GESTRA®

Conductivity Switch

LRS 1-50

EN
English

Original Installation &
Operating Manual

819223-04

Contents

Contents continued

Important notes

Usage for the intended purpose

The LRS 1-50 conductivity switch is used in combination with the LRG 1.-.. conductivity electrodes as a limit switch, e.g. in steam boilers and hot water installations and in condensate and feedwater tanks. The conductivity switch indicates when a MIN and MAX conductivity has been reached.

The LRS 1-50 conductivity switch can be combined in a circuit with the LRG 12-1, LRG 16-4, LRG 16-9, LRG 17-1 and LRG 19-1 conductivity electrodes.

Function

In combination with the LRG 1.-.. conductivity electrode, the **LRS 1-50 conductivity switch** measures the electrical conductivity of conductive fluids. LRG 12-2, LRG 16-4, LRG 17-1, LRG 19-1 conductivity electrodes can be connected, or the LRG 16-9 model with integrated resistance thermometer for measuring the fluid temperature. A separate Pt100 resistance thermometer may also be used to measure the temperature.

When the **LRG 1.-.. conductivity electrode** is connected, a reference measurement is taken and the conductivity reading is then adapted to the installation conditions by adjusting correction factor **CF**.

If a resistance thermometer is connected, the water temperature is measured as well as the conductivity. This enables the change in conductivity that occurs as the temperature rises to be compensated and referred to the normalised reference temperature of 25 °C.

For this purpose, the water temperature is measured in the conductivity switch and the reading is automatically compensated as a function of the adjusted temperature coefficient **tC** (%/°C). If the temperature changes, thanks to linear temperature compensation the reading is referenced to 25 °C across the entire measurement range, and shown as an actual value on the 7-segment LED display.

The MIN/MAX limits can be adjusted as long as they remain within the measuring range.

If the MIN or MAX limit is reached, the MIN or MAX output contact switches and the MIN or MAX LED lights up. It switches back when the conductivity is above or below the set hysteresis.

Faults or malfunctions in the conductivity electrode, the electrical connection or the settings are indicated on the 7-segment LED display. In the event of a malfunction, the MIN and MAX alarm is triggered.

If faults occur only in the LRS 1-50 conductivity switch, the MIN and MAX alarm is triggered and the system is restarted.

Parameters can be changed or the MIN/MAX alarm simulated by operating the rotary knob.

Electrical conductivity is measured in µS/cm. In some countries, ppm (parts per million) is used instead. Conversion 1 µS/cm = 0.5 ppm. The conductivity switch can be set as appropriate.

Important notes continued

Safety note

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

Maintenance and setup work may only be performed by authorised staff who have undergone specific training.

Danger

The terminal strips of the equipment are 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 strips (installation, removal, connecting cables).

Attention

The name plate indicates the technical features of the equipment. Do not bring into service or operate any equipment that does not bear its own specific name plate.

Potentially explosive areas

The equipment must not be used in potentially explosive atmospheres.

Note

LRG 12-1, LRG 16-4, LRG 16-9, LRG 17-1 and LRG 19-1 conductivity electrodes are simple items of electrical equipment as specified in EN 60079-11 section 5.7.
The equipment may be used in potentially explosive atmospheres only in combination with approved Zener barriers. Suitable for use in Ex zones 1 and 2 (1999/92/EC). The equipment does not have Ex classification.

Technical data

LRS 1-50

Supply voltage
24 VDC +/– 20%

Fuse
External semi-delay 0.5A

Power consumption
4 W

Connecting a conductivity electrode
1 input for LRG 12-1, LRG 16-4, LRG 17-1 and LRG 19-1 conductivity electrode (cell constant 1 cm^{-1}), 3-pole with shield,
1 input for LRG 16-9 conductivity electrode (cell constant 0.5 cm^{-1}), with integrated resistance thermometer Pt100, 5-pole with shield.

Measuring voltage
0.8 Vss, pulse duty factor tv=0.5, frequency 20-10000 Hz.

Measuring range
1 to 10000 µS/cm at 25 °C or 1 to 5000 ppm at 25 °C.

Switching hysteresis
MIN limit: + 3% of set MIN limit
MAX limit: – 3% of set MAX limit

Outputs
LRS 1-50: 2 volt-free relay contacts, 8 A 250 V AC / 30 V DC cos φ = 1.

