

Conductivity Transmitter

LRGT 16-3

LRGT 16-4

LRGT 17-3

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Content of this Manual

Product:

- Conductivity Transmitter LRGT 16-3
- Conductivity Transmitter LRGT 16-4
- Conductivity Transmitter LRGT 17-3

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Scope of delivery/Product package

- 1 x conductivity transmitter LRGT 1x-x
- 1 x sealing ring, D 33 x 39, form D, DIN 7603-2.4068, bright annealed
- 1 x Installation & Operating Manual

Required accessories for LRGT 16-3, LRGT 17-3 and LRGT 16-4 when installing for the first time

- Connecting cable, M12 A-coded, 5m, mat. no. 1508392
- Connecting cable, M12 A-coded, 10m, mat. no. 1508394
- Connecting cable, M12 A-coded, 30m, mat. no. 1508395

Optional accessories or retrofit

- Cable jack M12 A-coded, mat. no. 52820

How to use this Manual

This Installation & Operating Manual describes how to correctly use LRGT 16-3, LRGT 16-4 and LRGT 17-3 conductivity transmitters. It applies to all persons who integrate this equipment into control systems, install, bring into service, operate, maintain and dispose of this equipment. Anyone carrying out the above-mentioned activities must have read this Installation & Operating Manual and understood its contents.

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

Availability of this Installation & Operating Manual

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

Illustrations and symbols used

1. Action to be taken

2.

- Lists
 - ◆ Bullet points in lists

A Keys to illustrations



Additional
information



Read the relevant
Installation & Operating Manual



Press the rotary knob

Hazard symbols in this Manual



Danger zone / Dangerous situation



Danger of death from electric shock

Types of warning

DANGER

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

WARNING

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

CAUTION

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

ATTENTION

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

Specialist terms/Abbreviations

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

IEC 61508

International standard IEC 61508 describes both the type of risk assessment and actions taken to provide appropriate safety functions.

SIL (safety integrity level)

Safety integrity levels SIL 1 to 4 are used to quantify risk reduction. SIL 4 is the highest level of risk reduction. International standard IEC 61508 forms the basis for establishing, testing and operating technical safety systems.

LRGT .. / LRR .. / URS .. / URB .. / SRL .. / etc.

Equipment and type designations of GESTRA.

SELV

Safety Extra Low Voltage

Operating point (of the system)

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

The pressure at the operating point does not have to match the design pressure, but is the same or lower.

Usage for the intended purpose

LRGT 16-3, LRGT 16-4 and LRGT 17-3 conductivity transmitters can be used as conductivity limiters and continuous blowdown controllers to continually monitor conductivity in steam boilers and hot water installations. They present a linear profile of conductivity in a preset measuring range via a 4-20 mA current output.

- The transmitter's secure 4-20 mA actual value output (SIL 2) can be used with a suitable conductivity controller, as a continuous blowdown controller with MIN/MAX alarm, for example.
- To ensure problem-free operation, pay attention to the requirements for water quality as specified in the technical rules (TRD) and EN standards for steam boiler plants.
- The equipment may only be used within the admissible pressure and temperature ratings, see "Technical data" on page 15 and "Example name plate/Identification" on page 18.

Admissible system components, dependent on the required safety integrity level

In accordance with standards EN 12952, EN 12953, IEC 61508 and the technical rules of VdTÜV Bulletin BP WAUE 0100-RL, the conductivity electrode can be operated with safety integrity level SIL 2.

If an electronic control unit (diagnostic tester) that also has a SIL 2 rating is connected to the 4-20 mA output, the entire event chain system can be operated at this safety integrity level.



A diagnostic tester with a higher SIL rating does not increase the safety of the overall system. The maximum achievable safety level is dictated by the lowest SIL rating of a participant in the event chain as a whole.

Systems without SIL rating

In systems without a SIL rating, any controller, display unit or diagnostic tester with an input for a standard 4-20 mA signal can be connected.



To ensure the proper use of equipment during all types of use, please also read the Installation & Operating Manuals for the system components used.

