GESTRA®

GESTRA Steam Systems

LRGT 16-1
LRGT 16-2
LRGT 17-1
KS 90

EN
English

Installation Instructions 818726-02

Conductivity Transmitter LRGT 16-1
Conductivity Transmitter LRGT 16-2
Conductivity Transmitter LRGT 17-1
Industrial Controller KS 90

spector compact

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Important Notes

Usage for the intended purpose

Use conductivity transmitters LRGT 16-1, LRGT 16-2 and LRGT 17-1 only for measuring the electrical conductivity in liquids.

When used for conductivity limiting or continuous boiler blowdown in steam boilers the conductivity transmitters LRGT 16-1, LRGT 16-2 and LRGT 17-1 must only be used in conjunction with the industrial controller KS 90.

To ensure trouble-free operation the requirements made on water quality according to TRD and EN regulations must be met.

Use the equipment only within the specified pressure and temperature ratings.

Any type of use differing from the usage described above is considered as improper. The resulting risk will have to be borne by the user alone. The manufacturer hereby expressly rejects any claims for any resulting damage.

Safety note

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

Danger

When loosening the conductivity transmitter steam or hot water might escape. This presents the danger of severe scalding. It is therefore essential not to remove the conductivity transmitter unless the boiler pressure is verified to be 0 bar.

The conductivity transmitter becomes hot during operation. This presents the risk of severe burns to hands arms when the equipment is touched.

Installation, de-installation and maintenance work should only be carried out when the system is cold.

ATEX (Atmosphère Explosible)

According to the European Directive 94/9/EC the equipment must **not** be used in explosion risk 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

LRGT 16-1
1 Conductivity transmitter LRGT 16-1
1 Joint ring 33 x 39, form D, DIN 7603, 1.4301, bright annealed
1 Installation manual

LRGT 16-2
1 Conductivity transmitter LRGT 16-2
1 Joint ring 33 x 39, form D, DIN 7603, 1.4301, bright annealed
1 Installation manual

LRGT 17-1
1 Conductivity transmitter LRGT 17-1
1 Joint ring 33 x 39, form D, DIN 7603, 1.4301, bright annealed
1 Installation manual

Description

The compact-design **conductivity transmitter LRGT 16-1, LRGT 16-2, LRGT 17-1** consists of a conductivity electrode, a temperature sensor for detecting the fluid temperature and a conductivity transmitting unit incoporated in the terminal box.

The conductivity transmitters LRGT 16-1 and LRGT 17-1 work according to the conductometric measuring method using **two** measuring electrodes and the conductivity transmitter LRGT 16-2 works according to the conductometric measuring method using **four** measuring electrodes. The equipment measures the conductivity of electrically conductive fluids (TDS content) and provides a 4-20 mA measuring current as a function of the detected conductivity value.

The conductivity transmitters are designed for use with the **industrial controller KS 90** for conductivity limiting and continuous boiler blowdown in steam boilers or for conductivity monitoring in condensate and feedwater systems.

The conductivity transmitters LRGT 16-1, LRGT 17-1 are mainly used in steam boilers with low TDS content, e.g. steam regenerators, high-pressure boilers or condensate tanks.

The conductivity transmitter LRGT 16-1 is also approved for feedwater monitoring on strips.

The conductivity transmitter LRGT 16-2 is mainly used in industrial boiler plants operating with pressures up to PN 40 and max. admissible conductivities acc. to TRD/EN of 8000/6000 µS/cm.

Function

LRGT 16-1, LRGT 17-1
A measuring current of variable frequency passes through the fluid, creating a potential gradient between the measuring electrode and the reference tube which is then used as measuring voltage U_U.

LRGT 16-2
The conductivity electrode consists of two current and two voltage electrodes. The current electrodes direct the measuring current U_I with a fixed frequency into the fluid, thereby creating a potential gradient between these electrodes. This potential difference is then picked up by the voltage electrodes and evaluated as measuring voltage U_U.

Function – continued –

LRGT 16-1, LRGT 17-1 und LRGT 16-2

The electrical conductivity is a function of temperature. A resistance thermometer integrated in the electrode measures the fluid temperatures so as to relate the measured values to the reference temperature.

The electrical conductivity is calculated from the measuring voltages U_U and U_I and – as a function of the adjusted temperature coefficient T_K – linearly based on the reference temperature of 25 °C. Once converted into a conductivity-dependent current signal, an output current of 4 – 20 mA is available for external use.

The cables leading to the measuring electrode, the reference tube and the resistance thermometer are monitored and checked for interruptions and short circuits. In addition, the circuit board is protected against excess temperatures in the terminal box. In the event of a malfunction, the LEDS on the circuit board will light up or flash and the current signal is set to 0 or 0.5 mA. As a consequence the controller KS 90 will signal sensor break.

A ten-pole code switch enables the parameterisation of the transmitter, the adaptation of the cell constant and the activation of a performance test. 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).

Technical Data

LRGT 16-1, LRGT 16-2, LRGT 17-1

Type approval
TÜV.WÜL.xx-003
GL 33254-06 HH

Service pressure
LRGT 16-1: 32 bar at 238 °C
LRGT 16-2: 32 bar at 238 °C
LRGT 17-1: 60 bar at 275 °C

Connection
Screwed 1" BSP (ISO 228-1)

Materials
Electrode screw-in body: 1.4571, X6CrNiMoTi17-12-2
Measuring electrode(s): 1.4571, X6CrNiMoTi17-12-2
Electrode insulation: PTFE
Terminal box: 3.2161 G AlSi8Cu3
LRGT 16-1, LRGT 17-1: measuring tube/screw: 1.4571, X6CrNiMoTi17-12-2
LRGT 16-1, LRGT 16-2: spacer disk: PEEK
LRGT 17-1: spacer disk: PEEK HT

Measuring length and length of installation (do **not** cut electrode tips!)
200, 300, 400, 500, 600, 800, 1000 mm (max. 400 mm for marine applications)

Temperature sensor
Resistance thermometer Pt 1000

Measuring cycle
1 sec.

Temperature compensation
Linear, T_k adjustable via code switch
- 0 % per °C
- 1.6 – 3.0 % per °C in steps of 0.1

Time constant (measured according to two-bath process)
Temperature: 9 sec.
Conductivity: 14 sec.

Indicators and adjustors
Two LEDs for status messages
One 10-pole code switch for setting:
- measuring range
- temperature coefficient
- cell constant
- functional test

Voltage supply
24 V DC (18-36 V DC)

Power consumption
4.5 watt

Fuse
Electronic thermal fuse T_{max} = 85 °C, hysteresis – 2 K

LRGT 16-1, LRGT 16-2, LRGT 17-1 – continued –

LRGT 16-1, LRGT 17-1

Measuring range*) (µS/cm at 25 °C)		Current output mA = µS/cm	
Preferred measuring range to 500 µS/cm		4 mA corresponds to	20 mA corresponds to
0.5	20	0.5	20
	100		100
	200		200
	500		500
	1000		1000
	2000		2000
	6000		6000
	12000		12000

LRGT 16-2

Measuring range*) (µS/cm at 25 °C)		Current output mA = µS/cm	
		4 mA corresponds to	20 mA corresponds to
100	3000	100	3000
	5000		5000
	7000		7000
	10000		10000
Adjustable via code switch. Max. load for actual value output 750 ohm. ***) Conversion** of µS/cm in ppm (part per million): 1 µS/cm = 0.5 ppm			

Cable entry
EMC cable gland with integrated cable clamp, M 20 x 1.5
5-pole screw-type terminal strip, detachable, conductor size 1.5 mm²

Protection
IP 65 to EN 60529

Admissible ambient temperature
Max. 70 °C

Storage and transport temperature
–40 to +80 °C

Weight
Approx. 2.5 kg

Name plate / marking

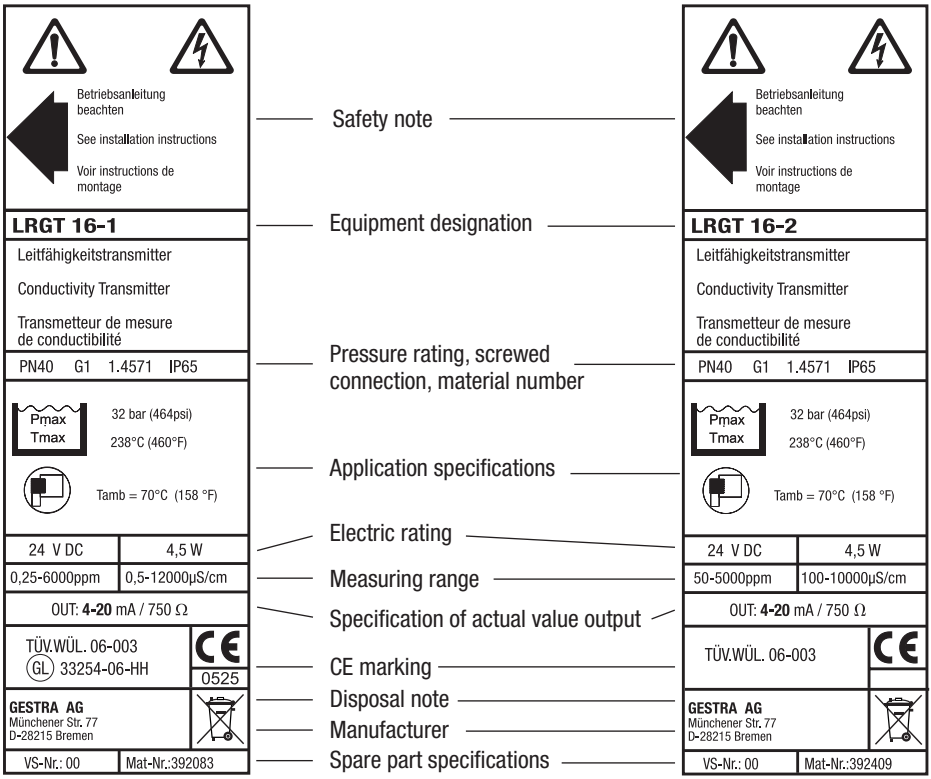


Fig. 1

Corrosion resistance

When used for its intended purpose the safe functioning of the equipment will not be impaired by corrosion.

Sizing

The electrode body must not be subjected to sharp increases in pressure. The dimensional allowances and anti-corrosion additives reflect the latest state of technology.