Inductive loads must have interference suppression (RC combination) as per the manufacturer's specifications.

Indicators and controls
1 rotary knob with integrated pushbutton for testing the MIN/MAX alarm and setting the parameters,
1 four-digit seven-segment LED display,
2 red LEDs for MIN/MAX alarm,
1 four-pole code switch for configuration.

Housing
Housing material: base of black polycarbonate; front of grey polycarbonate
Conductor size: 1 x 4.0 mm^2 solid per wire, or
1 x 2.5 mm^2 stranded wire with sleeve to DIN 46228 or
2 x 1.5 mm^2 stranded wire with sleeve to DIN 46228 (min. ∅ 0.1 mm)
Terminal strips can be removed separately
Housing attachment: Mounting clip on support rail TH 35, EN 60715

Electrical safety
Pollution degree 2 for installation in control cabinet with protection rating IP 54, fully insulated

IP rating
Housing: IP 40 to EN 60529
Terminal strip: IP 20 to EN 60529
With panel adapter: IP 65 to EN 60529

Weight
Approx. 0.2 kg

Ambient temperature
when system is switched on 0 ... 55 °C
in operation –10 ... 55 °C

Technical data continued

LRS 1-50 continued

Transport temperature
–20 ... +80 °C (<100 hours), only switch on after a defrosting period of 24 hours.

Storage temperature
–20 ... +70 °C, only switch on after a defrosting period of 24 hours.

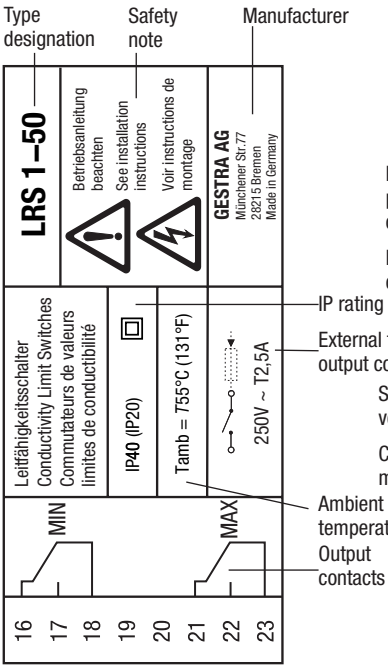
Relative humidity
max. 95%, non-condensing

Product package

LRS 1-50
1 conductivity switch LRS 1-50
1 adhesive sign for ppm
1 Installation & Operating Manual

Example of name plate/identification

Name plate, top



Name plate, bottom

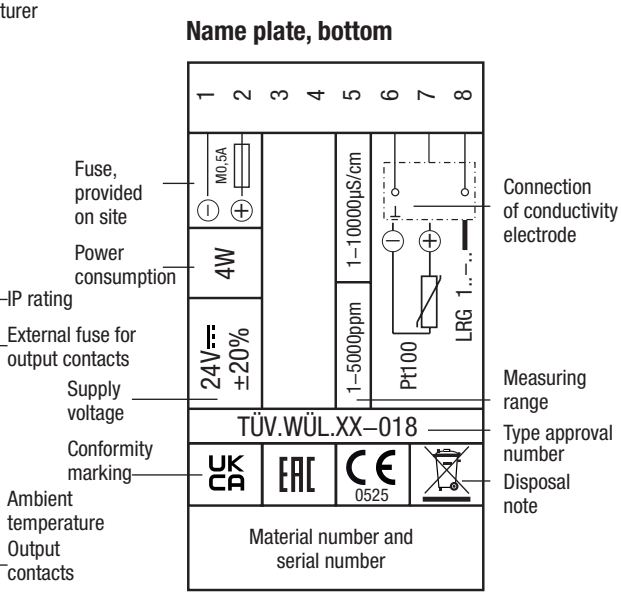


Fig. 1

Installation

Installation in the door of the control cabinet

The small panel adapter with rotary knob, stock code 441553, enables the conductivity switch to be installed in the door of a control cabinet.

The advantage of using the adapter is that the status is visible and alarms can be tested without opening the control cabinet door. When installed, the adapter has a rating of IP65. Please refer to the panel adapter Installation & Operating Manual 850625-xx for further information.

