GESTRA®

Conductivity Switch

LRGS 15-1

EN
English

Original Installation Instructions

818758-02

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Important Notes

Usage for the intended purpose

The conductivity switch LRGS 15-1 must only be used for measuring the electrical conductivity in liquids.

Safety note

The equipment must only be installed by and commissioned by qualified and competent staff.

Retrofitting and maintenance work must only be performed by qualified staff who – through adequate training – have achieved a recognised level of competence.

Danger

When loosening the conductivity switch hot water or steam may escape. This presents the risk of severe scalding.
Before removing the conductivity switch make sure that the boiler pressure is 0 bar.

The conductivity switch is hot during operation. This presents the risk of severe burns to hands and arms. Before mounting, servicing or removing the equipment make sure that it has cooled down to room temperatures.

The terminal strips of the conductivity switch LRGS 15-1 are live during operation. This presents the danger of electric shock.

Cut off power supply to the equipment before mounting, removing or connecting the terminal strips.

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

The equipment meets the requirements of the Low Voltage Directive 2014/35/EU and the EMC Directive 2014/30/EU.

ATEX (Atmosphère Explosible)

According to the European Directive 2014/34/EU the equipment must **not** be used in potentially explosive areas.

Note on the Declaration of Conformity / Declaration by the Manufacturer CE

For details on the conformity of our equipment according to the European Directives see our Declaration of Conformity or our Declaration of Manufacturer.

The current Declaration of Conformity / Declaration of Manufacturer are available in the Internet under www.gestra.de/documents or can be requested from us.

Explanatory Notes

Scope of supply

LRGS 15-1
1 Conductivity switch LRGS 15-1
1 Joint ring 27 x 32, form D, DIN 7603, 2.4068, bright annealed
1 Installation manual

Function

The conductivity switch LRGS 15-1 is a compact system consisting of a conductivity monitoring electrode and a conductivity switch integrated in the terminal box.

The LRGS 15-1 is used as limit switch and continuous blowdown controller in steam boilers.

The conductivity switch works according to the conductometric measuring method, continuously sensing the electrical conductivity of the boiler water and thus taking a direct measurement of the total dissolved solids (TDS).

The conductivity switch features an integrated 2-position controller for actuating a continuous blowdown valve and automatic closing of the valve on boiler shut-down. Furthermore, an additional adjustable contact outputs a signal when a limit is reached.

The electrical conductivity being a function of temperature, the measured value must be based on a reference temperature of 25 °C. For calibration purposes a reference measurement (at 25 °C) is therefore required.

If, however, a resistance thermometer (boiler water temperature) is applied, the adjustable temperature coefficient can be used to compensate the obtained conductivity values. This means that the conductivity reading will not be affected by variations in pressure and temperature.

Electrical conductivity is measured in units of microSiemens per centimeter (µS/cm). However, in some countries the unit ppm (parts per million) is used. Conversion: 1 µS/cm = 0.5 ppm.
The conductivity switch can be switched to either µS/cm or ppm.

Technical Data

LRGS 15-1

Service pressure
PN 25, 25 bar at 224 °C

Mechanical connection
Screwed ¾", EN ISO 228-1
Screwed ¾" NPT (optional)

Materials
Electrode body for screwing in place: 1.4571, X6CrNiMoTi17-12-2 or
1.4404, A 479 316 L (for NPT thread)
Measuring electrode: 1.4571, X6CrNiMoTi17-12-2
Electrode rod insulation: PTFE
Terminal box: Polycarbonate

Measuring length & length of installation
200, 300, 400, 500, 600, 800, 1000 mm

Input
1 Input for resistance thermometer, e. g. TRG 5-53, measuring insert Pt 100

Measuring range
100 to 10000 µS/cm at 25 °C or 50 to 5000 ppm at 25 °C

Setpoint
Adjustable between 100 and 10000 µS/cm or 50 to 5000 ppm

MAX limit
Adjustable between 100 and 10000 µS/cm or 50 to 5000 ppm

Switching hysteresis
Controller output: –10 % of the adjusted setpoint
MAX limit: –3 % of the adjusted MAX limit

Temperature coefficient T_k (if a resistance thermometer Pt 100 is connected)
1.6 – 3.0 % per °C, adjustable in steps of 0.1

Supply voltages
230 V, +10 / –15 %, 50-60 Hz
115 V, +10 / –15 %, 50-60 Hz (optional)

Power consumption
5 VA

Fuse
External slow-blow fuse, 63 mA at 230 V
External slow-blow fuse, 125 mA at 115 V

Output
3 Volt-free relay contacts, 5 A 230 V AC / 30 V DC cos $\varphi = 1$ (IEC 61810)
Provide contactor with inference suppressor (RC combination).
Contact material: AgNi 0.15

Technical Data – continued –

LRGS 15-1 – continued –

Indicators and adjustors
1 Four-digit, seven-segment indicator, red, for showing the actual value (X) / setpoint (W) and status & malfunction messages
2 Amber LEDs for indicating the actual value (X) / setpoint (W)
1 Red LED for indicating the MAX limit
2 green LEDs for indicating “Valve OPEN / CLOSED”
4 Pushbuttons for parameter settings