Dimensions

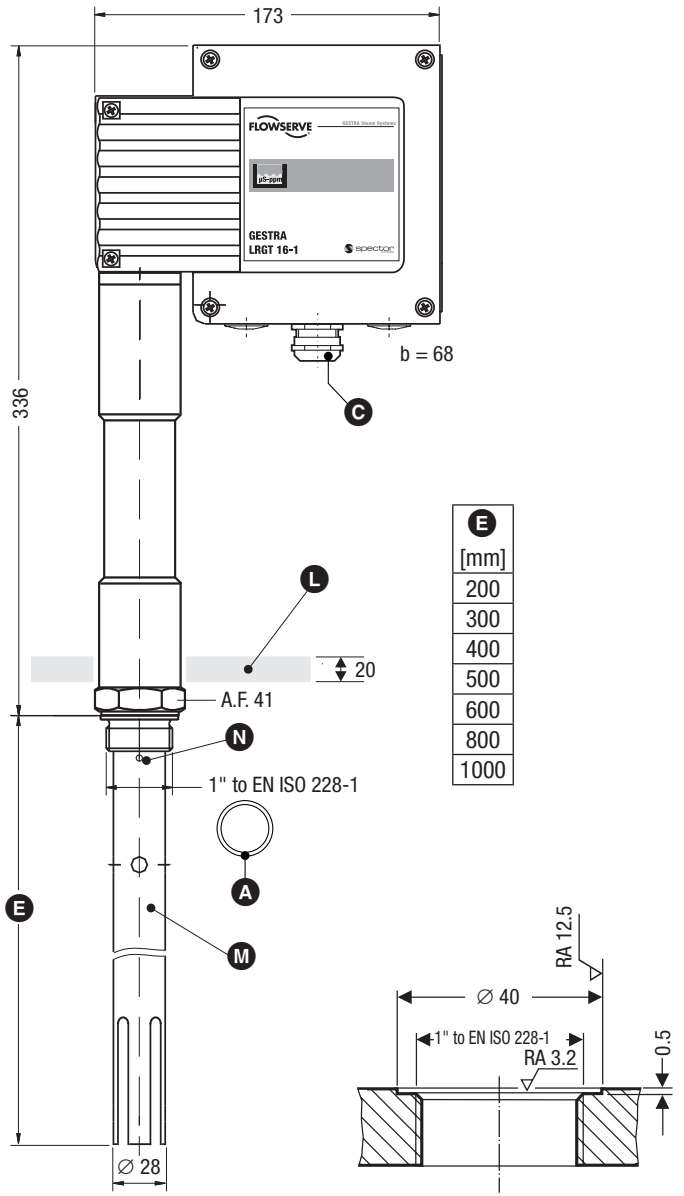


Fig. 2 *LRGT 16-1*

Dimensions – continued –

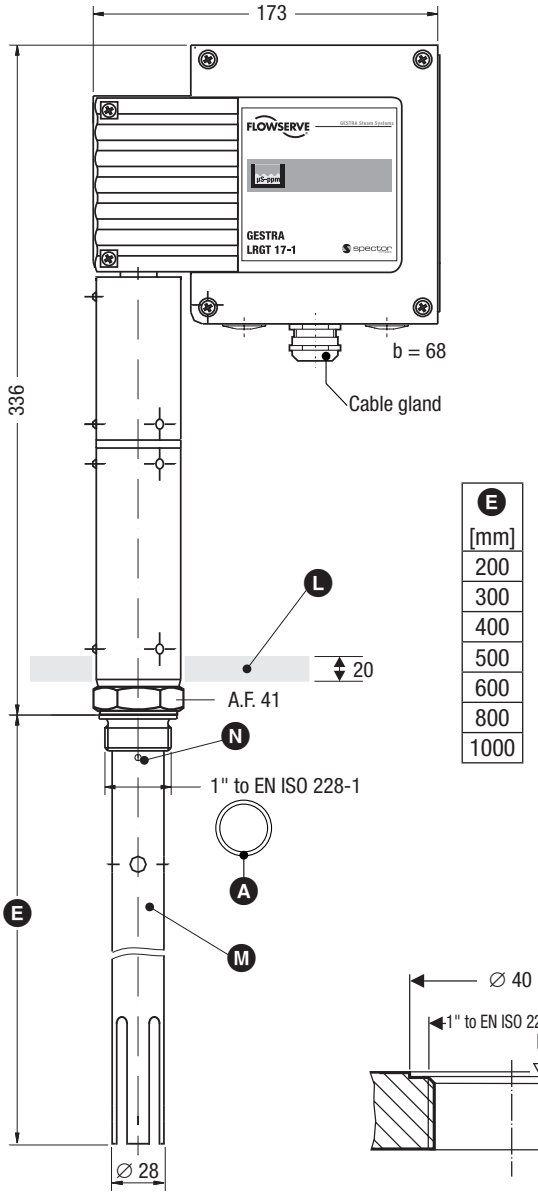


Fig. 3 *LRGT 17-1*

Dimensions – continued –

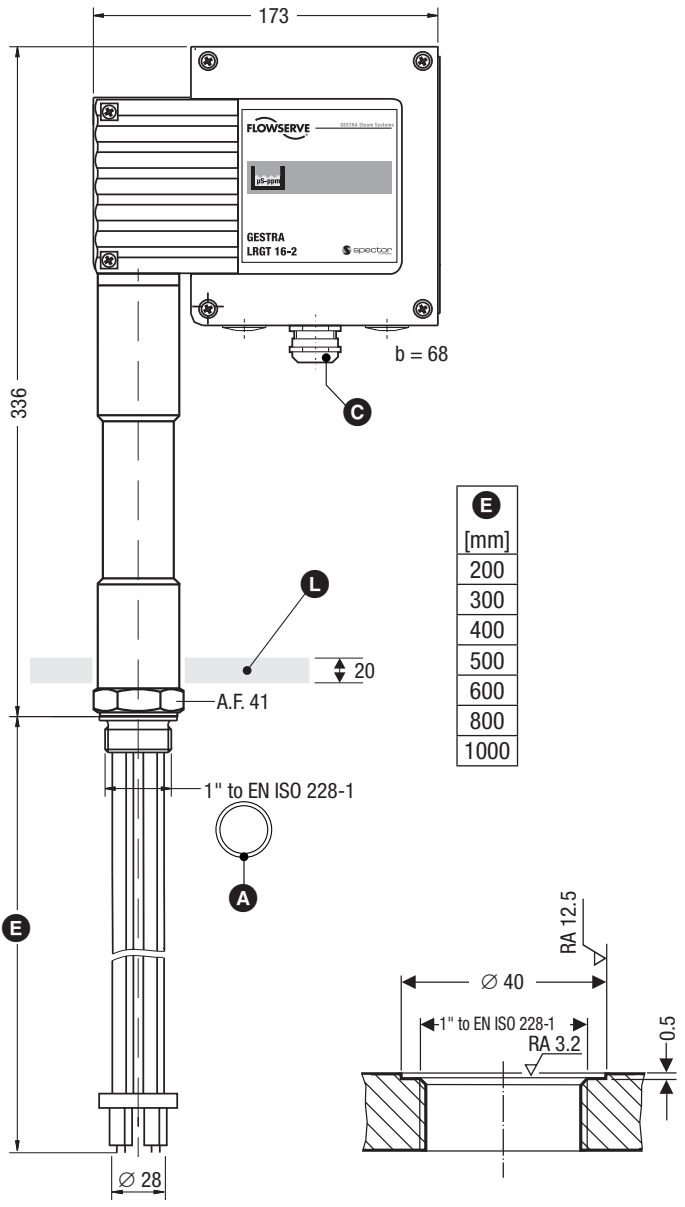
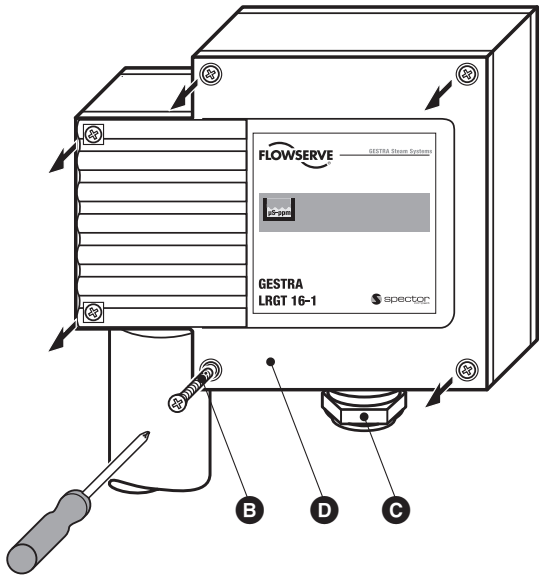


Fig. 4 *LRGT 16-2*

Functional Elements

LRGT 16-1, LRGT 16-2, LRGT 17-1



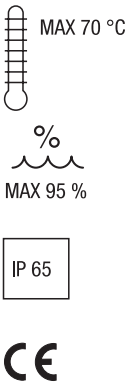


Fig. 5

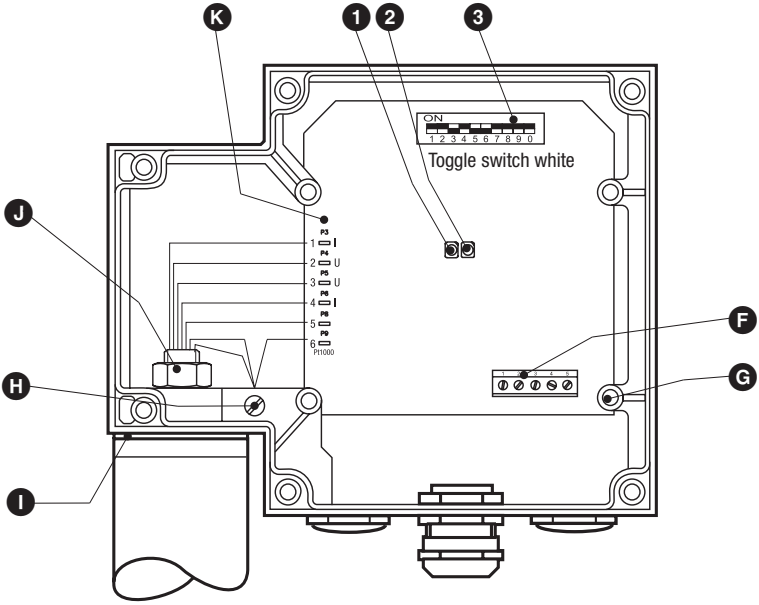


Fig. 6 *LRGT 16-1 (without cover plate)*

Technical Data / Functional Elements

Key

1. LED 1, green
2. LED 2, red
3. Code switch

A. Joint ring 33 x 39, form D, DIN 7603, 1.4301, bright annealed
B. Cover screws (cross recess head screws M4)
C. EMC cable gland M 20 x 1.5
D. Housing cover
E. Measuring length and length of installation
F. Terminal strip
G. Fixing screws for electronic circuit board
H. Functional earth connection
I. Seat ring
J. Fixing nut for terminal box
K. Terminal lugs for electrode lines, functional earth
L. Thermal insulation
M. Reference tube
N. Set screw M 2.5 DIN 913

Installation

Installation notes

Attention

- The seating surfaces and threads on the vessel and mounting flange must be accurately machined.
- Use only the supplied ring joint 33 x 39, form D, DIN 7603, 1.4301, bright annealed.
- Do **not** insulate the threads with hemp or PTFE tape.
- The conductivity transmitter can be installed horizontally or with a vertical inclination. Be sure that the measuring surface is permanently submerged.
- The specified torques must be strictly observed.
- Do **not** lag the terminal box.