Fig. 2

Dimensions of LRS 1-50

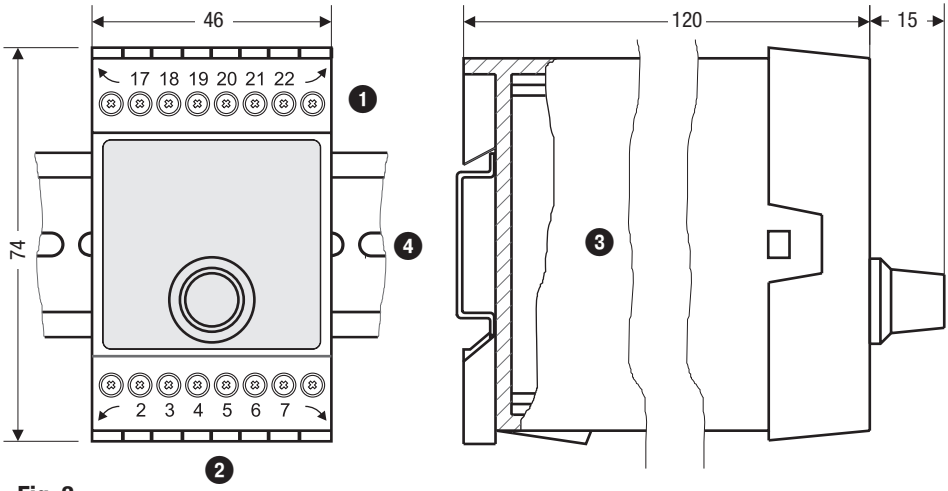


Fig. 3

1. Upper terminal strip
2. Lower terminal strip
3. Housing
4. Support rail TH 35, EN 60715

Key

Installation in a control cabinet

The LRS 1-50 conductivity switch is clipped onto a type TH 35, EN 60715 support rail in the control cabinet. **Fig. 3** ❹