Cable entry / Electric connection
Cable glands with integrated cable clamp, 3 x M 16 x 1.5
1 Four-pole screw-type terminal strip for mains connection
1 Three-pole screw-type terminal strip for connecting the continuous blowdown valve
1 Three-pole screw-type terminal strip for MAX limit
The terminal strips can be detached; conductor size 1.5 mm^2
4 Terminal lugs for connecting the resistance thermometer

Protection
IP 65 to DIN EN 60529

Protection class
2 (protective insulation)

Weight
Approx. 1.5 kg

Environmental conditions:

Ambient temperature
when system is switched on: 0 ° ... 70 °C
during operation –10 ° ... 70 °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

Site altitude
max. 2000 m

Name plate / marking

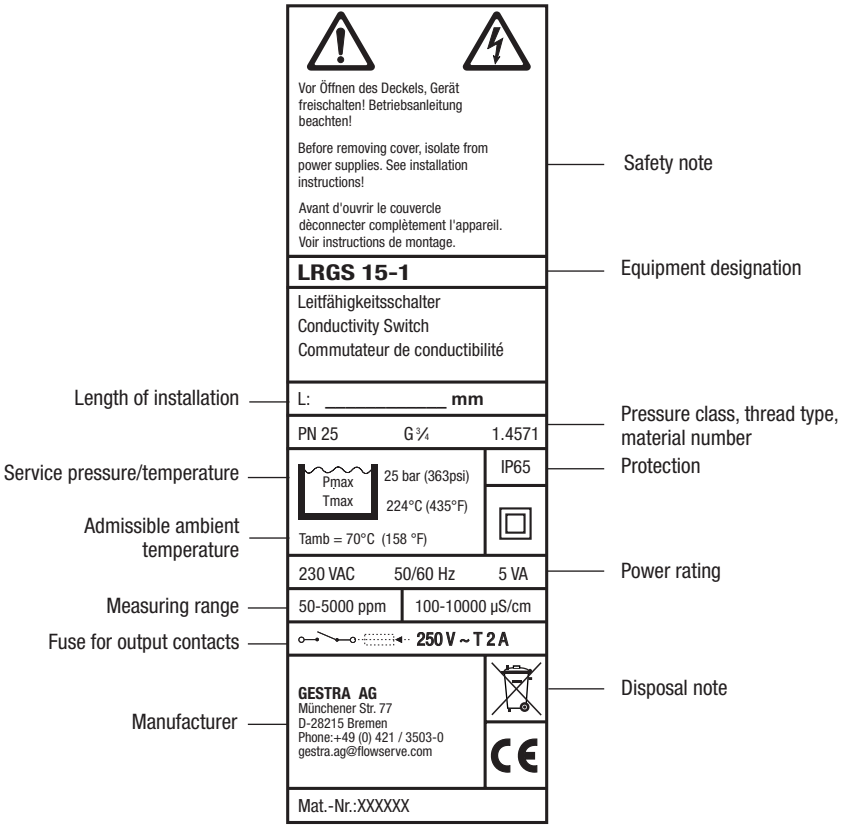


Fig. 1

Dimensions

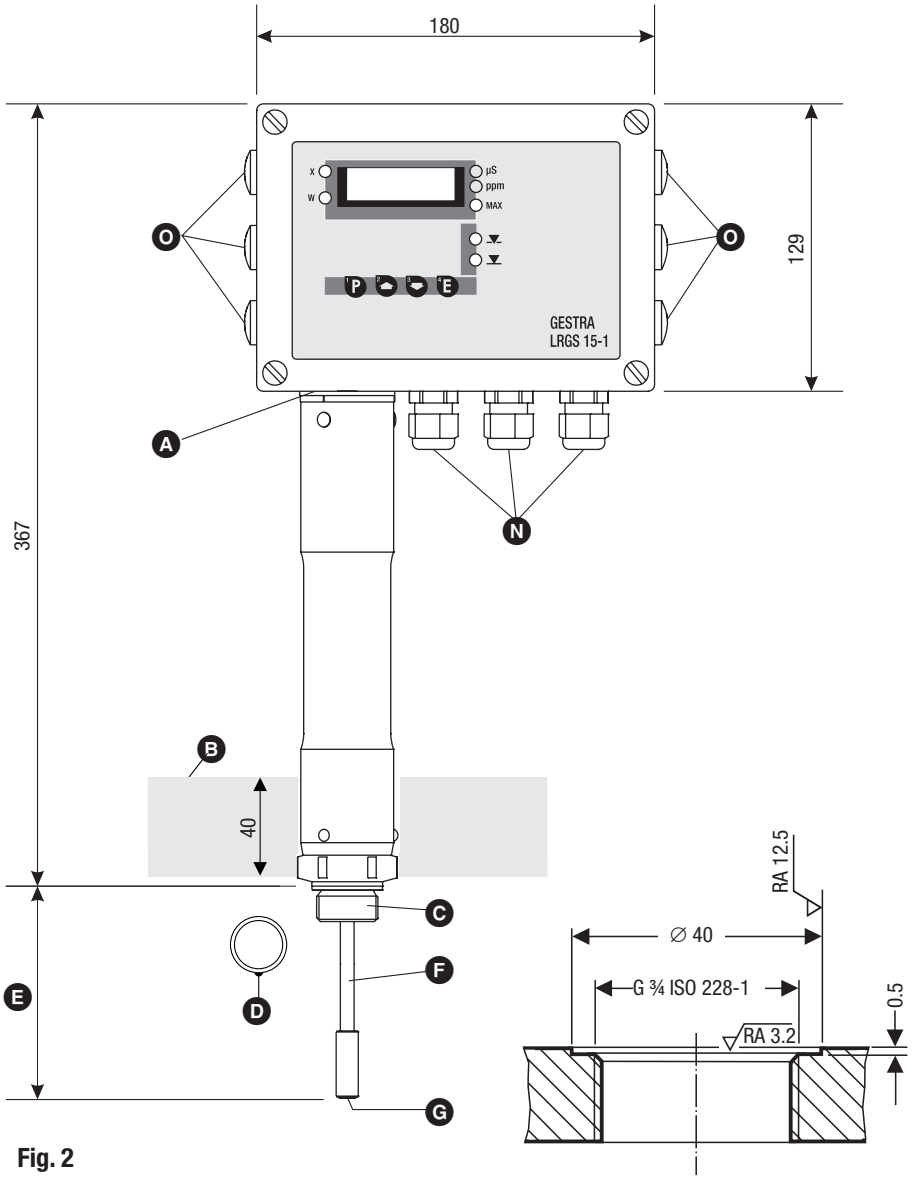


Fig. 2

Functional Elements

LRGS 15-1

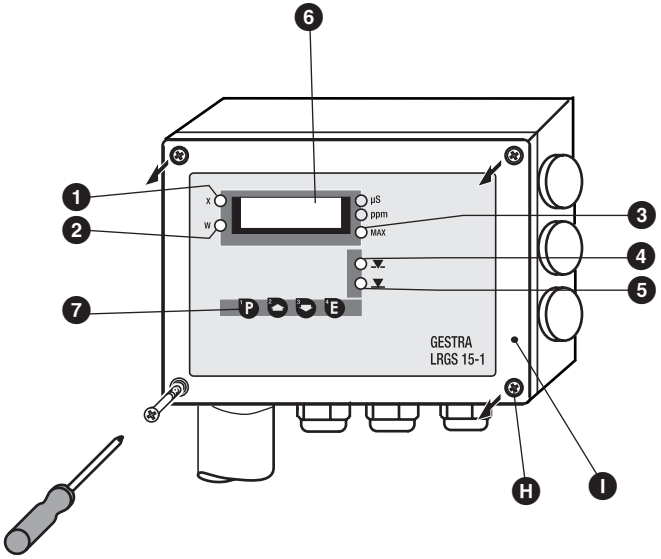