LRGT 16-1, LRGT 17-1

- Provide a spacing of **approx. 30 mm** between the lower end of the reference tube and the boiler wall, the smoke tubes and other metallic fittings as well as the low water level (LW).
- Do **not** cut the measuring electrode and the reference tube of the conductivity transmitter.

LRGT 16-2

- Provide a spacing of **approx. 60 mm** between the lower end of the reference tube and the boiler wall, the smoke tubes and other metallic fittings as well as the low water level (LW).
- Do **not** cut the measuring electrode.
- Avoid impacts and shocks to the electrode.

Note

- For the approval of the boiler standpipe the relevant local and national regulations must be observed.
- Several examples of installation are shown on pages 17/18.

LRGT 16-1 (for marine applications)

- Max. admissible length of measurement and installation: 400 mm.
- When installed in steam boilers the conductivity transmitter must be secured against unscrewing.

Mounting conductivity transmitter

1. Check seating surfaces of threads or mounting flange provided on vessel or boiler standpipe (see **Fig. 2, 3, 4**). If necessary re-work the surfaces according to the specification indicated in the drawing.
2. Place the supplied ring joint Ⓐ onto the seating surface Ⓑ of the conductivity transmitter.
3. Apply a light smear of silicone grease to the thread of the conductivity transmitter.
4. Screw conductivity transmitter into thread or flange provided on vessel or boiler standpipe and tighten with an open-end spanner A. F. 41 mm. The torque required when cold is 150 Nm.

Examples of Installation

Conductivity monitoring, direct installation of conductivity transmitter via lateral flanged connection

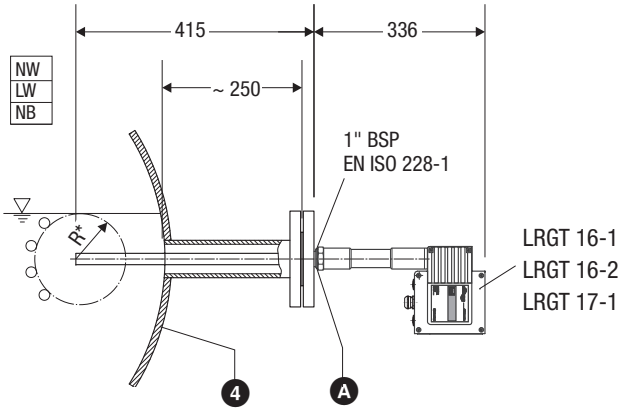


Fig. 7

R*: LRGT 16-1, LRGT 17-1 R = 30 mm
LRGT 16-2 R = 60 mm

Conductivity monitoring and continuous blowdown control, direct installation of conductivity transmitter via measuring pot and connection of a continuous blowdown valve

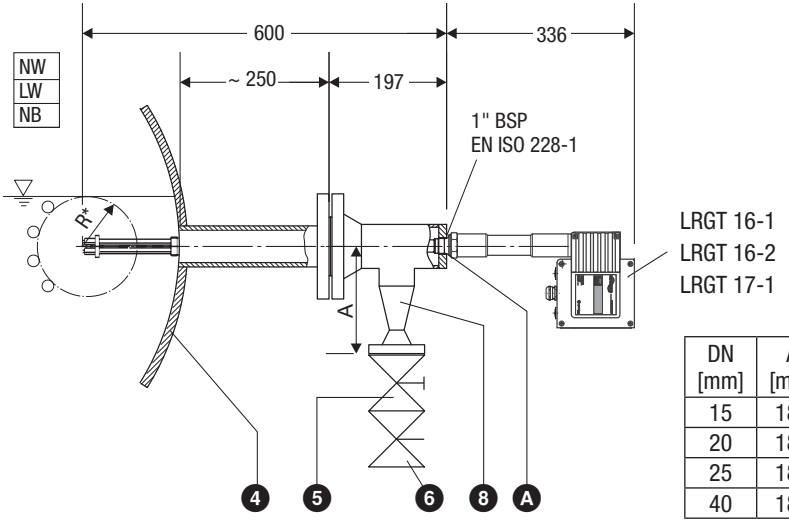


Fig. 8

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

R*: LRGT 16-1, LRGT 17-1 R = 30 mm
LRGT 16-2 R = 60 mm

Examples of Installation – continued –

Conductivity monitoring and continuous blowdown control, installation of conductivity transmitter in blowdown line via separate measuring pot

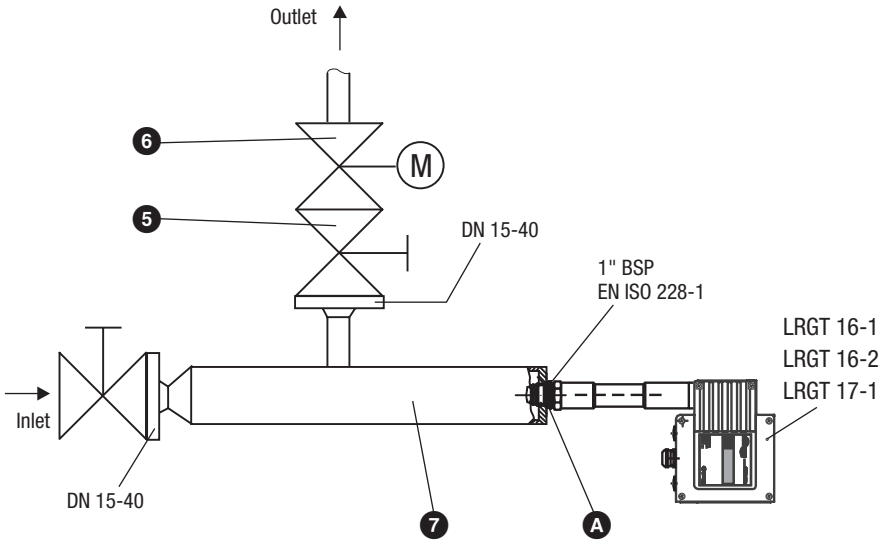


Fig. 9

Key

- **A** Ring joint 33 x 39, form D, DIN 7603, 1.4301, bright annealed
- **4** Boiler drum
- **5** Shut-off valve GAV
- **6** Continuous blowdown valve BAE
- **7** Measuring pot
- **8** T-type connector

Tools

- Open-end spanner 18 (19) A. F.
- Open-end spanner 41 A. F.
- Screwdriver for hexagon-socket head screws, size 1.3
- Screwdriver for cross-recess head screws, size 1 and 2

Electrical Connection

LRGT 16-1, LRGT 16-2, LRGT 17-1

The terminal box is screwed to the electrode by means of a self-locking fixing nut.

Before establishing the electrical connection you can turn the terminal box by max. +/– 180 ° to the desired position (cable outlet).

A flexible multi-core control cable, min. conductor size 0.75 mm^2 can be used for wiring.

Connecting the conductivity transmitter

With the terminal box being open:

1. Undo cover screws Ⓑ, remove cover Ⓓ, **Fig. 5**
2. Detach terminal strip Ⓕ from circuit board.
3. Unscrew the cap nut Ⓝ of the cable gland Ⓒ and take out the lamellar insert Ⓟ, **Fig. 10**
4. Cut off outer sheath of the cable Ⓢ and expose the braided screen Ⓠ over a length of approx. 10 – 15 mm.
5. Push cap nut Ⓝ and lamellar insert Ⓟ with sealing ring Ⓞ onto the cable.
6. Bend braided screen Ⓠ outwards at a right angle (90°).
7. Fold braided screen Ⓠ towards outer sheath, i. e. by 180°.
8. Push lamellar insert Ⓟ with sealing ring Ⓞ into gland body Ⓡ, turn it briefly around both sides of the cable axis and snap anti-rotation element into place.
9. Firmly screw on cap nut Ⓝ.
10. Connect the individual cables according to the wiring diagram to the terminal strip Ⓕ.
11. Re-attach terminal strip Ⓕ to circuit board.
12. Replace cover Ⓓ and fasten the cover screws Ⓑ.

Connecting the conductivity transmitter – continued –

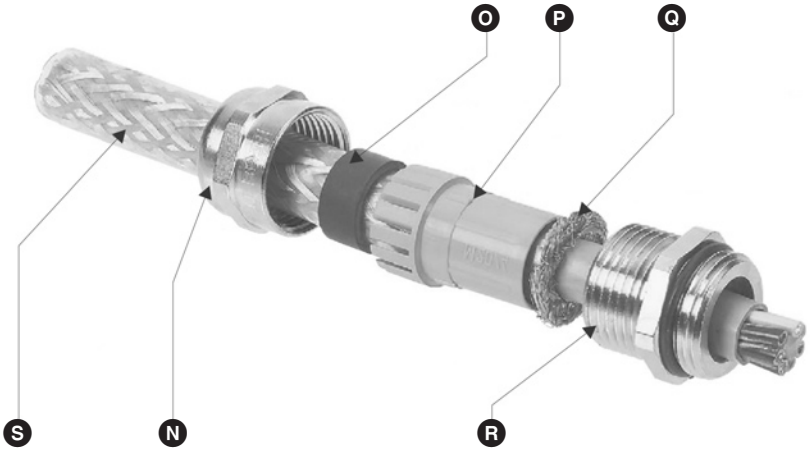


Fig. 10

Key

- **N** Cap nut
- **O** Sealing ring
- **P** Lamellar insert
- **Q** Braided screen
- **R** Gland body
- **S** Shielded cable

Electrical Connection – continued –

Safety power supply unit for LRGT 16-1, LRGT 16-2, LRGT 17-1

To supply the conductivity transmitter with 24 V DC, a safety power supply unit (PSU), e.g. Siemens SITOP power 05, must be used; this must provide a level of isolation against voltages hazardous to touch that at least meets the requirements for double or reinforced insulation as per DIN EN 50178 or DIN EN 61010-1 or DIN EN 60730-1 or DIN EN 60950 (electrically protective separation). The PSU must be equipped with a protective device to DIN EN 61010-1.