In the control cabinet: Wiring the conductivity switch

Wiring diagram for conductivity switch LRS 1-50

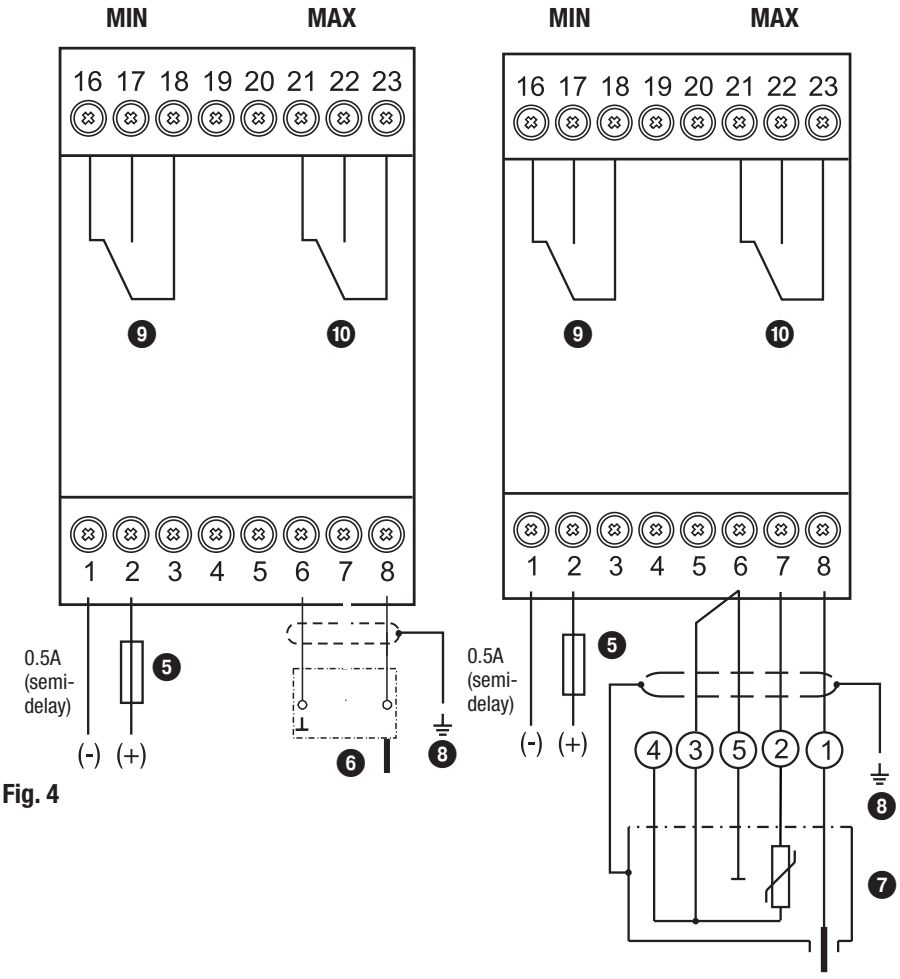


Fig. 4

Key

- **5** Connection of supply voltage 24 V DC with semi-delay fuse 0.5A provided on site
- **6** Conductivity electrode LRG 1.-.. (terminal 6/7: resistance thermometer can be connected)
- **7** Conductivity electrode LRG 16-9 with integrated resistance thermometer
- **8** Central earthing point (CEP) in control cabinet
- **9** MIN output contact
- **10** MAX output contact

In the control cabinet: Wiring the conductivity switch continued

Supply voltage connection

The equipment is supplied with 24 V DC and has an external semi-delay 0.5A fuse. Please use a safety power supply unit with reliable electrical isolation.

This power supply unit must be electrically isolated from dangerous live voltages and meet the requirements for double or reinforced insulation in accordance with one of the following standards:

EN 61010-1, EN 60730-1, EN 60950-1 or EN 62368-1.

Connection of output contacts

Wire the upper terminal strip ❶ (terminals 16-23) in line with the desired switching functions.
Provide an external slow-blow 2.5A fuse for the output contacts.

Switching off inductive loads produces surges that can have a major adverse effect on open and closed-loop control systems. Connected inductive loads must therefore have interference suppression (RC combination) as per the manufacturer's specifications.

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

If the installation requires a lockout function, this must be implemented in the downstream (safety) circuit. This circuit must conform to the requirements of EN 50156.

Connecting an LRG 12-2, LRG 16-4, LRG 17-1 or LRG 19-1 conductivity electrode and TRG 5-.. resistance thermometer

To connect the equipment, please use a shielded, multi-core control cable with a minimum conductor size of 0.5 mm^2, e.g. LiYCY 2 x 0.5 mm^2.

Wire the terminal strip as shown in the wiring diagram. **Fig. 4**
Connect the shield to the central earthing point (CEP) in the control cabinet.

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

Connecting an LRG 16-9 conductivity electrode

The LRG 16-9 conductivity electrode features an M12 A-coded, 5-pole sensor connector, see pin assignment in **Fig. 4.** A pre-wired control cable (with plug and socket) is available in various lengths as an accessory for connecting the equipment.

To connect the LRS 1-50 conductivity switch, please remove the connector and wire the terminal strip as shown in the wiring diagram. **Fig. 4.** Due to different cable manufacturers we cannot specify the wire colour. Please check the cable pin assignment before connecting.

Connect the shield to the central earthing point (CEP) in the control cabinet.

If you are not using the pre-wired control cable, use a 5-core shielded control cable as a connecting cable, e.g. LiYCY 5 x 0.5 mm^2. In addition, connect a shielded socket to the control cable at the electrode end.

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

Attention

■ Do not use unused terminals as support terminals.

In the system:
Wiring the conductivity electrode

Connecting an LRG 12-2, LRG 16-4, LRG 17-1 or LRG 19-1 conductivity electrode and TRG 5-.. resistance thermometer

To connect the equipment, please use a shielded, multi-core control cable with a minimum conductor size of 0.5 mm^2, e.g. LiYCY 3 x 0.5 mm^2.

Wire the terminal strip as shown in the wiring diagram. **Fig. 4**
Connect the shield to the central earthing point (CEP) in the control cabinet.

The max. cable length between the conductivity electrode/resistance thermometer and conductivity switch is 30 m, or max. 10 m with a conductivity of 1-10 µS/cm.

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

Connecting an LRG 16-9 conductivity electrode

The LRG 16-9 conductivity electrode features an M12 A-coded, 5-pole sensor connector, see pin assignment in **Fig. 4.** A pre-wired control cable (with plug 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 the equipment is installed outdoors.

To connect the LRS 1-50 conductivity switch, please remove the connector and wire the terminal strip as shown in the wiring diagram. **Fig. 4**

Connect the shield to the central earthing point (CEP) in the control cabinet.