- You can find the latest Installation & Operating Manuals for other system components on our website: www.gestra.com

Improper use



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

Do not use the equipment in potentially explosive atmospheres.



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

The name plate indicates the technical features of the equipment.

Basic safety notes



Danger to life from scalding if the conductivity electrode is removed under pressure. Steam or hot water can spurt forcefully out of the equipment.

- Only remove the conductivity electrode at a **boiler pressure of 0 bar**.



Risk of severe burns when working on a conductivity electrodes that has not been allowed to cool. The conductivity electrode becomes very hot during operation.

- Always allow conductivity electrodes to cool.
- Perform all installation and maintenance work only when the conductivity electrode has been allowed to cool.



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

- Always switch off the voltage to the plant before performing connection work.
- Check that the plant is not carrying live voltage before commencing work.



Danger to life from a faulty LRGT 1x-x conductivity electrode due to the sudden escape of hot steam or hot water.

Jolts or impacts during transport or installation can damage the conductivity electrode, causing pressurised hot steam or hot water to escape through the pressure relief hole.

- To prevent damage during transport and installation, do not expose the electrode rods to hard impacts.
- Before and after installation, check that the conductivity electrode is undamaged.
- When bringing the conductivity electrode into service, check that it is not leaking.



Attempts to repair the equipment will cause the plant to become unsafe.

- The LRGT 1x-x conductivity electrode may only be repaired by the manufacturer, GESTRA.
- Only replace faulty equipment with identical equipment from GESTRA.

Basic safety notes



A lack of proper maintenance and cleaning can result in damage to the conductivity electrode and/or false measurement results and warning messages.

- Check the conductivity electrode once a year by performing comparative measurements. If the “CF” (cell constant) value of 003.0 is exceeded after recalibration, the warning message “CF.Hi” will appear.
- Adhere to the maintenance and cleaning intervals, see page 58.

Required personnel qualifications

Activity	Personnel	
Integration in control system	Specialist staff	Plant designer
Installation/electrical connection/bringing into service	Specialist staff	The unit is an item of equipment with a safety function (EU Pressure Equipment Directive) and may only be installed, electrically connected and brought into service by suitable, trained staff.
Company	Boiler service technician	Staff trained by the plant operator.
Maintenance work	Specialist staff	Maintenance and refits may only be performed by authorised staff who have undergone specific training.
Refits	Specialist staff	Persons trained by the plant operator to work with pressure and temperature.

Fig. 1

Notes on product liability

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

Functional safety, safety integrity level (SIL)

LRGT 16-3, LRGT 16-4 and LRGT 17-3 conductivity transmitters have a secure 4-20 mA actual value output (SIL 2). If an electronic control unit (diagnostic tester) that also has a SIL 2 rating is connected to the 4-20 mA output, the entire event chain system can be operated at this safety integrity level.

When combined with the accessories, you will have a type B subsystem in accordance with IEC 61508. The technical and safety characteristics in Fig. 2 below are based solely on LRGT 16-3, LRGT 16-4 and LRGT 17-3 conductivity transmitters.

Check the secure current output regularly

Once a year, check that conductivity transmitters are functioning correctly by initiating the test function ($T1 = 1$ year).

The test function is initiated on site using the rotary knob integrated in the terminal box, see page 50.