Fig. 3

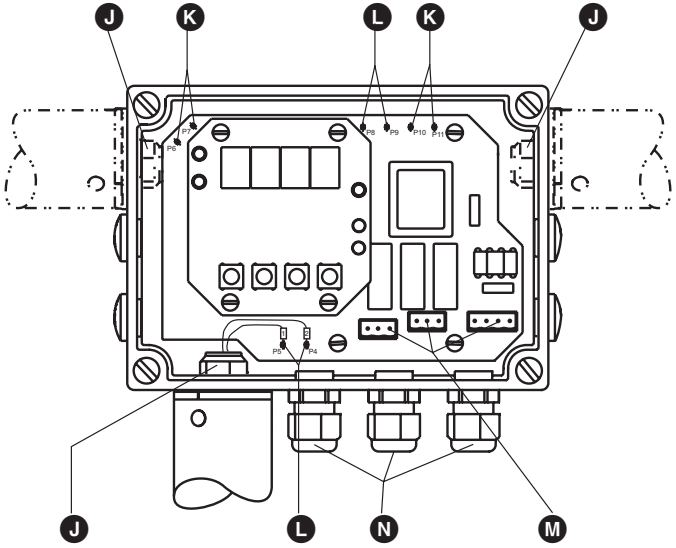


Fig. 4

Dimensions / Functional Elements – continued –

Key

1. LED 1:The seven-segment indicator shows the setpoint
2. LED 2: The seven-segment indicator shows the actual value
3. LED 3: MAX limit reached
4. LED 4: Continuous blowdown valve opens
5. LED 5: Continuous blowdown valve in operating position
6. Seven-segment indicator (indication of actual value or setpoint, temperature, error code)
7. Pushbuttons

A. Gasket
B. Thermal insulation
C. Thread ¾"
D. Joint ring 27 x 32, form D, DIN 7603, 2.4068, bright annealed
E. Length of installation
F. Measuring electrode
G. Measuring surface
H. Cover screws (cross-recess head screws M4)
I. Cover
J. Fixing nut for terminal box
K. Terminal lugs for resistance thermometer
L. Terminal lugs for electrode lines
M. Terminal strips
N. Cable glands 3 x M 16 x 1.5
O. Sealing plugs