If you are not using the pre-wired control cable, use a 5-core shielded control cable as a connecting cable, e.g. LiYCY 5 x 0.5 mm^2. In addition, connect a shielded socket to the control cable at the electrode end.

The max. cable length between the conductivity electrode and switch is 30 m, or max. 10 m with a conductivity of 1-10 µS/cm.

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

Attention

- Please start up the equipment as described in the Installation & Operating Manuals for the LRG 12-2, LRG 16-4, LRG 16-9, LRG 17-1, LRG 19-1 and TRG 5-..
- Route the connecting cables between items of equipment separately from power lines.
- Check the shield connection to the central earthing point (CEP) in the control cabinet.

Tools

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

Factory settings

Changing the factory settings

Conductivity switch LRS 1-50

- MAX switchpoint AL.Hi = 6000 µS/cm
- MIN switchpoint AL.Lo = 500 µS/cm
- Switching hysteresis: +/– 3% (fixed)
- Correction factor CF: 1
- Temperature compensation inP: No (no)
- Temperature coefficient tC: 2.1% / °C
- Damping FiLt: oFF
- Password PW: oFF
- **Code switch ⓫**: All switches OFF.

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).

Changing the unit of measurement

Electrical conductivity is measured in µS/cm. In some countries, ppm (parts per million) is used instead. Conversion 1µS/cm = 0.5 ppm. Set the desired unit using code switch ⓫. This will then apply to all conductivity readings and set values. If you have set ppm as the unit of measurement, please use the supplied adhesive sign and stick this over the unit on the housing.

To change the unit, proceed as follows:

- Insert a screwdriver on the right and left between the terminal strip and the front frame, as shown by the arrows.
- Release the terminal strip on the right and left by turning the screwdriver in the direction of the arrow.
- Remove the terminal strip.
- On code switch ⓫ set switch S4 to ON = ppm (parts per million)
- Put on the lower terminal strip.
- Switch the supply voltage back on. The equipment restarts.

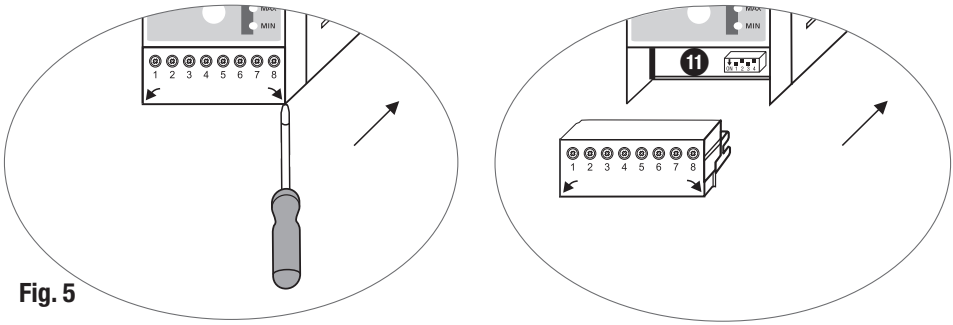


Fig. 5

Attention

Do **not** change the settings of switches S1, S2 and S3 on code switch ⓫!

Operating the conductivity switch

Meaning of codes on the 7-segment display

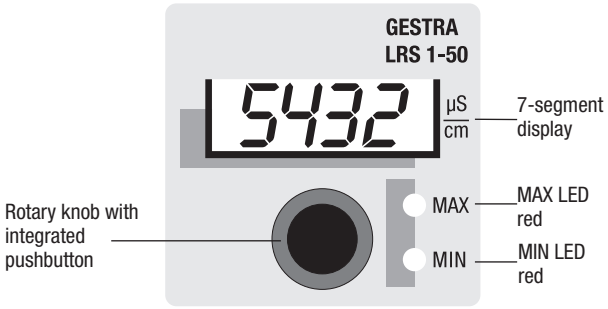


Fig. 6

Code	**Meaning**		
Appears when rotary knob is turned clockwise:			
AL.Hi	Alarm High	MAX switchpoint	Adjustable between 1 and 9999 µS/cm
AL.Lo	Alarm Low	MIN switchpoint	
CAL	Electrode calibration	Electrode calibration. Last reading is displayed.	
CF	Correction factor	Adjustable between 0.05 and 5.000 in increments of 0.001	
inP	Input Pt100	Temperature compensation YES (no)	
tC	Temperature coefficient	Temperature coefficient T_k 0.0 – 3.0% per °C, adjustable in increments of 0.1	
tESt	Test	Output relays are tested	
FiLt	Filter	Filter is switched on/off (damping)	
PW	Password	on = password protection is enabled oFF = password protection is disabled	
	Factory setting	1902 (cannot be changed)	