Reliability data to EN 61508

Description	Characteristic values	
	LRGT 1x-3	LRGT 16-4
Safety integrity level	SIL 2	SIL 2
Architecture	1oo1	1oo1
Type of equipment	Type B	Type B
Hardware fault tolerance	HFT = 0	HFT = 0
Overall failure rate for dangerous undetected failures	$\lambda_{DU} < 50 \cdot 10^{-8} \text{ 1/h}$	$\lambda_{DU} < 50 \cdot 10^{-8} \text{ 1/h}$
Overall failure rate for dangerous detected failures	$\lambda_{DD} < 5000 \cdot 10^{-9} \text{ 1/h}$	$\lambda_{DD} < 5000 \cdot 10^{-9} \text{ 1/h}$
Safe failure fraction	SFF > 95.0%	SFF > 90.0%
Test interval	T1 = 1 year	T1 = 1 year
Probability of failure on demand	PFD < $50 \cdot 10^{-4}$	PFD < $50 \cdot 10^{-4}$
Diagnostic coverage Percentage of dangerous failures detected by a test.	DC > 90.0%	DC > 85.0%
Mean time to failure	MTTF _d > 30 a	MTTF _d > 30 a
Mean time to failure	MTTF > 10 a	MTTF > 10 a
Diagnostic interval	T2 = 1 hour	T2 = 1 hour
Performance level (to ISO 13849)	PL = d	PL = d
Probability of failure per hour	PFH < $50 \cdot 10^{-8} \text{ 1/h}$	PFH < $50 \cdot 10^{-8} \text{ 1/h}$
Ambient temperature as a basis for calculation	Tu = 60 °C	Tu = 60 °C
Mean time to repair	MTTR = 0 (no repair)	MTTR = 0 (no repair)
Fraction of undetected dangerous failures that have a common cause	beta = 2%	beta = 2%
Fraction of detected dangerous failures that have a common cause	beta d = 1%	beta d = 1%

Fig. 2

Function

The equipment measures the electrical conductivity of electrically conductive fluids and converts the information into a conductivity-dependent 4-20 mA current signal.

Measuring process of the LRGT 16-3 and LRGT 17-3

LRGT 16-3 and LRGT 17-3 conductivity transmitters use the conductometric two-electrode measuring process. A measuring current with a suitable frequency for the measuring range is introduced into the fluid. This produces a potential gradient between the electrode and the measuring tube, which is analysed as a measuring voltage.

Measuring process of the LRGT 16-4

The LRGT 16-4 conductivity transmitter uses the conductometric four-electrode measuring process. It consists of two current and two voltage electrodes. The current electrodes introduce a measuring current with a fixed frequency into the fluid. This gives rise to a potential gradient between these electrodes. This potential gradient is then picked up by the voltage electrodes and analysed as measuring voltage.

Temperature compensation of readings based on a reference temperature (25 °C)

The electrical conductivity changes as a function of the temperature. In order to base the readings on a reference temperature, an integrated resistance thermometer measures the temperature of the fluid. The electrical conductivity is calculated from the measuring current and measuring voltage, and then based on the reference temperature of 25 °C through temperature compensation.

Compensation process

Based on a set temperature coefficient, the conductivity reading is corrected to form a linear characteristic. The coefficient (default 2.1% per °C) is normally used for steam generating units with a constant pressure. Conductivity is established for a fluid temperature of 25 °C.

The gradient is then verified at service pressure using a calibrated conductivity meter.

Transmitter function

The transmitter function is the ability of the electrode to provide a scalable measuring range on the 4-20 mA current output interface and to make this available to one or more recipients for analysis.

This equipment does not have any controlling or limiting functions.

Automatic self-test

An automatic self-test periodically monitors the safety and function of the conductivity transmitters and measured value acquisition.

Faults in the electrical connection or electronic measuring equipment trigger a fault indication on the display, and the current output is set to 0 mA.

Function

Indications and signals, see page 48 / 52 *

LRGT 1x-x conductivity transmitters feature a green 4-digit, 7-segment display for showing readings, status information and error codes. The operating status is indicated by one red and three green LEDs.

Behaviour when switched on *

The display alternately shows the software version, the type and then the measured conductivity.

Behaviour in normal operation (no faults) *

The display shows the measured conductivity value (4 digits), e.g. 1550, and converts this value into a current signal from 4-20 mA, in accordance with the predefined measuring range (see page 43, Sout parameter).

Behaviour in the event of malfunctions *

The error state or malfunction is shown on the display by an error code, e.g. E.005 (error codes see page 52).

Every time there is a fault, 0 mA is output via the current output.



Faults are displayed based on their priority. Indications with higher priority are shown continuously before those with low priority. If several indications need attention, the display does not alternate between them.



Electrode faults cannot be acknowledged.

When the fault is corrected, the indication also disappears from the display, and the LRGT 16-3, LRGT 17-3 or LRGT 16-4-conductivity transmitter returns to normal operation.