Installation

Attention

- Do not bend the measuring electrode during installation.
- Do not subject electrode to shocks.
- Note that the measuring electrode of the conductivity switch must not be cut!
- The conductivity switch is designed for installation in a boiler standpipe.
- The seating surfaces and threads of the vessel standpipe or mounting flange must be accurately machined.
- Use only the supplied joint ring 27 x 32, form D, DIN 7603, 2.4068, bright annealed.
- Do not insulate the thread with hemp or PTFE tape.
- Do not include the terminal box in the thermal insulation of the boiler.
- The conductivity switch can be mounted vertically or horizontally or with an inclination. The terminal box can be repositioned to ensure that the cable gland points in the required direction.
- Note that the measuring surface of the measuring electrode **Fig. 2** must always be in contact with the fluid.
- Make sure that there is a distance of at least **50 mm** between the measuring surface and the boiler wall, the smoke tubes, other metallic installations and the min. water level (LW).
- The indicated torques for tightening must be observed without fail!

Note

- For the approval of the boiler standpipe and the mounting flange the relevant regulations must be observed.
- See pages 14 and 15 for typical examples of installation.

Installation – continued –

Repositioning the terminal box

Dismounting the terminal box

1. Undo cover screws Ⓗ and remove cover Ⓘ, **Fig. 3**.
2. Pull electrode cables off the terminal lugs.
3. Unscrew and remove fixing nut Ⓙ with open-end spanner 19 mm A. F. Pull electrodes cables through the fixing nut Ⓙ.
4. Remove terminal box and pull electrode lines through the hole of the fixing screw.
5. Remove gasket Ⓐ between electrode and terminal box.

Mounting the terminal box

1. Depending on the desired position of installation, unscrew the corresponding sealing plug Ⓞ and screw it into the bore in which the electrode rod was previously screwed, **Fig. 4**.
2. Put gasket Ⓐ onto the electrode rod. Use only undamaged gaskets.
3. Pull electrode cables through the now free bore in the terminal box and put the terminal box onto the electrode rod, making sure that the gasket fits correctly between the electrode rod and the terminal box.
4. Pull electrode cables through fixing nut Ⓙ. Use a 19 mm A. F. spanner to attach the fixing nut Ⓙ to the fixing screw and tighten with a torque of 25 Nm.
5. Connect electrode cables to terminal lugs according to the wiring diagram, **Fig. 8**.
6. Replace cover Ⓘ and fasten cover screws Ⓗ.

Mounting conductivity switch LRGS 15-1

1. Check sealing surfaces of boiler standpipe or flange (see **Fig. 2**) and, if necessary, re-finish them as specified in the drawing.
2. Put the supplied joint ring Ⓓ onto the seating surface of the conductivity switch.
3. Apply a light smear of silicone grease to the thread of the conductivity switch.
4. Screw the conductivity switch into the boiler standpipe or flange and tighten with an open-end spanner 41 mm A. F. The torque when cold is 160 Nm.

Tools

- Open-end spanner 19 mm A. F.
- Open-end spanner 41 mm A. F.
- Screwdriver for cross-recess head screws, size 1 and 2

Examples of Installation

LRGS 15-1 used as conductivity electrode

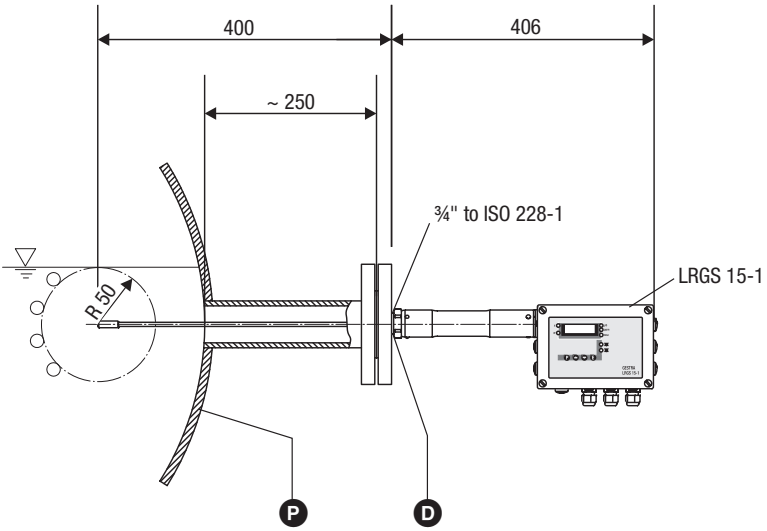
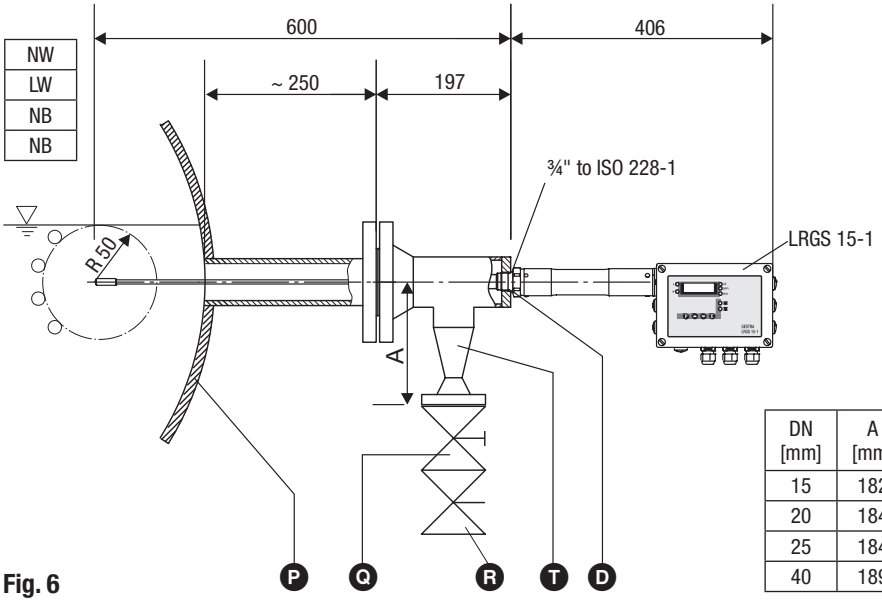