Appears in parameterization mode		
quit	Quit	Input is not confirmed
done	Done	Input is confirmed

Appears in the event of malfunctions		
E.001	Error	Temperature sensor defective, temperature reading too low
E.002	Error	Temperature sensor defective, temperature reading too high
E.005	Error	Acquired reading defective, reading too low
E.006	Error	Acquired reading defective, reading too high
E.013	Error	MIN switchpoint higher than MAX switchpoint

Bringing into service

Setting parameters

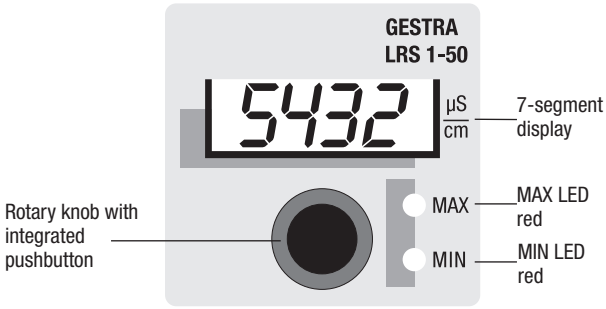


Fig. 6

Starting		
Action	**Indication**	**Function**
Switch on the supply voltage. Water level between MIN and MAX.	7-segment display shows software and equipment version	System test, takes approx. 3 sec.
	7-segment display shows actual value	System switches to operating mode

Setting parameters		
Action	**7-segment display**	**Function**
Turn rotary knob until desired parameter is shown	Display toggles between parameter and saved value.	Selecting the parameter
Press and hold the pushbutton (on rotary knob)	First digit (000**0**) flashes.	Parameterization mode active. First digit can be changed.
Turn rotary knob	A new value is displayed.	Turning clockwise increases the value, turning anti-clockwise reduces the value.
Briefly press the pushbutton. The number increases with each press	2nd, 3rd or 4th digit flashes. (from right to left)	2nd, 3rd or 4th digit can be changed using the rotary knob. Turning clockwise increases the value, turning anti-clockwise reduces the value.
If you do not take any further action:	quit is briefly displayed. After this, the display toggles between the parameter and the old value.	The parameter is automatically shown once more and your entry is not confirmed.
When your entries are complete: press and hold the pushbutton	done is briefly displayed. After this, the display toggles between the parameter and the new value.	Your entry is confirmed and the parameter is automatically shown once more.
Turn the rotary knob until the next parameter is shown. Or turn the rotary knob until the actual value is displayed. Or after 30s, the actual value is displayed automatically.		

If **password protection** is enabled, you must enter the password before you can change parameters. For the password, see section "Password protection".

Setting switchpoints and parameters

Setting the MIN/MAX switchpoints	
Action	**Function**
Select parameter AL.Lo, enter and save the desired conductivity.	Set the MIN switchpoint between 1 and 9999 µS/cm or 1 and 5000 ppm
Select parameter AL.Hi, enter and save the desired conductivity.	Set the MAX switchpoint between 1 and 9999 µS/cm or 1 and 5000 ppm

Conductivity electrode LRG 1.-..: Setting correction factor CF	
Select correction factor CF, enter and save the required value. Alternatively, use calibration function CAL (software version “S-13” and later).	Once operating temperature is reached, measure the conductivity of a water sample (at 25 °C). In increments, set the correction factor until the displayed actual value matches the reference reading. This adapts the conductivity reading to the installation conditions or compensates for deviations during operation.

Conductivity electrode LRG 1.-.. with separate resistance thermometer and LRG 16-9	
Switching on temperature compensation	
Select setting inP and turn the rotary knob clockwise. YES is displayed. Save the setting.	
Setting the temperature coefficient tC	
Select temperature coefficient tC, enter and save the desired percentage.	Once operating temperature is reached, measure the conductivity of a water sample (at 25 °C). In increments, set the temperature coefficient until the displayed actual value matches the reference reading.
If necessary: Select correction factor CF, enter and save the required value.	During operation, the indicated conductivity may differ from the reference reading, e.g. due to soiling. In that case, set the correction factor in increments until the displayed actual value matches the reference reading.