Tools

- Screwdriver for cross-recess head screws, size 1
- Screwdriver for slotted head screws, size 2.5, completely insulated to VDE 0680-1
- Open-end spanner 12 A. F.
- Open-end spanner 18 (19) A. F.

Wiring diagram for conductivity transmitter LRGT 16-1, LRGT 17-1

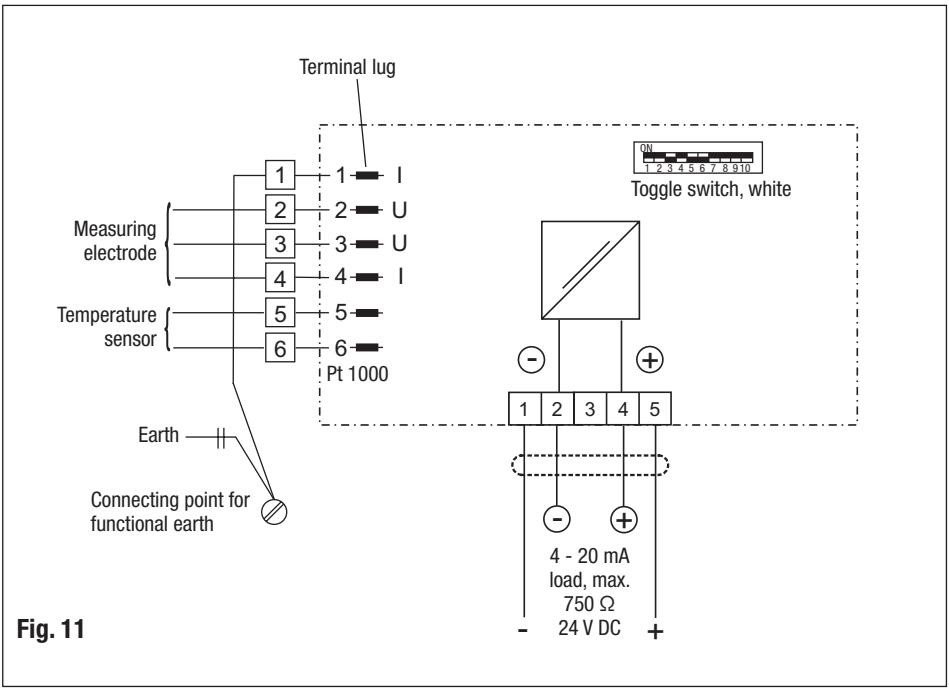


Fig. 11

Wiring diagram for conductivity transmitter LRGT 16-2

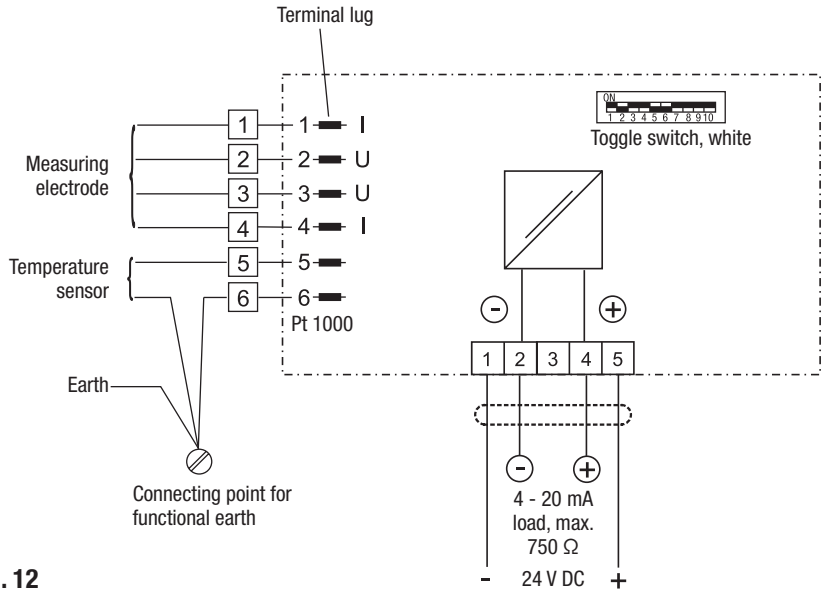


Fig. 12

Basic Settings

Factory setting

The conductivity transmitter features the following factory set default values:

LRGT 16-1, LRGT 17-1

- Measuring range: 0.5 µS/cm to 500 µS/cm (at 25 °C) **preferred measuring range**
- Temperature coefficient: 2.1 (% / °C)

LRGT 16-2

- Measuring range: 100 µS/cm to 7000 µS/cm (at 25 °C)
- Temperature coefficient: 2.1 (% / °C)

Establishing measuring range and actual value output

To set the parameter of the conductivity transmitter, open the housing and use the 10-pole code switch on the circuit board. The code switch can also be used for adapting the cell constant and initiating a functional test. In the following tables, the factory settings are highlighted in grey.

1. Establish the measuring range (control range) of the conductivity transmitter on the basis of the conductivity range of the steam boiler.
2. Set the desired measuring range via code switch. You can use a ball-point pen to set the code switch.

LRGT 16-1, LRGT 17-1

Code switch			Measuring range (µS/cm at 25 °C)		Current output mA = µS/cm	
1	2	3			4 mA is equivalent to	20 mA is equivalent to
OFF	OFF	OFF	0.5	20	0.5	20
ON	OFF	OFF		100		100
OFF	**ON**	OFF		200		200
ON	**ON**	**OFF**		**500**		**500**
Factory setting						
OFF	OFF	**ON**		1000		1000
ON	OFF	**ON**		2000		2000
OFF	**ON**	**ON**		6000		6000
ON	**ON**	**ON**		12000		12000

When the supply voltage is applied (during commissioning) the first output will be 4 mA, then the output current increases until it reaches the actual value.

Establishing measuring range and actual value output – continued –

LRGT 16-2

Code switch			Measuring range (µS/cm at 25 °C)		Current output mA = µS/cm	
1	2	3			4 mA is equivalent to	20 mA is equivalent to
OFF	OFF	OFF	100	3000	100	3000
ON	OFF	OFF		5000		5000
OFF	**ON**	**OFF**		**7000**		**7000**
Factory setting						
ON	**ON**	OFF		10000		10000
ON	**ON**	**ON**		12000		12000

When the supply voltage is applied (during commissioning) the first output will be 4 mA, then the output current increases until it reaches the actual value.

Checking temperature coefficient setting T_k

For a linear compensation of the measured conductivity value based at 25 °C the temperature coefficient T_k is set at our works to 2.1 % per °C. Once the service temperature is reached you can check this setting by carrying out a comparison measurement – e. g. as part of the commissioning procedure.

If there is a deviation between the indicated conductivity and the measured comparison value, correct the readings of the transmitter by adjusting a lower or higher temperature coefficient. Continue modifying the T_k setting step by step until the indicated conductivity value and measured comparison value agree. Please wait 1 to 2 minutes after each step until the measured value has settled.

Code switch				**Temperature coefficient T_K (% / °C)**
4	**5**	**6**	**7**	
OFF	OFF	OFF	OFF	0 (no compensation)
ON	OFF	OFF	OFF	1.6
OFF	**ON**	OFF	OFF	1.7
ON	**ON**	OFF	OFF	1.8
OFF	OFF	**ON**	OFF	1.9
ON	OFF	**ON**	OFF	2.0
OFF	**ON**	**ON**	**OFF**	**2.1**
Factory setting				
ON	**ON**	**ON**	OFF	2.2
OFF	OFF	OFF	**ON**	2.3
ON	OFF	OFF	**ON**	2.4
OFF	**ON**	OFF	**ON**	2.5
ON	**ON**	OFF	**ON**	2.6
OFF	OFF	**ON**	**ON**	2.7
ON	OFF	**ON**	**ON**	2.8
OFF	**ON**	**ON**	**ON**	2.9
ON	**ON**	**ON**	**ON**	3.0

Commissioning Procedure

Checking electrical connection

1. Check that the conductivity transmitter is wired in accordance with the wiring diagram (**Fig. 11, 12**, page 21, 22).
2. Make sure that the mains voltage is the same as indicated on the name plate.

Applying mains voltage

Apply mains voltage.

Note

- To remedy malfunctions that might occur during the commissioning procedure see chapter “Systematic malfunction analysis” on page 30 – 31.

Operation

Correcting the measured value

- If the indicated conductivity reading differs from the measured comparison value check and re-adjust the temperature coefficient setting T_k (see section “Settings” on page 25).
- Only if the temperature coefficient setting is no longer sufficient for the correction should the cell constant be modified.
- If a modification is no longer possible remove the transmitter and clean the measuring surface.

Checking the temperature coefficient setting T_k

For settings and procedure see page 25.

Adapting cell constant

The factory set cell constant is a characteristic geometric quantity of the equipment and influences the calculation of conductivity. However, during operation this constant can drift, e. g. due to dirt accumulated on the measuring electrode.

- Depending on the deviation set code switches 8 or 9 briefly to ON and then back to OFF. Wait for approx. 1 – 2 minutes until the measured value has adjusted itself.
- Repeat this procedure step by step until the indicated value matches the measured comparison value.
- If the conductivity transmitter and the controller are spatially separated the adaptation must be made by a second person or by measuring the current in the transmitter.
- If an adaptation is no longer possible remove the transmitter and clean the measuring surface and/or the measuring electrodes.