Fig. 5

LRGS 15-1 used for continuous blowdown control



DN [mm]	A [mm]
15	182
20	184
25	184
40	189

Fig. 6

Examples of Installation – continued –

LRGS 15-1 used for continuous blowdown control

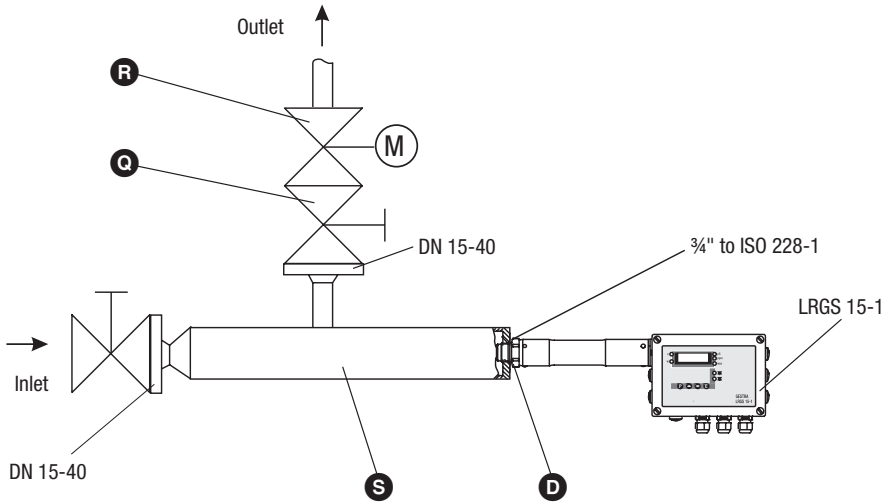


Fig. 7

Key

- **D** Joint ring 27 x 32, form D, DIN 7603, 2.4068, bright annealed
- **P** Boiler drum
- **Q** Shut-off valve GAV
- **R** Continuous blowdown valve BAE
- **S** Measuring pot
- **T** T-type connector

Electrical Connection

Aligning the terminal box

Before establishing the electrical connection align the terminal box such that all indicators and adjustors are easily accessible and the cable outlets point into the desired direction.

1. Undo cover screws Ⓗ and remove cover Ⓘ **(Fig. 3)**.
2. Unscrew fixing nut Ⓙ with an open-end spanner 19 mm A. F. and rotate the terminal box into the desired direction.
3. Tighten fixing nut Ⓙ with a torque of 25 Nm.
4. Replace cover Ⓘ and tighten cover nuts Ⓙ.

Connecting conductivity transmitter LRGS 15-1

Multi-core flexible control cable (CSA of conductor: 0.75 – 1.5 mm^2) can be used for wiring.

1. Undo cover screws Ⓗ and remove cover Ⓘ, **Fig. 3, 4**.
2. Detach terminal strips Ⓜ from electronic insert.
3. Strip off approx. 40 mm of cable insulation coating and remove approx. 5 mm of conductor end insulation.
4. Undo cable glands Ⓝ. Pull mains cable through the cable gland on the right hand side and the control lines through the other cable glands.
5. Connect the mains and control lines to the terminal strips Ⓜ according to the wiring diagram (inside of cover).
6. Attach the terminal strips Ⓜ to the electronic insert.
7. For connecting an external resistance thermometer use a screened two-core cable, e. g. Ölflex 110 CH, manufactured by LAPP, 2 x 0.5 mm^2. Max. cable length between resistance thermometer and conductivity switch: 25 m.
8. When connecting an external resistance thermometer strip off approx. 20 cm of cable insulation and remove approx. 5 mm of conductor end insulation.
9. If an additional cable entry is required, replace one of the sealing plugs with a cable gland M 16 x 1.5
10. Terminate all wire ends with crimp connectors 2.8 x 0.8 and connect them to the terminal lugs as indicated in the wiring diagram. Connect the screen to the thermometer.
11. Replace cover Ⓘ and tighten cover screws Ⓗ.