Operation, alarm and testing

Checking the displays and function of the MIN/MAX output contacts

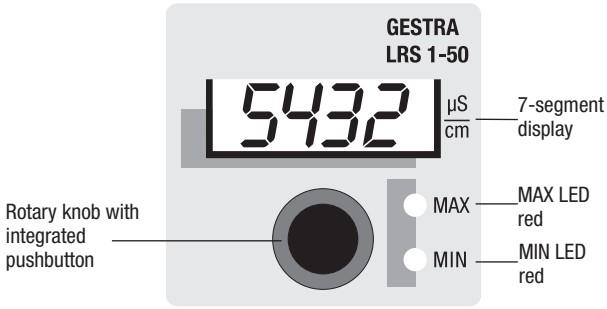


Fig. 6

Operation		
Action	**Indication**	**Function**
Conductivity between MIN and MAX.	The actual value is shown on the 7-segment display. MIN and MAX LEDs do not light up.	MIN output contacts 16/18 open, 17/18 closed. MAX output contacts 21/23 open, 22/23 closed.

MIN alarm		
Conductivity below MIN switch-point.	MIN LED lights up red	MIN output contacts 16/18 closed, 17/18 open.

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

Test of MIN alarm and MAX alarm		
Action	**Indication**	**Function**
In operating mode: Conductivity between MIN and MAX Select Test parameter. Press and hold the pushbutton. 7-segment display: Test flashes.	MAX LED lights up red for 3 seconds	MAX output contact 21/23 closed, 22/23 open.
	The MIN and MAX LED do not light up for 1 second	MIN output contact 16/18 open, 17/18 closed. MAX output contact 21/23 open, 22/23 closed.
	MIN LED lights up red for 3 seconds	MIN output contact 16/18 closed, 17/18 open.
Test complete, release push-button. 7-segment display: Test is displayed.	Note: If you continue holding the pushbutton, the test sequence will start again. You can interrupt the test sequence at any time by releasing the pushbutton.	
Turn the rotary knob until the actual value is displayed. Or after 30s, the actual value is displayed automatically.		

Password protection

Parameters can be password-protected from software version “S-13” onwards. The default password is 1902 and cannot be changed.

Enabling password protection		
Action	**Display**	**Function**
Turn the rotary knob until the entry PW is shown.	The display toggles between the arameter name and the parameter value.	Parameter selected.
Press and hold the pushbutton (on rotary knob).	PASS	Password entry is required.
Release and then press and hold the pushbutton once more.	First digit (000**0**) flashes.	Enter the password starting with the digit on the right.
Turn the rotary knob clockwise or anti-clockwise to enter the required digit.	000X	The first digit is entered.
Briefly press the pushbutton.	Second digit from the right flashes (00**0**X).	The second digit can be entered.
Repeat the last two steps until the password has been entered in full.	The entered password is displayed (XXXX).	The password is entered in full.
Press and hold the pushbutton.	donE	The correct password was entered. The parameter may be edited.
	FAiL	The wrong password was entered. The parameter is still password-protected.
	quit	Processing time has elapsed. System switches back to the parameter. Password entry is cancelled.
Disabled password protection is re-enabled after 30 minutes with no activity (rotary knob). The password must be entered again. When the equipment is restarted, the parameters are password-protected, if password protection was previously enabled.		

Calibration		
Action	**Display**	**Function**
Turn the rotary knob until the entry CAL is shown.	CAL is displayed.	Calibration is selected.
Press and hold the pushbutton (on rotary knob)	The last reading is displayed and the digit on the right flashes (xxxX).	Enter the conductivity starting with the digit on the right.
Turn the rotary knob clock-wise or anti-clockwise to enter the required digit.	xxxX	The first digit is entered.
Briefly press the pushbutton.	Second digit from the right flashes (xxXx).	The second digit can be entered.
Repeat the last two steps to enter the conductivity in full.	The entered conductivity is displayed (xxxx).	The conductivity is entered in full.
	quit	Processing time has elapsed. System switches back to the parameter. Entry was discontinued due to lack of activity.
Press and hold the pushbutton (on rotary knob).	donE	New calibration value has been accepted and a corresponding CF value calculated.
	CF.Er	CF value is outside the admissible range. Previous calibration has been retained.

