipment settings

Conductivity controller LRR 1-50, LRR 1-51

Code switch ⑬				Configuration
S1	S2	S3 *	S4	
OFF				Reserve (factory setting)
ON				Reserve
	OFF			Reserve
	ON			Reserve (factory setting)
		OFF		Terminal 3/4 (Out 2) as actual value output (X) (factory setting) *
		ON		Terminal 3/4 (Out 2) as manipulated variable output (Yw) *
			OFF	Electrical conductivity measured in $\mu\text{S}/\text{cm}$ (factory setting)
			ON	Electrical conductivity measured in ppm

* Controller software version 311178.13 or later



Attention

Do **not** move switches S1 and S2 on code switch ⑬!

Tools

- Screwdriver size 3.5 x 100 mm, fully insulated to VDE 0680-1.

Operating the conductivity controller

Meaning of codes on the 7-segment display

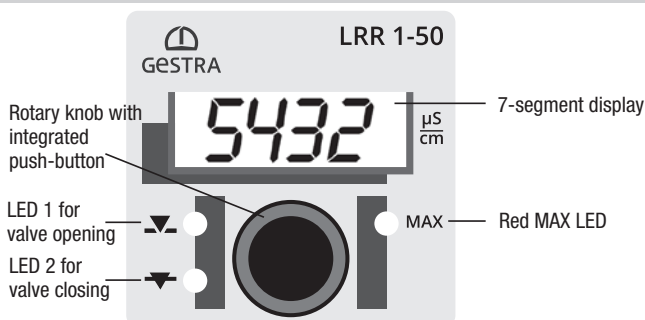


Fig. 6

Code	Meaning	
Indicated when rotary knob is turned clockwise:		
AL.Hi	Alarm High	MAX switchpoint, adjustable from 0.5 to 4999.5 ppm (1 to 9999 µS/cm)
SP	Set point	Adjustable from 0.5 to 4999.5 ppm (1 to 9999 µS/cm)
HySt	Hysteresis	Reset hysteresis, adjustable from 1 to 25% of set point
FiLt	Filter	Switching the filter on/off (damping)
PW	Password	on = password protection is enabled off = password protection is disabled
	Factory default setting	1902 (cannot be changed)

LRR 1-50 only			LRR 1-51 only	
CAL	Electrode calibration	Electrode calibration, last reading is shown	Sin.L	Lower end of measuring range, adjustable from 0.0 - 0.25 - 25 - 50 ppm (0 - 0.5 - 50 - 100 µS/cm)
CF	Correction factor	Adjustable from 0.05 to 5.000 in increments of 0.001		Sin.H
inP	Input for Pt100	Temperature compensation YES (no)		
tC	Temperature coefficient	tC 0.0 – 3.0% per °C, adjustable in increments of 0.1		

Sout		Standardization of current output, adjustable between 5 and 5000 ppm (10 and 9999 µS/cm)
Si		Flushing interval, adjustable from 0 to 24 hours in increments of 1h
Sd		Flushing time, adjustable from 1 to 4 minutes in increments of 1min.
tEst	Test	Test of output relays

Indicated in parameterization mode		
quit	Quit	Entry is not confirmed
done	Done	Entry is confirmed

Indicated in the event of errors		
E.001	Error	Faulty temperature sensor, temperature reading too low (LRR 1-50 only)
E.002	Error	Faulty temperature sensor, temperature reading too high (LRR 1-50 only)
E.005	Error	Faulty measured value acquisition, reading too low
E.006	Error	Faulty measured value acquisition, reading too high