Note

The default setting of the cell constant can be restored. For this purpose set code switches 8 and 9 simultaneously to ON. After approx. 1 second set both switches back to OFF. Repeat the procedure described in the paragraph above **Adapting cell constant** until the conductivity reading matches the reference measured value.

Adapting cell constant – continued –

Deviation of the indicated conductivity	Code switch			LED indicator	
	8	9	Function	green	red
Non	OFF	OFF	No change		
Indicated value < measured comparative value	**ON**	OFF	Cell constant increases	Rapidly flashing	
Indicated value > measured comparative value	OFF	**ON**	Cell constant decreases		Rapidly flashing
	ON	**ON**	Restores factory setting	Both rapidly flashing	

Functional test

1. To check the functions of the conductivity transmitter set code switch 10 to ON in order to simulate a value that exceeds the measuring range limit and to provide a current output of 20 mA.
2. After finishing the functional test set the code switch back to OFF.

Code switch 10	Functional test
OFF	Normal operation
ON	Simulation: measuring range limit exceeded

LEDs and malfunction indication

The two LEDs in the centre of the electronic insert indicate the status of the conductivity transmitter.

Normal operation	Green LED	Red LED	Current output [mA]
Conductivity 0 to +10 % of measured range		lit	proportional to measured value
Conductivity 10 to +90 % of measured range	lit	lit	proportional to measured value
Conductivity 90 to +100 % of measured range	lit		proportional to measured value

Flashing LEDs indicate a malfunction.

Malfunction	Green LED	Red LED	Current output [mA]
Electrode lines interrupted or measuring surface / measuring electrodes exposed		flashing	0
Value below 0 % setting		flashing	4
Value above 100 %, e. g. measuring range too small	flashing		20
Short circuit electrode lines		flashing	0
Temperature in terminal box exceeds 85 °C	flashing	flashing	0
Lines to resistance thermometer interrupted or short-circuited	flashing alternately		0.5

Malfunctions

Fault-finding list for troubleshooting

Equipment is not working

Fault:	No supply voltage.
Remedy:	Apply power and check all electrical connections.

Fault:	Electronic insert of the conductivity transmitter defective.
Remedy:	Replace electronic insert.

Fault:	Mass connection to vessel interrupted – no function.
Remedy:	Clean seating surfaces and screw in electrode with metal joint ring 33 x 39, form D, DIN 7603, made from 1.4301, bright annealed. Do not seal electrode with hemp or PTFE tape.

Equipment signals malfunction

LED display:	Red LED flashing.
Current output:	0 mA
Fault:	Electrode lines interrupted or measuring surface / measuring electrodes exposed.
Remedy:	Check connections of the electrode lines (electronic insert, terminal lugs 1 – 4). Replace equipment if necessary. Check water level and installation.

LED display:	Red LED flashing.
Current output:	4 mA
Fault:	Value below 0 % setting, e.g. measuring surface / measuring electrodes exposed.
Remedy:	Check water level and installation.

LED display:	Green LED flashing.
Current output:	20 mA
Fault:	Value above 100 % setting, e. g. measuring range too small.
Remedy:	Set a larger measuring range.

LED display:	Red LED flashing.
Current output:	0 mA
Fault:	Short-circuited in electrode lines.
Remedy:	Check connections of the electrode lines (electronic insert, terminal lugs 1 – 4). Replace equipment if necessary.

LED display:	Red and green LEDs are flashing.
Current output:	0 mA
Fault:	Temperature in terminal box exceeds 85 °C.
Remedy:	Check ambient temperature. Make sure it does not exceed 70 °C.

Malfunctions – continued –

Fault-finding list for troubleshooting – continued –

LED display:	Red and green LEDs are flashing alternately.
Current output:	0.5 mA
Fault:	Electrical connections to resistance thermometer interrupted or short-circuited, thermometer defective.
Remedy:	Check thermometer connections (electronic insert, terminal lugs 5 – 6). Replace equipment if necessary.

Inaccurate readings

Fault:	Conductivity reading higher than comparison value.
Remedy:	During commissioning: Reduce temperature coefficient T_k. During operation: Reduce cell constant.

Fault:	Conductivity reading lower than comparison value.
Remedy:	During commissioning: Increase temperature coefficient T_k. During operation: Increase cell constant.

Fault:	The measurement result can no longer be adjusted by changing the cell constant.
Remedy:	Remove conductivity transmitter and clean measuring surface / measuring electrodes.

Cleaning the measuring electrode

The equipment must only be installed and removed by qualified personnel. For more information see section “Installation” on page 16.

To clean the measuring electrode take the conductivity transmitter out of service and de-install it.

LRGT 16-1, LRGT 17-1

To clean the measuring electrode take the conductivity transmitter out of service and de-install it. Then undo the safety set screw Ⓝ and unscrew the measuring tube Ⓜ by hand.

LRGT 16-2

Clean the electrode rod and the measuring surface:

- Use a fat-free cloth to wipe off loose deposits.
- Use abrasive linen (medium grain size) to remove encrusted dirt deposits.

Malfunctions – continued –

Exchanging the electronic insert

1. Unscrew cover screws Ⓑ and remove housing cover Ⓓ.
2. Pull electrode wires from terminal lugs Ⓚ on circuit board. Detach terminal strip Ⓕ.
3. Undo the functional earth Ⓗ connection.
4. Unscrew the fixing screws Ⓖ for the electronic insert and take out the insert. The electronic insert is available as spare part (type LRV 1-40) for LRGT 16-1, LRGT 17-1, type LRV 1-42 for LRGT 16-2.
5. Install the new electronic insert in reverse order.

Note

Please indicate the serial number stated on the name plate when ordering spare parts.

After replacing the electronic insert check the conductivity readings of the controller KS 90 by carrying out a comparison measurement.

If you encounter any deviations, correct the cell constant of the conductivity transmitter.

If faults occur that are not listed in the fault-finding list or cannot be corrected, please contact our Technical Services or authorized agency in your country.

Decommissioning

Danger

Risk of severe burns and scalds all over the body.

Depressurise the vessel or measuring pot (0 bar) and make sure that it has cooled down to room temperature (20 °C) before de-installing the conductivity transmitter.

Exchanging the conductivity transmitter

1. Switch off the voltage supply.
2. Unscrew cover screws Ⓑ and remove the housing cover Ⓓ.
3. Disconnect the connecting wires from the terminal strips Ⓕ and pull wires out of the cable gland.
4. Remove the conductivity transmitter.
5. Install and connect the new conductivity transmitter.
6. Switch on voltage supply.

Disposal

Remove the conductivity transmitter and separate the waste materials in accordance with the material specification.

Electronic components (boards) must be disposed of separately.

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

Industrial Controller KS 90

Important Notes

Usage for the intended purpose

The industrial controller KS 90 in conjunction with the conductivity transmitter LRGT 16-1, LRGT 16-2 or LRGT 17-1 is designed for controlling continuous blowdown in steam boilers.

Safety notes

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

Danger

The terminal strips of the KS 90 are live during operation.

Risk of severe injuries due to electric shock.

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

Explanatory Notes

Scope of supply

KS 90

1 Industrial controller KS 90 in DIN slide-in case
1 Installation manual

Function

The measuring current of the conductivity transmitter LRGT 16-1, LRGT 16-2 or LRGT 17-1 is evaluated by the industrial controller KS 90 as actual value. The KS 90 is a three-position stepping controller that converts the difference between the actual value and the setpoint into actuating signals for the electric motor-actuated continuous blowdown valve.

An alarm will also be raised when the adjustable MAX limit is exceeded.

Technical data

Input
1 Current input 4 – 20 mA

Outputs
2 Volt-free make contacts (relays 1 and 2) for connecting the continuous blowdown valve.
1 Volt-free make contact for signalling the MAX limit.
Max. contact rating with a switching voltage of 24 V AC/DC 115 V AC/DC and 230 V AC: resistive / inductive 3 A.

Indicators and adjustors
- LED indicator, alphanumeric
- Two-digit red LED for multifunctional indication
- LED status indicator for alarm / control state
- Keypad for menu-driven configuration, parameter setting and operation

Mains supply
230 V +10 / –15 %, 50 – 60 Hz
115 V +10 / –15 %, 50 – 60 Hz
24 V +10 / –15 %, 50 – 60 Hz (optional)

Power consumption
7 VA

Enclosure
Slide-in case to DIN 43700 for panel mounting or installation in control cabinets.
Dimensions: 48 x 96 x 111 mm
Electrical connection via flat-pin connector 1 x 6.3 or 2 x 2.8 mm to DIN 46244