Troubleshooting

Indications, diagnosis and remedies

Attention

Please check the following before fault diagnosis:

Supply voltage:
Is the conductivity switch supplied with the voltage specified on the name plate?

Wiring:
Does the wiring conform to the wiring diagram?

Error codes on the 7-segment display		
Error code	**Error**	**Remedy**
E.001	Temperature sensor defective, temperature reading too low	Check resistance thermometer of LRG 16-9 conductivity electrode and replace if necessary. Check electrical connection (short circuit, open circuit?).
E.002	Temperature sensor defective, temperature reading too high	
E.005	Conductivity electrode defective, reading too low.	Check conductivity electrode and replace if necessary. Check electrical connection.
E.006	Conductivity electrode defective, reading too high.	Check conductivity electrode and replace if necessary. Check electrical connection.
E.013	MIN switchpoint higher than MAX switchpoint	Reset switchpoints
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 malfunction, the MIN and MAX alarm is triggered.		

All error codes not listed here are available as reserves.

Attention

- For further fault diagnosis, please refer to the Installation & Operating Manuals for the LRG 12-2, LRG 16-4, LRG 16-9, LRG 17-1, LRG 19-1 and TRG 5-..

Note

In the event of a malfunction in the conductivity switch, the MIN and MAX alarm is triggered and the equipment restarts.
If the process is continually repeated, 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 per manufacturer's specifications.
- Route connecting cables to the conductivity electrode separately from power lines.
- Increase the distance from sources of interference.
- Check the shield connection. Check the equipment shielding with the aid of the Installation & Operating Manuals. If equalisation currents can be expected (outdoor installations), connect the shield to one side only.
- Suppress HF interference using hinged-shell ferrite rings.

Replacing/taking the equipment out of service

- Switch off the supply voltage and **cut off power** to the equipment.
- Remove the upper and lower terminal strips **Fig. 7**
  - Insert a screwdriver on the right and left between the terminal strip and the front frame, as shown by the arrows.
  - Release the terminal strip on the right and left sides by turning the screwdriver in the direction of the arrow.
  - Remove the terminal strip.
- Release the white slider holder on the underside of the housing and detach the equipment from the support rail

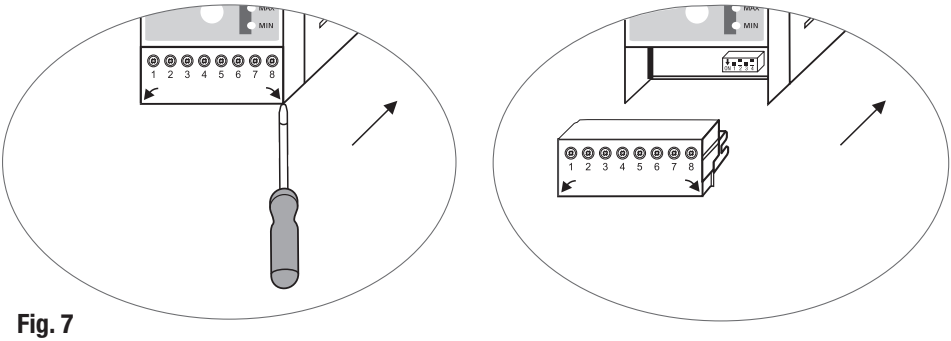


Fig. 7

Disposal

The equipment must be disposed of in accordance with statutory waste disposal regulations.

In the event of malfunctions or faults that cannot be remedied with the aid of this Installation & Operating Manual, please contact our service centre or authorised agent in your country.

Declaration of Conformity
Directives and Standards

For more information on the conformity of the equipment as well as applied Directives and Standards please refer to our Declaration of Conformity and associated certificates and/or approvals.

The Declaration of Conformity can be found online at www.gestra.com and associated certificates can be requested from:

GESTRA AG
Münchener Straße 77
28215 Bremen
Germany
Telefon +49 421 3503-0
Telefax +49 421 3503-393
E-mail info@de.gestra.com
Web www.gestra.com

Note that Declarations of Conformity and associated certificates lose their validity if equipment is modified without prior consultation with us.

For your notes

For your notes

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

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