Bringing into service

Setting parameters

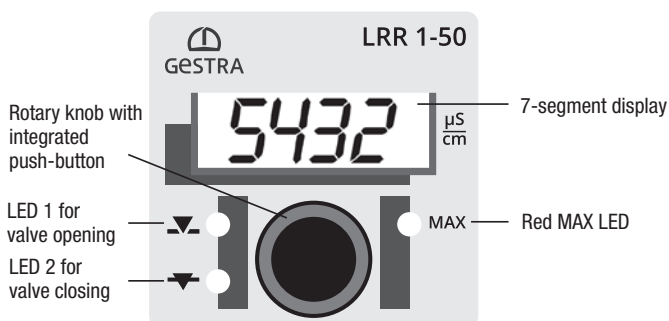


Fig. 6

Starting		
Action	Indication	Function
Switch on supply voltage.	7-segment display shows software/equipment version	System test, takes approx. 3 s.
	7-segment display shows actual value, LEDs light up.	Switch to operating mode
Actual value < set point	1. LED 1 for valve opening flashes 2. LED 2 for valve closing flashes.	Continuous blowdown valve opens for time Sd then moves into OPERATING position.
Actual value > set point	1. LED 1 for valve opening flashes 2. LED 2 for valve closing flashes.	Continuous blowdown valve opens. After the conductivity has fallen by the set hysteresis HySt, the valve moves into OPERATING position.

Setting parameters		
Action	7-segment display	Function
Turn rotary knob until desired parameter is shown	Display toggles between parameter and saved value.	The parameter is selected
Press and hold the push-button (on rotary knob)	First digit (000 <u>0</u>) flashes.	Parameterization mode active. You can change the first digit.
Turn rotary knob	A new value is displayed.	Turning clockwise increases the value, turning counterclockwise reduces the value.
Briefly press the push-button. The digit increases with each press	2nd, 3rd or 4th digit flashes (from right to left).	2nd, 3rd or 4th digit can now be changed using the rotary knob. Turning clockwise increases the value, turning counterclockwise reduces the value
If you take no further action:	quit is briefly displayed. After this, the display toggles between the parameter and the old value.	The system automatically returns to parameter settings and your entry is not confirmed.
When your entries are complete: Press and hold the push-button	done is briefly displayed. After this, the display toggles between the parameter and the new value.	Your entry is confirmed and the system automatically returns to parameter settings.
Turn the rotary knob until the next parameter is shown. Or turn the rotary knob until the actual value is displayed. Or after 30 s, the actual value is displayed automatically.		



If **password protection** is enabled, you must enter the password before changing a parameter. See section on password protection.

Bringing into service

Conductivity controller LRR 1-50: Setting switchpoints and parameters

Setting the MAX switchpoint	
Action	Function
Select parameter AL.Hi, enter and save the desired conductivity.	The MAX switchpoint is set between 1 and 5000 ppm or 1 and 9999 $\mu\text{S}/\text{cm}$.

Setting the set point	
Select parameter SP, enter and save the desired conductivity.	The set point is set between 1 and 5000 ppm or 1 and 9999 $\mu\text{S}/\text{cm}$.

Setting the reset hysteresis	
Select parameter HySt, enter and save the required value.	The reset hysteresis is set between 1 and 25% of the set point.

Conductivity electrode LRG 1-: Setting the correction factor	
Select correction factor CF, enter and save the required value. Alternatively, use calibration function CAL (from software version "S-13" onward).	Once service temperature is reached, measure the conductivity of a water sample [at 77 °F (25 °C)]. Change the correction factor in increments until the indicated actual value matches the reference reading. This adapts the conductivity measurement to the specific conditions of the installation, or compensates for deviations during operation.

Conductivity electrode LRG 16-9	
Switching on temperature compensation	
Select setting inP and turn the rotary knob clockwise. YES appears. Save the setting.	
Setting the temperature coefficient	
Select temperature coefficient tC, enter and save the desired percentage.	Once service temperature is reached, measure the conductivity of a water sample [at 77 °F (25 °C)]. Change the temperature coefficient in increments until the indicated actual value matches the reference reading.
If necessary: Select correction factor CF, enter and save the required value. Alternatively, use calibration function CAL (from software version "S-13" onward).	During operation, the indicated conductivity may differ from the reference reading, e.g., due to dirt deposits. In this case, change the correction factor in increments until the indicated actual value matches the reference reading.