Behaviour when performing the test function *

Initiating the test function by pressing the rotary knob on the LRGT 1x-x causes the maximum output current of 20 mA to be output. This enables you to check the effect of limit violation on connected diagnostic testers.



* The tables on page 48 ff. clearly show the relationship between the equipment status, the display and the status LEDs.

Setting parameters and changing factory settings

If necessary, you can adapt the electrode parameters to suit on-site conditions at the plant. You can set parameters and change factory settings using a rotary knob on the terminal box, see page 38 ff.

Technical data

Model and mechanical connection

- | | |
|-----------------------------------|--|
| ■ LRGT 16-3, LRGT 16-4, LRGT 17-3 | Thread G1 A, EN ISO 228-1, see Fig. 6, 8 and 9 |
|-----------------------------------|--|

Nominal pressure rating, admissible service pressure and temperature

- | | | |
|-------------|-------|------------------------|
| ■ LRGT 16-3 | PN 40 | 32 bar (abs) at 238 °C |
| ■ LRGT 16-4 | PN 40 | 32 bar (abs) at 238 °C |
| ■ LRGT 17-3 | PN 63 | 60 bar (abs) at 275 °C |

Materials

- | | |
|---|--------------------------------|
| ■ Terminal box | 3.2581 G AISi12, powder-coated |
| ■ Sheath | 1.4301 X5 CrNi 18-10 |
| ■ Measuring electrodes | 1.4571 X6CrNiMoTi17-12-2 |
| ■ Electrode insulation | PTFE |
| ■ Screw-in body: | |
| ◆ Measuring tube/screw of
LRGT 16-3, LRGT 17-3 | 1.4571, X6CrNiMoTi17-12-2 |
| ◆ Spacer disc of
LRGT 16-3, LRGT 16-4, LRGT 17-3 | PEEK |

Available electrode lengths (do not shorten)

- | | |
|------------------------|---|
| ■ LRGT 16-3, LRGT 17-3 | 200, 300, 400, 500, 600, 800, 1000 (mm) |
| ■ LRGT 16-4 | 180, 300, 380, 500, 600, 800, 1000 (mm) |

Temperature sensor

- | | |
|-------------------------------------|-------------|
| ■ Resistance thermometer | Pt 1000 |
| ■ Fluid temperature measuring range | 0 to 280 °C |

Conductivity range at 25 °C

- | | |
|-----------------------------|--|
| ■ LRGT 16-3, LRGT 17-3 | 0.5 µS/cm to 6000 µS/cm, 0.25 - 3000 ppm * |
| ◆ Preferred measuring range | up to 1000 µS/cm |
| ■ LRGT 16-4 | 50 µS/cm to 10,000 µS/cm, 25 - 5000 ppm * |
| ◆ Preferred measuring range | from 500 µS/cm |

* Conversion of µS/cm to ppm (parts per million): 1 µS/cm = 0.5 ppm

Measuring cycle

- | |
|------------|
| ■ 1 second |
|------------|

Technical data

Measurement quality (figures for value ranges between the on-site calibration points)

■ LRGT 1x-3

Resolution for internal processing *	Measurement error	Linearity error
◆ Range 1: 0.5 μ S - 10 μ S	7%	2%
◆ Range 2: 10 μ S - 250 μ S	3%	2%
◆ Range 3: 250 μ S - 2600 μ S	3%	1%
◆ Range 4: 2600 μ S - 21000 μ S	3%	1%

■ LRGT 16-4

Resolution for internal processing *	Measurement error	Linearity error
◆ Range 1: 10 μ S - 100 μ S	2%	2%
◆ Range 2: 100 μ S - 2000 μ S	2%	1.5%
◆ Range 3: 2000 μ S - 50000 μ S	2%	1%

* Resolution for internal processing based on 15 bits with plus or minus sign (16 bits).



The above figures refer to the uncompensated conductivity.