Electrical Connection – continued –

Attention

- Note that the following basic insulated lines must not be installed in extra-low voltage areas: mains and control lines.
- To prevent the welding together of contacts provide an external slow-blow fuse T 2 A for the output contacts.
- Connected contactors must be provided with interference suppressors (RC combinations) as specified by the manufacturer.
- Provide an external slow-blow fuse 63 A (at 230 V) or 125 mA (at 115 V) for the coductivity switch.
- For disconnecting the conductivity switch install an easily accessible disconnecting switch in the close proximity of the equipment (EN 61010-1).
- Mark the disconnecting switch as isolating device for the conductivity switch.

Tools

- Screwdriver for cross-recess head screws, size 1 and 2
- Screwdriver for slotted screws, size 2.5, completely insulated to VDE 0680
- Open-end spanner 19 mm A. F.

Wiring diagram for conductivity switch LRGS 15-1

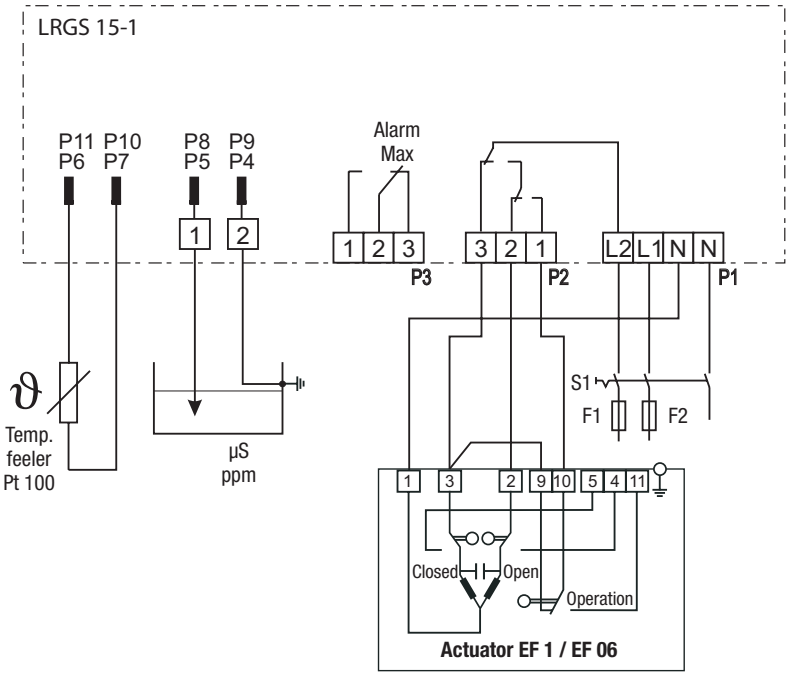


Fig. 8

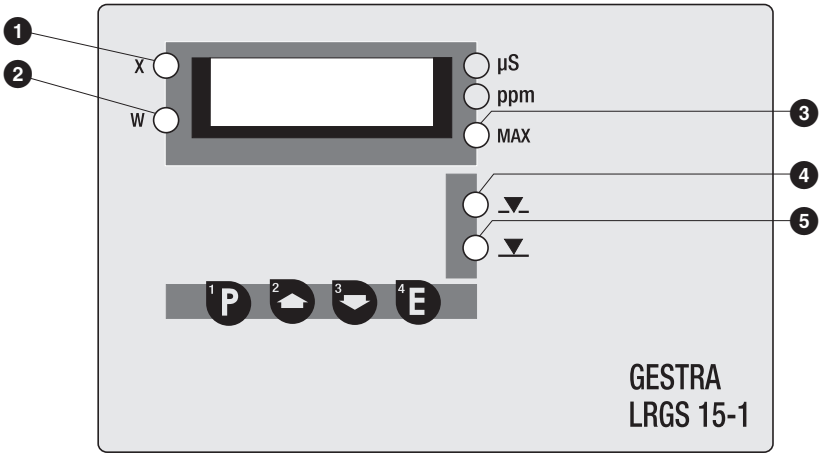
S1 Disconnector
F1 Fuse for output contact
F2 Fuse for conductivity switch

After the burner is switched off (stand-by operation), L2 must remain live until the actuator has closed the continuous blowdown valve. L1 and L2 must be connected to an outer conductor of the same phase.

If no resistance thermometer is connected, the terminal lugs P 6, 7, 10 and 11 remain unassigned.

Commissioning

Keys and indicators



Function of the keys
Key 1 (P): For entering parameter setting mode
Key 2: Decrease value, scroll up
Key 3: Increase value, scroll down
Key 4 (E): Leave parameter setting mode, return to input mode and save settings

7 Segment display
Indicating actual value or setpoint, temperature, error code

LEDs 1 – 5
LED 1: The 7-segment display shows the setpoint
LED 2: The 7-segment display shows the actual value
LED 3: MAX limit reached
LED 4: Continuous blowdown valve opens
LED 5 Continuous blowdown valve in operating position

Checking electrical connection

1. Make sure that the conductivity switch is connected in accordance with the wiring diagram.
2. Verify that the available supply voltage corresponds to the voltage that is stated on the name plate.

Applying mains voltage

Apply mains voltage. First the type designation and the software version are briefly indicated, then the actual value is shown on the 7-segment display.