Setting the actual value output-current output standardization	
Select parameter Sout, enter and save the desired conductivity.	The current output is set between 5 and 5000 ppm (10 and 9999 $\mu\text{S}/\text{cm}$)

Setting the flushing interval and flushing time	
Select parameter Si, enter and save the desired time.	The flushing interval is set between 0 and 24 hours.
Select parameter Sd, enter and save the desired time.	The flushing time is set between 1 and 4 minutes.

Bringing into service

Conductivity controller LRR 1-50: Setting switchpoints and parameters

Calibration		
Action	Display	Function
Turn rotary knob until CAL is shown.	CAL is shown.	Calibration is selected.
Press and hold the push-button (on rotary knob)	The last reading is shown and the digit on the right flashes (xxxX).	Enter the conductivity, starting with the digit on the right.
Turn the rotary knob clockwise or counterclockwise to enter the required digit.	xxxX	Enter the first digit.
Briefly press the push-button.	The second digit from the right flashes (xxXx).	You can enter the second digit.
Repeat the last two steps until you have entered the conductivity in full.	The entered conductivity (xxxx) is shown.	Enter the conductivity in full.
	quit	Timeout. The system returns to parameter settings. Entry has been discontinued due to a lack of activity.
Press and hold the push-button (on rotary knob).	donE	The new calibration value has been applied and a CF value calculated on this basis.
	CF.Er	CF value is outside the admissible range. The previous calibration has been retained.

Bringing into service

Conductivity controller LRR 1-51: Setting switchpoints and parameters

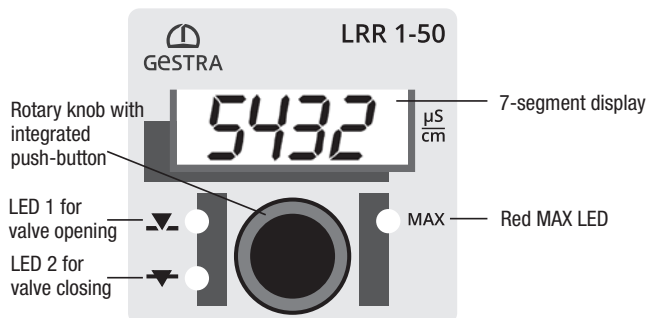


Fig. 6

Setting the MAX switchpoint	
Action	Function
Select parameter AL.Hi, enter and save the desired conductivity.	The MAX switchpoint is set between 1 and 5000 ppm or 1 and 9999 µS/cm.

Setting the set point	
Select parameter SP, enter and save the desired conductivity.	The set point is set between 1 and 5000 ppm or 1 and 9999 µS/cm.

Setting the reset hysteresis	
Select parameter HySt, enter and save the required value.	The reset hysteresis is set between 1 and 25% of the set point.

Setting the lower and upper ends of measuring range	
Select parameter Sin.L, enter and save the desired conductivity.	Lower end of measuring range is set in stages 0.0 - 0.25 - 25 - 50 ppm (0.0 - 0.5 - 50 - 100 µS/cm)
Select parameter Sin.H, enter and save the desired conductivity.	Upper end of measuring range is set in stages 10 - 50 - 100 - 250 - 500 - 1000 - 1500 - 2500 - 3000 - 3500 - 5000 - 6000 ppm (20 - 100 - 200 - 500 - 1000 - 2000 - 3000 - 5000 - 6000 - 7000 - 10000 - 12000 µS/cm)

Setting the actual value output-current output standardization	
Select parameter Sout, enter and save the desired conductivity.	The current output is set between 5 and 5000 ppm (10 and 9999 µS/cm)

Setting the flushing interval and flushing time	
Select parameter Si, enter and save the desired time.	The flushing interval is set between 0 and 24 hours.
Select parameter Sd, enter and save the desired time.	The flushing time is set between 1 and 4 minutes.

Operation, alarm and test

Conductivity controller LRR 1-50, LRR 1-51: Checking indications and the function of the MAX output contact

Operation		
Action	Indication	Function
Actual value < set point	The actual value is shown on the 7-segment display. LED 2 for valve closing flashes, MAX LED is not lit.	Valve output contact 19/17 closed, MAX output contact 21/23 open, 22/23 closed.