Protection to DIN EN 60529
Front: IP 54
Casing: IP 20
Terminal strip: IP 00

Admissible ambient temperature
0 – 55 °C

Weight
Approx. 0.45 kg

Name plate KS 90

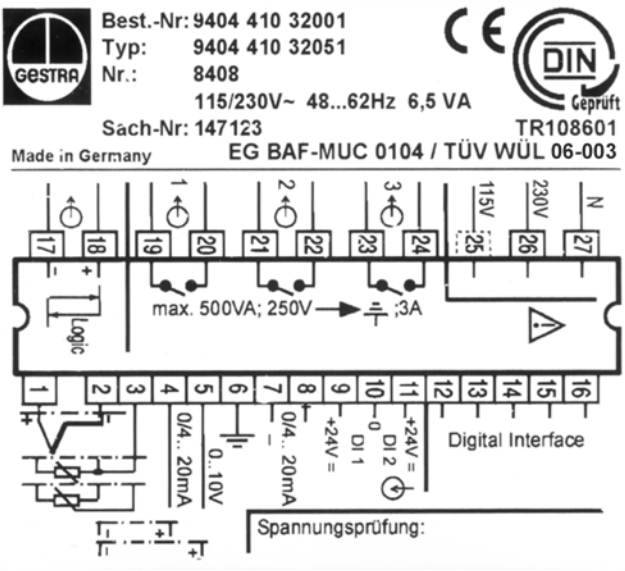


Fig. 13

Dimensions

KS 90

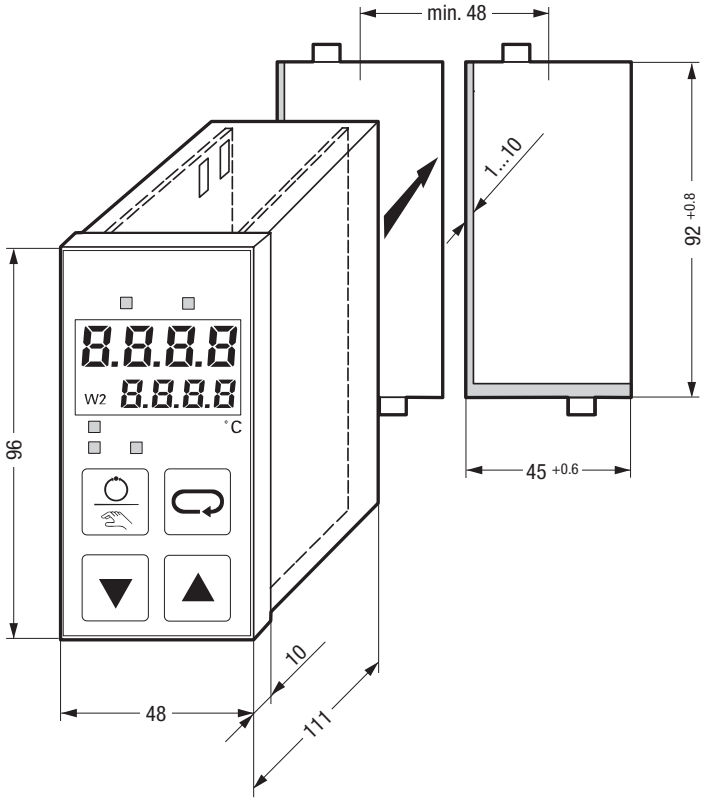
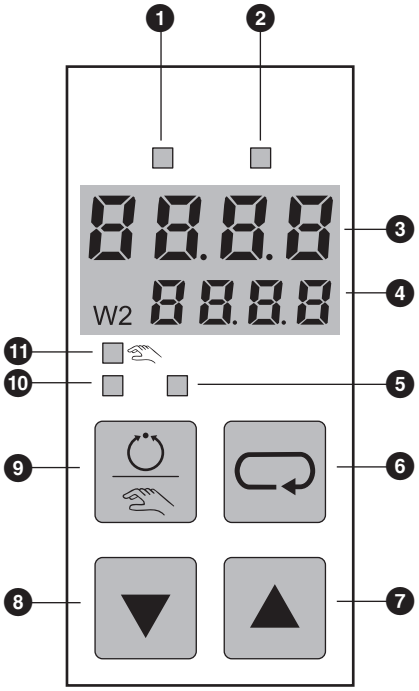


Fig. 14

Functional Elements

KS 90

Front view



1. Yellow LED lit: continuous blowdown valve closes
2. Yellow LED lit: continuous blowdown valve opens
3. Actual value
4. Setpoint
5. Red LED lit: Alarm 2 (value outside limits)
6. Selector/release key
7. Increase value
8. Decrease value
9. Automatic / Manual
10. Green LED lit: Alarm 1 – MAX limit exceeded
11. Red LED lit: Manual
    LED flashing if manipulated variable Y in function

Fig. 15

Versions

The following versions of the industrial controller must be used:

Supply voltage

230/115 V AC	**9404 410 3 2 0 0 1**
24 V AC	**9404 410 5 2 0 0 1**

Mounting

Installation in control cabinet door (see **Fig. 14**, page 37 and **Fig. 16**)

1. Dimension of panel cut-out: $45^{+0.6}$ x $92^{+0.8}$
2. Use the supplied mounting brackets to install the industrial controller KS 90.
   The KS 90 can be installed in any position, i. e. it is also suitable for installation in an inclined control desk.

Attention

- Make sure that the mounted industrial controller KS 90 is provided with sufficient aeration so that the max. admissible ambient temperature in the equipment is not exceeded.
- The equipment contains component parts susceptible to electrostatic discharges.

Note

If the perimeter sealing rib is fitted for sealing the front panel cut-out where the controller is mounted, the front of the control cabinet door has the protection rating IP 54 (see **Fig. 16**).

Example of installation

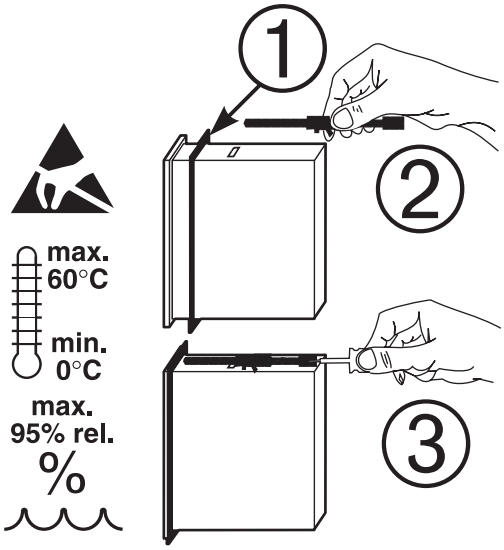


Fig. 16

Electrical Connection

Connecting the industrial controller KS 90

1. Connecting earth
   If outside interference voltages (concerns also H. F. interferences) act on the equipment, malfunctions may occur. To discharge interferences and ensure electromagnetic immunity, an earth must be connected. Terminal 8 (**Fig. 17**, see page 42) must be connected to earth potential by means of a short cable (approx. 20 cm, e. g. to control cabinet earth). Keep this cable separate from mains cables.
2. Keep mains cables separate from signal and instrument lines. We recommend twisted and drilled measuring lines (screen connected to earth).

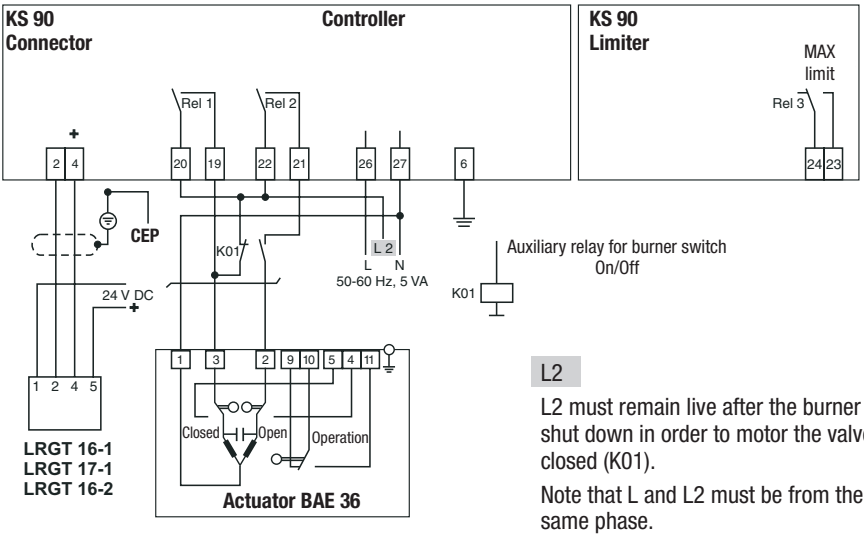
Note

Connected final controlling elements must be provided with suppressor circuits as specified by the manufacturer so as to prevent voltage peaks which can lead to malfunctions in the controller.

The equipment must be protected by an individual or common fuse for a max. power consumption of 10 VA per unit (standard fuse rating, min. 1.0 A).

- Signal and instrument circuits may carry max. 50 V r.m.s. against ground,
- Mains circuits may carry max. 250 V r.m.s. between terminals.

Wiring diagram LRGT 16-1, LRGT 16-2, LRGT 17-1, KS 90



L2

L2 must remain live after the burner is shut down in order to motor the valve closed (K01).

Note that L and L2 must be from the same phase.

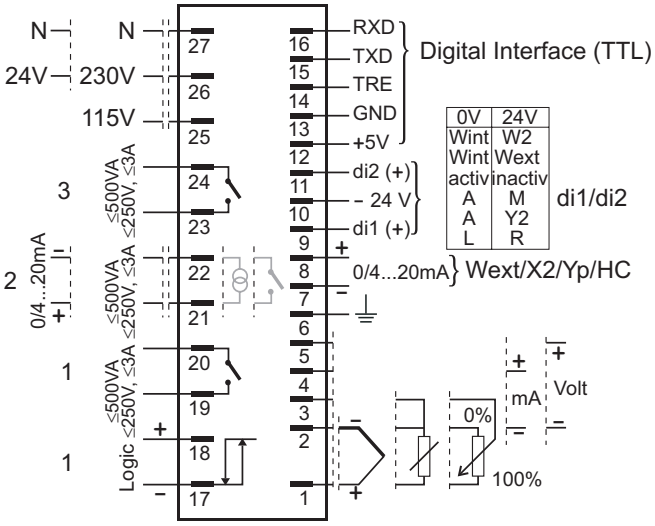


Fig. 17

Wiring diagram LRGT 16-1, LRGT 16-2, LRGT 17-1, KS 90 – continued –

Output 1: Continuous blowdown valve closes, relay contact closed

Output 2: Continuous blowdown valve opens, relay contact closed

Output 3: Max. limit exceeded, relay contact open

Attention

If the MAX contact (72 hrs. operation) is connected, the industrial controller KS 90 must remain permanently in function as otherwise the limit switch contact would switch to malfunction.

If the valve is to be closed with the burner operating in modulating mode during the phase when the burner is shut down, an additional auxiliary relay must be provided on site (K01).

Setting up the industrial controller KS 90

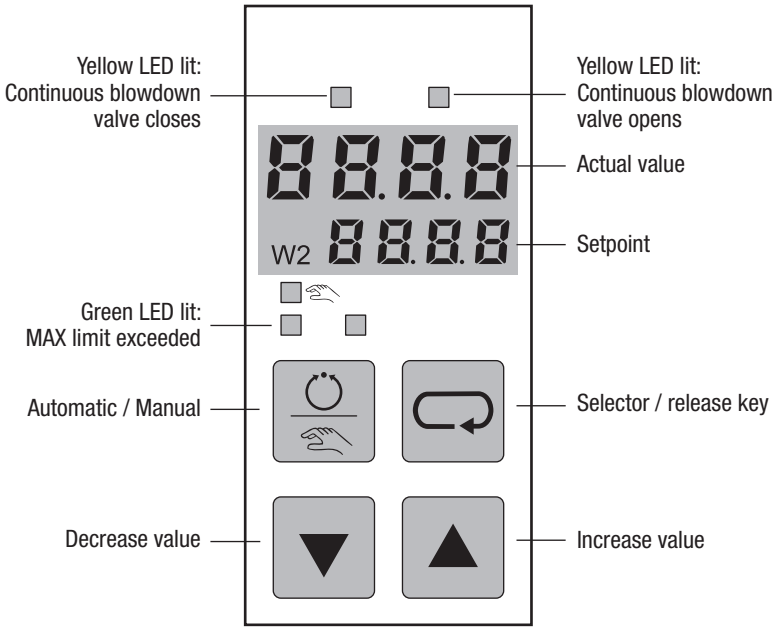
Operating structure

The operating and indicating elements of the industrial controller KS 90 are shown on page 38, **Fig. 15**.