Time constant "T" (measured using the two-bath process)

	Temperature	Conductivity
■ LRGT 16-3, LRGT 17-3	9 seconds	14 seconds
■ LRGT 16-4	11 seconds	19 seconds

Temperature compensation

- The temperature compensation process is linear and can be set via parameter tC, see page 42.

Supply voltage

- 24 V DC $\pm$ 20%

Power consumption

- Max. 7 W

Current input

- Max. 0.35 A

Internal fuse

- T2A

Safety cutout at excessive temperature

- Cutout occurs when an excessive temperature of 75 °C is measured in the electrode tip

Electrode voltage

- < 500 mV (RMS) at no load

Technical data

Analogue output

- 1 x actual value output 4-20 mA
- Max. output load 500 Ω
- M12 connector, 5-pole, A-coded

Indicators and controls

- 1 x 4-digit green 7-segment display for showing readings and status information
- 1 x red LED for indicating an error state
- 3 x green LEDs for indicating the unit $\mu\text{S}/\text{cm}$ / ppm and OK status
- 1 x rotary knob IP65 with button for menu navigation and test function

Protection class

- III Safety Extra Low Voltage (SELV)

IP rating to EN 60529

- IP 65

Admissible ambient conditions

- Service temperature: 0 °C – 70 °C
- Storage temperature: -40 °C – 80 °C
- Transport temperature: -40 °C – 80 °C
- Air humidity: 10% – 95%, non-condensing

Weight

- LRGT 16-3, LRGT 16-4, LRGT 17-3 approx. 2.1 kg

Example name plate/Identification

 Betriebsanleitung beachten! See installation instruction!			
 Vor dem Öffnen des Deckels Gerät freischalten! Before removing cover isolate from power supplies!			
1			
2			
3			
4	5	6	7
 bar (psi)		8	
 °C (°F)		 Tamb = T °C (°F)	
9		10	
L/H= 11			
ppm 12		μS/cm 13	
14			
15			
16			
17	UK CA	EAC	CE
			18
19			20
21	 12345678-12345678		

Fig. 3

- 1 Safety note
- 2 Equipment designation
- 3 Equipment function
- 4 Nominal pressure rating
- 5 Connection thread
- 6 Material of screw-in body
- 7 IP rating
- 8 Operating data (maximum pressure and temperature)
- 9 Supply voltage
- 10 Power consumption
- 11 Installed length in mm
- 12 Measuring range in ppm
- 13 Measuring range in μS/cm
- 14 Data interface
- 15 Safety integrity level
- 16 Type-approval number
- 17 Conformity marking
- 18 Disposal information
- 19 Manufacturer
- 20 Protection class
- 21 Material number-serial number



The date of production (quarter and year) is stamped on the screw-in body of each conductivity transmitter.

Factory settings

LRGT 1x-x conductivity transmitters are delivered ex works with the following settings:

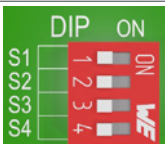
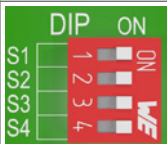
Parameter	Display in menu	Unit	Parameter values	
			LRGT 16-3 LRGT 17-3	LRGT 16-4
Cell constant	CF		0.210	
Temperature coefficient	tC	% / °C	002.1	
Filter constant (damping)	FILt	seconds	0025	
Scale of current output	Sout	μS	0500	7000
Display unit	Unit		μS	
Password	PW	- - -	oFF	
DIP switch	- - -	- - -	OFF	ON
				
			Do not change the DIP switch factory settings.	