Set point exceeded		
Actual value > set point	The actual value is shown on the 7-segment display. 1. LED 1 for valve opening flashes 2. LED 2 for valve closing flashes, MAX LED is not lit.	Continuous blowdown valve opens. After the conductivity has fallen by the set hysteresis HySt, the valve moves into OPERATING position. 1. Valve output contact 19/16 closed. 2. Valve output contact 19/17 closed. MAX output contact 21/23 open, 22/23 closed.

MAX alarm		
Conductivity above MAX switchpoint.	MAX LED lights up red	MAX output contacts 21/23 closed, 22/23 open.

Standby		
Burner is switched off (standby) Supply voltage for conductivity controller is also switched off. When they are switched on again, the system restarts. See page 18		Valve output contact 19/18 closed. Continuous blowdown valve closes.

Test of MAX alarm		
Action	Indication	Function
In operating mode: Actual value < set point. Select Test parameter. Press and hold push-button. 7-segment display: Test flashes.	MAX LED lights up red for 3 seconds	MAX output contact 21/23 closed, 22/23 open.
	After 3 seconds: MAX LED goes out.	MAX output contact 21/23 open, 22/23 closed.
Test complete, release push-button. 7-segment display: Test is displayed.	Note: If you continue holding the push-button, the test sequence will start again. You can cancel the test sequence at any time by releasing the push-button.	
Turn the rotary knob until the actual value is displayed. Or after 30 s, the actual value is displayed automatically.		



Note

The continuous blowdown valve has three limit switches for the CLOSED, OPEN and OPERATING positions. In OPERATING position, the continuous blowdown valve is slightly open. This enables a certain blowdown volume to be removed from the boiler, to keep the TDS below the limit. The blowdown volume is established using the capacity charts of the continuous blowdown valve. Please refer to the Installation & Operating Manual for GESTRA continuous blowdown valves.

Operation, alarm and test

Password protection

The option of password protection for parameters is available as of software version “S-13”. The default password is 1902 and cannot be changed.

Enabling password protection		
Action	Display	Function
Turn rotary knob until PW is shown.	The display toggles between the parameter name and the parameter value.	Parameter is selected.
Press and hold the push-button (on rotary knob).	PASS	Password entry is required.
Release the push-button, then press and hold it again.	First digit (0000) flashes.	Enter the password, starting with the digit on the right.
Turn the rotary knob clockwise or counterclockwise to enter the required digit.	000X	Enter the first digit.
Briefly press the push-button.	The second digit from the right flashes (000X).	You can enter the second digit.
Repeat the last two steps until the password has been entered in full.	The entered password (XXXX) is shown	Enter the password in full.
Press and hold the push-button.	donE	The correct password has been entered. The parameter can be edited.
	FAIL	The wrong password has been entered. The parameter is still password-protected.
	quit	Timeout. The system returns to parameter settings. Password entry is discontinued.
Once disabled, password protection is reactivated after 30 minutes of no activity (i.e., rotary knob is not turned), and the password must be entered again. The parameters are password-protected when the equipment is restarted, if password protection was previously enabled.		

Fault indications and troubleshooting

Indications, diagnosis and corrective action



Attention

Please check the following before fault diagnosis:

Supply voltage:

Is the conductivity controller supplied with the voltage specified on the rating plate?

Wiring

Does the wiring conform to the wiring diagram?

Error codes on the 7-segment display		
Error code	Error	Corrective action
E.001	Faulty temperature sensor, temperature reading too low	Check resistance thermometer and LRG 16-9 conductivity electrode and replace if necessary. Check electrical connection (short circuit, open circuit?).
E.002	Faulty temperature sensor, temperature reading too high	
E.005	Faulty conductivity electrode, reading too low.	Check conductivity electrode and replace if necessary. Check electrical connection.
	Faulty conductivity transmitter, measuring current < 4 mA	Check conductivity transmitter and replace if necessary. Check electrical connection.
E.006	Faulty conductivity electrode, reading too high.	Check conductivity electrode and replace if necessary. Check electrical connection. Check boiler water.
	Faulty conductivity transmitter, measuring current > 20 mA	Check conductivity transmitter and replace if necessary. Check electrical connection.
E.097	Walkthrough application error	Internal error. Replace equipment.
E.098	Walkthrough test error	Internal error. Replace equipment.
E.099	Internal test error	Internal error. Replace equipment.
In the event of a fault, the MAX alarm is triggered and the continuous blowdown valve moves into OPERATING position.		