Commissioning – continued –

Factory settings

When the conductivity switch LRGS 15-1 I started, it has the following default settings:

- Setpoint: 5000 µS/cm
- MAX limit: 8000 µS/cm
- Correction of measured value (CF): 0.2
- PT 100: OFF
- Temperature coefficient: 2.1 %/C
- Unit: µS/cm

Setting parameters

To enter the parameter setting mode press button **P**.

Setting parameter						
Key	**Parameter**	**Display**	**Key**	**Adjustment range**	**Key**	**Display**
→**P** ←**P**	1 Setpoint	1._SP	→**E** ←**P**	100-9999 µS/cm press key ▲ or ▼ to change	→**E**	SAVE return to 1 Setpoint
▲ ▼	2 MAX limit	2._AL	→**E** ←**P**	100-9999 µS/cm press key ▲ or ▼ to change	→**E**	SAVE return to 2 MAX limit
▲ ▼	3 Correction of measured value	3._CF	→**E** ←**P**	0.050-5.000 press key ▲ or ▼ to change	→**E**	SAVE return to 3 Correction of measured value
▲ ▼	4 PT 100	4._Pt	→**E** ←**P**	ON / OFF press key ▲ or ▼ to change	→**E**	SAVE return to 4 PT 100
▲ ▼	4.1 TK	4.1.tC	→**E** ←**P**	1.6 to 3.0 %/°C press key ▲ or ▼ to change	→**E**	SAVE return to 4.1 TK
▲ ▼	5 Unit	5._dI	→**E** ←**P**	µS/cm / ppm press key ▲ or ▼ to change	→**E**	SAVE return to 5 Unit

To return to normal operation press again button **P**.

Setting parameters – continued –

Correcting measured value by performing a reference measurement

- Measure the electrical conductivity of the boiler water sample (at 25 °C).
- Once the operating temperature is reached, change the correction factor indicated in the parameter setting **3 Correction of measured value** step by step until the indicated actual value agrees with the reference reading.
  The default factory setting of the correction factor is 1.

Correcting the measured value by temperature compensation

- Precondition: Boiler pressure 0 bar, temperature of boiler water: 25 °C, fluid temperature measured by means of a resistance thermometer Pt 100.
- Measure the electrical conductivity of the boiler water. Change the correction factor indicated in the parameter setting **3 Correction of measured value** step by step until the indicated actual value agrees with the current boiler water reading. The conductivity switch is now adapted to the installation conditions.
- Once the operating temperature is reached measure the electrical conductivity of a boiler water sample (at 25 °C).
- Set parameter **4 PT 100** to ON. Adjust the temperature coefficient in parameter **4.1 TK** step by step until the indicated actual value agrees with the measured value. The default factory setting for the TK is 2.1 % / °C.

Setting further parameters

- Set the switchpoint at which the continuous blowdown valve shall open in the parameter **1 Setpoint**.
- Set the switchpoint at which an alarm message shall be triggered in the parameter **2 MAX limit**.
- The electrical conductivity is measured in µS/cm. In some countries the unit ppm (parts per million) is used. Conversion: 1 µS/cm = 0.5 ppm. In parameter **5 Unit** you can set the desired unit. It is then used for all conductivity readings and settings. Mark the adjusted unit on the front plastic sheet with a waterproof pen.
- If values or settings are changed and the key **E** is pressed to confirm the new entry, the word SAVE appears for approx. 1 sec. on the display. The equipment will then switch back to where the menu has started.
- If a key is pressed but no entry is made within 10 seconds the equipment will return to the display of the actual value.

Operation

LRGS 15-1

Start		
Mains voltage L is switched on	Indication of actual value, LED 2 is illuminated and LED 4 is flashing	Continuous blowdown valve is actuated for 120 sec. and opens
After 120 sec: Actual value < setpoint	Indication of actual value, LED 2 und LED 5 are illuminated	Continuous blowdown valve is motored to the OPERATING position
After 120 sec: Actual value > setpoint	Indication of actual value, LED 2 and LED 4 are illuminated	Continuous blowdown valve is motored to the position OPEN. Once the conductivity has decreased by –10 % of the setpoint the valve is motored back to the OPERATING position.

Operation		
Show setpoint	Press key ▲, LED 1 is lights up and the setpoint is indicated	
Actual value > setpoint	Indication of actual value, LED 2 and LED 4 are illuminated	Continuous blowdown valve is motored to the OPEN position. Once the conductivity has decreased by –10 % of the setpoint the valve is motored back to the OPERATING position.
MAX limit exceeded	Indication of actual value, LED 2, LED 3 and 5 are illuminated	Output contact P 3, 1 / 2 is open. Continuous blowdown valve is motored to the position OPEN.
Burner is switched off (stand-by operation)		Continuous blowdown valve is motored to the position CLOSED.
Show fluid temperature (provided that a resistance thermometer is connected)	Press key ▼, the fluid temperature will be indicated.	