The operating structure of the industrial controller comprises three levels:

- Operating level
- Parameter setting level
- Configuration level

When the auxiliary energy is switched on the equipment is first initialised and then the adjusted process is executed. The equipment is then in the operating level.



Setting up the industrial controller KS 90 – continued –

Configuration level

In the configuration level the industrial controller is adapted to its control task. For this purpose it is necessary to key completely through the configuration level.

Hold down selector key ⮌ for min. 3 seconds
to select the parameter level.

Min. 3 seconds

Hold down selector key ⮌ for min. 5 seconds
to select the configuration level.

Min. 5 seconds

Note

The indicated values are vital and must not be changed!

To enter the first configuration value (3172)
press keys ▼ or ▲ several times.

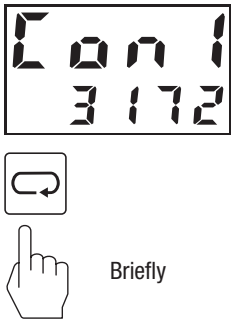
The setting 3172 determines:
Type of input: 4 – 20 mA, InL/InH adjustable
Controller function: 3 position stepping controller

Assignment of the outputs:
Relay 1: Valve CLOSED
Relay 2: Valve OPEN
Relay 3: Alarm 1

Several times briefly

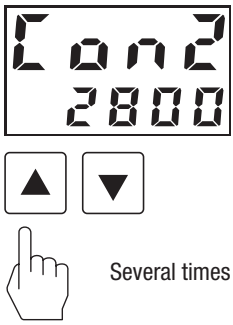
Configuration level – continued –

Press selector key ⮌ briefly.
The adjusted value is saved and the display shows the next configuration value.

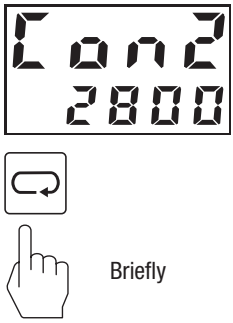


To enter the configuration value (2800) press keys ▼ or ▲ several times.

Setting 2800:
Alarm 1: Sensor alarm + limit contact
Absolute limit contact



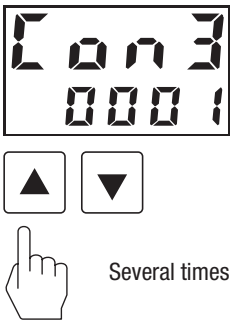
Press selector key ⮌ briefly.
The adjusted value is saved and the display shows the next configuration value.



Configuration level – continued –

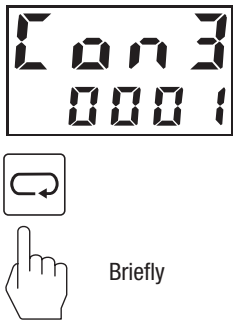
To enter the configuration value 0001
press keys ▼ or ▲ several times.

Setting 0001:
Reaction in the event of sensor alarm like X < W:
Valve motors to closed position.



Several times briefly

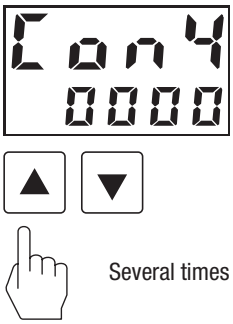
Press selector key briefly.
The adjusted value is saved and the display shows the next configuration value.



Briefly

To enter the last configuration value 0000
press keys ▼ or ▲ several times.

Setting 0000:
No setting for configuration value 4!

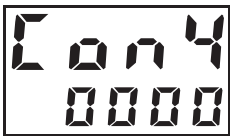


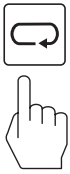
Several times briefly

Configuration level – continued –

Press selector key briefly.

All modifications become effective and the equipment leaves the configuration level and goes back to the operating level.





Briefly

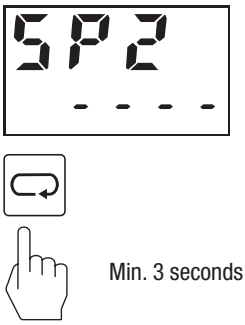
Parameter level

At parameter level, the equipment is adapted to the controlled system. Only the parameters that are required for the configured equipment are shown. For a table listing all possible parameter settings refer to page 61.

Note

- If nothing is entered within 30 seconds the equipment will automatically switch back to the operating level.
- The longer you press key ▼ or ▲ the faster the values are changed.
- We recommend that you set first the beginning and the end of the measuring range (**InL**, **InH**) and then the lower and upper setpoint limits (**SPL**, **SPH**).

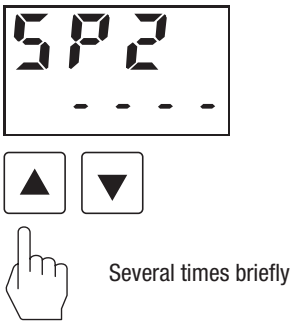
Hold down selector key ⮌ for min. 3 seconds to enter the parameter level.



To set the parameter **Setpoint** press keys ▼ or ▲ several times.

The setpoint must be between the lower and upper setpoint limits (parameter SPL and SPH). If it is not possible to set the desired setpoint check the parameter settings SPH and InH and, if required, increase them.

Required setting: ----



Parameter level – continued –

Press selector key briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered.

Briefly

To set the parameter **Limit contact 1 low** press keys ▼ or ▲ several times.

Possible adjustment range:
Lower setpoint limit SPL…9999;

Setting 5000 (equivalent to MAX cut-out function)

Several times briefly

Press selector key briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered

Briefly

Parameter level – continued –

To set the parameter **Limit contact 1 high**
press keys ▼ or ▲ several times.

Required setting: ----

Do not change the parameter setting **Limit contact 1 high** afterwards!

Several times briefly

Press selector key ⮌ briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.

Briefly

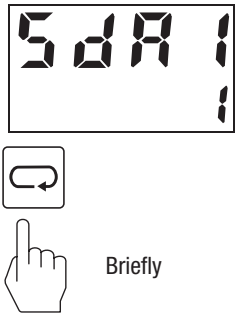
To set the parameter **Alarm switching differential for LCH 1**
press keys ▼ or ▲ several times.

Possible adjustment range: 1…9999 min:
Setting: 1

Several times briefly

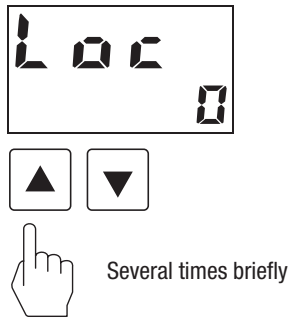
Parameter level – continued –

Press selector key briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.

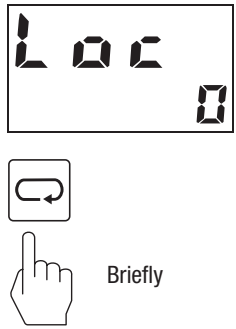


To set the parameter **Operation locking** press keys ▼ or ▲ several times.

Setting: 0



Press selector key briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.



Parameter level – continued –

To set the parameter **Lower setpoint limit**
press keys ▼ or ▲ several times.

Possible adjustment range:
Beginning of measuring range (InL)…upper setpoint limit (SPH – 1)

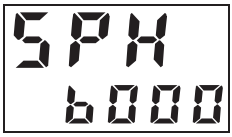
Several times briefly

Press selector key ⮌ briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.

Briefly

To set the parameter **Upper setpoint limit**
press keys ▼ or ▲ several times.

Possible adjustment range: Lower setpoint limit (SPL + 1)…
End of measuring range (InH)
Setting: e. g. 6000

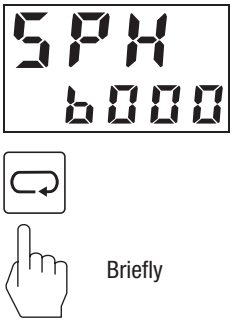


Several times briefly

Parameter level – continued –

Press selector key ⮌ briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered.

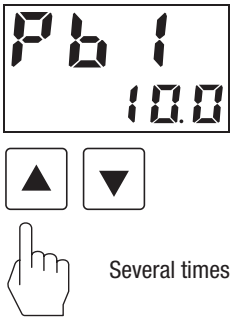


Briefly

To set the parameter **Proportional band** press keys ▼ or ▲ several times.

Possible adjustment range: 0.1…999.9 %

Setting: 10 %



Several times briefly

Press selector key ⮌ briefly.

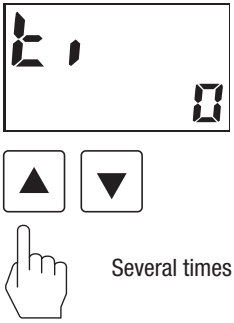
The adjusted parameter setting becomes effective and the next parameter can be entered.

Briefly

Parameter level – continued –

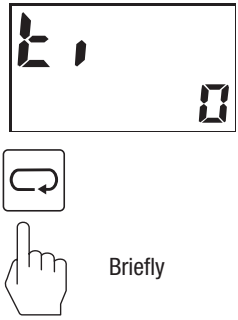
To set the parameter **Integral time**
press keys ▼ or ▲ several times.

Setting: 0



Several times briefly

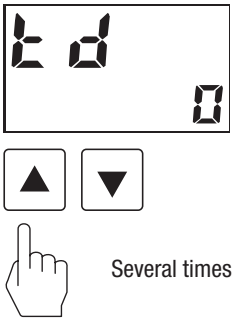
Press selector key ⮌ briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.



Briefly

To set the parameter **Derivative time**
press keys ▼ or ▲ several times.