Errors without an error code	
Error	Corrective action
Actual value < set point. Continuous blowdown valve opens.	Check code switch S4. Switch must be in the ON position.
4-20 mA actual value display remains in the 4-8 mA or 20 mA range when the conductivity changes	Check code switch S3 with the help of the table on p. 19. Switch must be in the OFF position
4-20 mA manipulated variable output (Yw) changes proportional to conductivity.	Check code switch S3 with the help of the table on p. 19. Switch must be in the ON position



Attention

- For further troubleshooting, please refer to the LRG 16-4, LRG 16-9 and LRGT 1.-.. Installation & Operating Manuals.



Note

In the event of a fault in the conductivity controller, the MAX alarm is triggered and the equipment restarts. If the process repeats itself continuously, the equipment must be replaced.

Further information

Action against high-frequency interference

High-frequency interference can be caused by out-of-phase switching operations. If such interference occurs and results in sporadic failure, we recommend taking the following action to suppress interference:

- Provide inductive loads with RC combinations as specified by the manufacturer.
- Route the connecting cable to the conductivity electrode or conductivity transmitter separately from power lines.
- Increase the distance from sources of interference.
- Check that the shield is correctly connected. Check the shield of items of equipment with the aid of the Installation & Operating Manuals. If equalizing currents are likely (outdoor installations), connect the shield on one side only.
- Suppress HF interference using hinged-shell ferrite rings.

Taking the “LRR 1-52”0, “LRR 1-53”1 out of service

- Switch off the supply voltage and **cut off power** to the equipment.
- Detach the upper and lower terminal strips. **Fig. 7**
 - Insert a screwdriver between the terminal strip and the front frame, at the arrow markings on the right and left.
 - Release the terminal strip on the right and left by turning the screwdriver in the direction of the arrow.
 - Detach the terminal strip.
- Release the white slider holder at the bottom of the unit and detach the unit from the support rail.

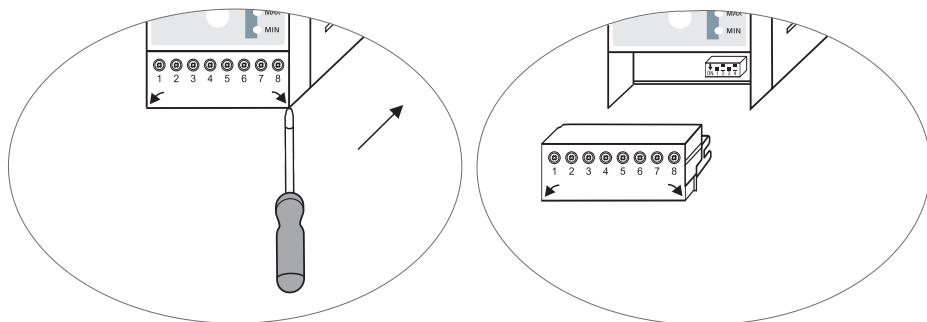


Fig. 7

Disposal

Dispose of the conductivity transmitter in accordance with statutory waste disposal regulations.

UL components

LRR1-50 and LRR 1-51 conductivity controllers are registered under XACN.E513189.

Declaration of Conformity Standards and directives

Please see our Declaration of Conformity and associated certificates for details on the conformity of our equipment and the applicable standards and directives.

You can download the Declaration of Conformity online at www.gestra.com or request certificates from the following address:

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e-mail info@de.gestra.com

Web www.gestra.com

Modifications to the equipment not approved by us will invalidate Declarations of Conformity and certificates.



You can find our authorized agents around the world at: **www.gestra.com**

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