Error messages (indicated by the 7 segment display)		
Error code	**Fault**	**Remedy**
E.01	Resistance thermometer Pt 100 short-circuited	Replace resistance thermometer
E.02	Resistance thermometer Pt 100 interrupted	Replace resistance thermometer
E.03	Short circuit in measuring electrode	Replace conductivity switch
E.04	Measuring electrode interrupted	Replace conductivity switch

In the event of an error message the LEDs 1, 3 und 5 are illuminated and the continuous blowdown valve is motored into the operating position.

Troubleshooting

Fault finding list

Equipment is not working

Fault:	Failure of power supply, no function.
Remedy:	Check voltage supply and all electrical connections.

Fault:	Electronic insert is defective.
Remedy:	Replace terminal box and electronic insert.

The equipment signals a malfunction

Error code:	E.01.
LED-Anzeige:	LEDs 1, 3 and 5 are illuminated.
Fault:	Lines leading to the resistance thermometer are short-circuited.
Remedy:	Check connections of the resistance thermometer (electronic insert, terminal lugs P 6/7 + P 10/11). If necessary replace the resistance thermometer.

Error code:	E.02.
LED display:	LEDs 1, 3 and 5 are illuminated.
Fault:	Lines leading to the resistance thermometer are interrupted.
Remedy:	Check connections of the resistance thermometer (electronic insert, terminal lugs P 6/7 + P 10/11). If necessary replace the resistance thermometer.

Error code:	E.03.
LED display:	LEDs 1, 3 and 5 are illuminated.
Fault:	Short circuit in measuring electrode.
Remedy:	Check connections of the measuring electrode (electronic insert, terminal lugs P 4/5 + P 8/9). If necessary replace the conductivity switch.

Error code:	E.04.
LED display:	LEDs 1, 3 and 5 are illuminated.
Fault:	Interruption in measuring electrode.
Remedy:	Check connections of the measuring electrode (electronic insert, terminal lugs P 4/5 + P 8/9). If necessary replace the conductivity switch.

Equipment gives inaccurate readings

Fault:	The indicated conductivity value exceeds the reference reading.
Remedy:	Change correction factor (Parameter:3 Correction of measured value) and, if necessary, temperature coefficient (4.1 TK).

Fault:	The indicated conductivity value is below the reference reading.
Remedy:	Change correction factor (Parameter:3 Correction of measured value) and, if necessary, temperature coefficient (4.1 TK).

Fault:	Adaptation of the measured value by changing the correction factor or the temperature coefficient not possible.
Remedy:	Remove the conductivity switch and clean the measuring electrode.

Cleaning measuring electrode, exchanging terminal box

Danger

When loosening the conductivity switch hot water or steam may escape. This presents the risk of severe scalding.
Before removing the conductivity switch make sure that the boiler pressure is 0 bar.

The conductivity switch is hot during operation. This presents the risk of severe burns to hands and arms. Before mounting, servicing or removing the equipment make sure that it has cooled down to room temperatures.

The terminal strips of the conductivity switch LRGS 15-1 are live during operation.
This presents the danger of electric shock.

Cut off power supply to the equipment before mounting, removing or connecting the terminal strips.

Cleaning measuring electrode

Before cleaning the measuring electrode take the conductivity switch out of service and cut off its power supply.

1. Unscrew the cover screws Ⓗ and remove the cover Ⓘ, **Fig. 3, 4.**
2. Detach the connecting wires from the terminal strips Ⓜ and pull the wires out of the cable glands.
3. Before removing the conductivity switch make sure that the equipment is neither hot nor under pressure.

Cleaning the measuring surface of the measuring electrode:

- Use a fat-free cloth to wipe off loose deposits.
- Remove hard deposits with an emery cloth of medium grain size.

Re-install the conductivity switch, taking the notes given in chapter “Installation”, “Electrical Connection” and “Commissioning” into account.

Exchanging the terminal box (with electronic insert)

Before exchanging the terminal box take the conductivity switch out of service and cut off its power supply.

1. Unscrew the cover screws Ⓗ and remove the cover Ⓘ, Fig. 3, 4.
2. Detach the connecting wires from the terminal strips Ⓜ and pull the wires out of the cable glands.
3. Remove the electrode wires from the terminal lugs.
4. Unscrew the fixing nut Ⓙ, using an open-end spanner 19 mm A.F. Pull electrode wires through the fixing nut Ⓙ.
5. Remove the terminal box and pull the electrode wires through the bore for the fixing screw.
6. Remove the gasket Ⓐ between the electrode and the terminal box.

Install a new terminal box, taking the notes given in chapter “Installation”, “Electrical Connection” and “Commissioning” into account.

Removing conductivity switch

Removing and disposing of conductivity switch

Before removing the conductivity switch take it out of service and cut off its power supply.

1. Unscrew the cover screws ⓗ and remove the cover ⓘ, Fig. 3, 4.
2. Detach the connecting wires from the terminal strips ⓜ and pull the wires out of the cable glands.
3. Before removing the conductivity switch make sure that the equipment is neither hot nor under pressure.

For the disposal of the conductivity switch observe the pertinent legal regulations concerning waste disposal.

Note

When ordering spare parts or replacement equipment please state the material number indicated on the name plate.

If faults occur that are not listed in this installation manual please contact our subsidiary or agency in your country.

For your notes

For your notes

Agencies all over the world: **www.gestra.de**

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