Setting: 0

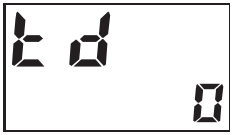


Several times briefly

Parameter level – continued –

Press selector key ⮌ briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered.



Briefly

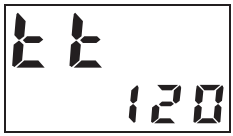
To set the parameter **Actuator run time** press keys ▼ or ▲ several times.

Setting: depends on actuator, e.g. 120 sec.

Several times briefly

Press selector key ⮌ briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered.



Briefly

Parameter level – continued –

To set the parameter **Min. step time**
press keys ▼ or ▲ several times.

Possible adjustment range: 0.1…2.0 sec.
Setting: 2.0 sec.

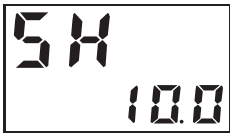
Several times briefly

Press selector key ⮌ briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.

Briefly

To set the parameter **Switchpoint separation**
press keys ▼ or ▲ several times.

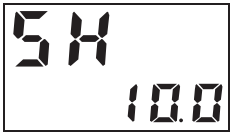
Possible adjustment range: 0.2…20 %
Setting: e. g. 10 %



Several times briefly

Parameter level – continued –

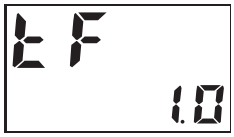
Press selector key ⮌ briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.



Briefly

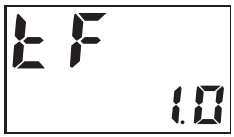
To set the parameter **Filter time constant**
press keys ▼ or ▲ several times.

Possible adjustment range: 0.0…999.9 sec
Setting: 1.0 sec



Several times briefly

Press selector key ⮌ briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.

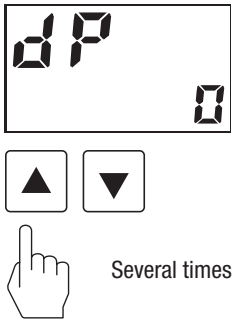


Briefly

Parameter level – continued –

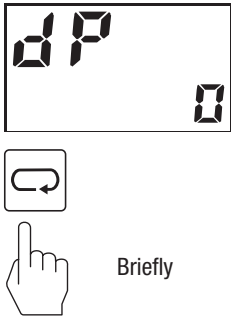
To set the parameter **Decimal point**
press keys ▼ or ▲ several times.

Possible adjustment range: 0, 1, 2
Setting: 0 (no decimal point)
applicable for parameters SP2, LCL1, SPL and SPH.



Several times briefly

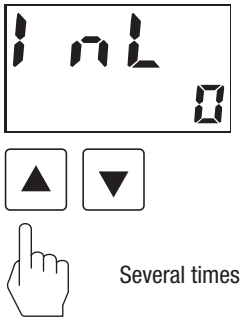
Press selector key briefly.
The adjusted parameter setting becomes effective and the next parameter can be entered.



Briefly

To set the parameter **Beginning of measuring range**
press keys ▼ or ▲ several times.

Possible adjustment range: -999…
End of measuring range (InH – 1)

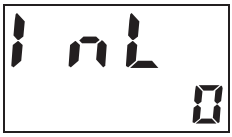


Several times briefly

Parameter level – continued –

Press selector key ⮌ briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered.

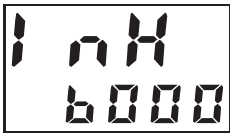


Briefly

To set the parameter **End of measuring range** press keys ▼ or ▲ several times.

Possible adjustment range:
Beginning of measuring range (InL + 1) …9999

Adapt the measuring range to the selected control range of the conductivity transmitter, e. g. 6000.



Several times briefly

Press selector key ⮌ briefly.

The adjusted parameter setting becomes effective and the next parameter can be entered.

Briefly

Parameter level – continued –

The following table lists all possible parameters:

■ Please first set the beginning and the end of the measuring range (**InL**, **InH**) and then the lower and upper setpoint limits (**SPL**, **SPH**).

No.	Parameter	Symbol	Adjustment range, setting
01	Setpoint	**SP2**	----
02	Limit contact 1 low **MAX alarm**	**LCL1**	Lower setpoint limit **SPL** …9999
03	Limit contact 1 high	**LCH1**	----
04	Alarm switch. differential for LC 1	**SdA1**	1…9999, setting: 1
05	Operation locking	**Loc**	0
06	Lower setpoint limit	**SPL**	Beginning of measuring range (**InL**) … upper setpoint limit (**SPH –1**)
07	Upper setpoint limit	**SPH**	Lower setpoint limit (**SPL + 1**) … end of measuring range (**InH**)
08	Proportional band	**Pb1**	0.1 … 999.9 %, setting: 10 %
09	Integral time	**ti**	0
10	Derivative time	**td**	0
11	Actuator run time	**tt**	depends on actuator, max. 6 minutes acc. to MAX position
12	Min. step time	**ttp**	0.1 … 2.0 sec., setting: 2.0 sec.
13	Switchpoint separation	**SH**	0.2 …20.0 %, setting: e. g. 10 %
14	Filter time constant	**tF**	0.0…999.9 sec., setting: 1.0 sec.
15	Decimal point	**dP**	0 / 1 / 2 (0 = no decimal point)
16	Beginning of measuring range	**InL**	- 999 ... (**InH - 1**)
17	End of measuring range	**InH**	(**InL + 1**) ... 9999

Please note:

■ The indication of the parameters **SP2, LCL, LCH, SdA 1, SPH, InL** and **InH** depends on the decimal point setting.

■ All values indicated in percent refer to the measuring range **InL** to **InH**.

Parameter level – continued –

Conductivity transmitter LRGT 16-1, LRGT 17-1		Controller	
Measuring range*) (µS/cm at 25 °C)		INL / SPL	INH / SPH
0.5	20	0.5	20
	100		100
	200		200
	500		500
	1000		1000
	2000		2000
	6000		6000
	12000		9999

Conductivity transmitter LRGT 16-2		Controller	
Measuring range*) (µS/cm at 25 °C)		INL / SPL	INH / SPH
100	3000	100	3000
	5000		5000
	7000		7000
	10000		9999
***) Conversion** of µS/cm in ppm (part per million): 1 µS/cm = 0.5 ppm			

If the industrial controller KS 90 is used in conjunction with the conductivity transmitter LRGT 16-1, LRGT 16-2 or LRGT 17-1 for conductivity limiting purpose, the Limit Contact Low (**LCL 1**) must be adjusted to the max. electrical conductivity setting.

When the limit value is exceeded, the green LED for alarm 1 lights up and relay output 3 opens the safety circuit of the heating system. The limit setting can be retrieved at the parameterisation level.

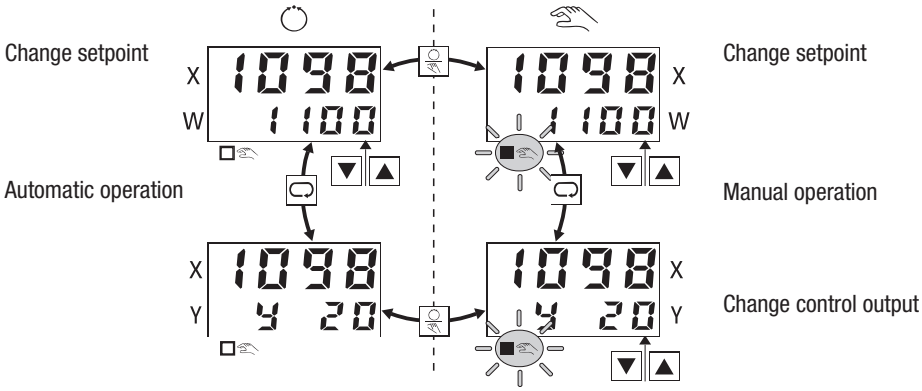
Attention

Relay output 3 does not interlock automatically.

The interlocking function must therefore be implemented in the follow-up circuit (safety circuit), which must meet the requirements of DIN EN 50156-1 / VDE 0116-1. The relay output must be protected by fuse up to a maximum of 1.2 A.

Setting up the industrial controller KS 90 – continued –

Operating level



This level is for process control.

Indication of actual value and setpoint

In manual and automatic operating mode the first display line shows the actual value X and the last display line the setpoint W.

Switching between manual and automatic mode

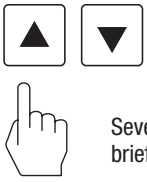
Press manual/automatic key .

The equipment switches from automatic to manual operation (or vice versa).

Briefly

Changing the setpoint

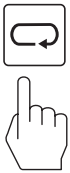
To change the setpoint press key ▼ or ▲ several times.



Several times briefly

The modification becomes effective after 2 sec.
or when pressing the selector key briefly.

The setpoint can be changed in manual and in automatic mode.



Briefly

Operating level – continued –

Changing the control output
(only possible during manual operation)

Press manual/automatic key [⟲] .

The equipment switches from automatic to manual operation.

Briefly

Briefly press selector key [⟲] .

The control output Y is indicated in the lower display line.

Briefly

To change the control output press keys [▼] or [▲] several times.

Briefly

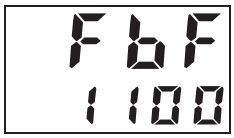
The modification becomes effective after 2 sec.
or when pressing the selector key [⟲] .

Briefly

Malfunction messages

Measuring current of conductivity transmitter has fallen below 2 mA or incorrect polarity in line.

The continuous blowdown valve is closed.



Troubleshooting

Fault-finding list for troubleshooting

Fault: Failure of voltage supply.

Remedy: Apply supply voltage. Make sure that the supply voltage and frequency are in accordance with the ratings indicated on the name plate of the industrial controller.

Fault: Faulty connections to conductivity transmitter or final controlling elements.

Remedy: Check all connections to conductivity transmitter and final controlling elements.

Fault: Malfunction in conductivity transmitter or final controlling element.

Remedy: Correct malfunction in conductivity transmitter or final controlling element (see page 30).

Fault: Incorrect configuration of industrial controller.

Remedy: Properly re-configure industrial controller (see page 45).

Fault: Incorrect parameter setting.

Remedy: Set new parameters (see page 49).

If the controller still does not work properly after troubleshooting, decommission the controller and replace it.

For your notes

For your notes

Agencies all over the world:

www.gestra.de

818726-02/06-2010cm (808546-04) · GESTRA AG · Bremen · Printed in Germany