Fig. 4

Overall view

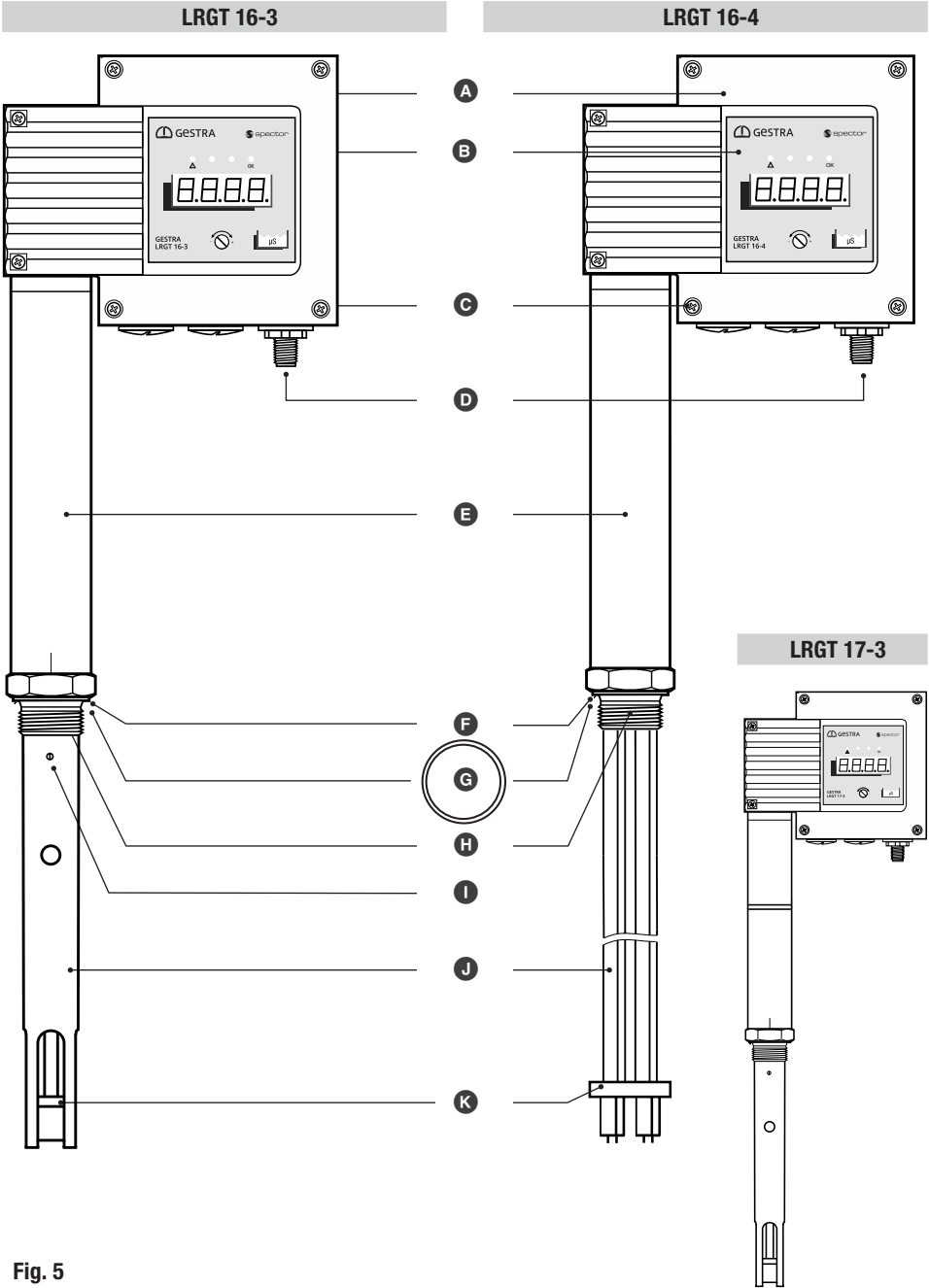


Fig. 5

Overall view

Key to Fig. 5

- A** Terminal box
- B** Operating panel with 4-digit LCD, alarm LEDs and rotary knob, see page 48
- C** Cover screws M4 x 16 mm
- D** M12 connector, 5-pole, A-coded
- E** Sheath
- F** Seal seat for sealing ring
- G** Sealing ring D 33 x 39, form D, DIN 7603-2.4068, bright annealed
- H** Electrode thread
- I** Threaded pin M2.5 mm (LRGT 16-3, LRGT 17-3)
- J** Measuring tube with measuring electrode (LRGT 16-3, LRGT 17-3),
measuring electrodes (LRGT 16-4)
- K** Spacer disc

Dimensions of the LRGT 16-3

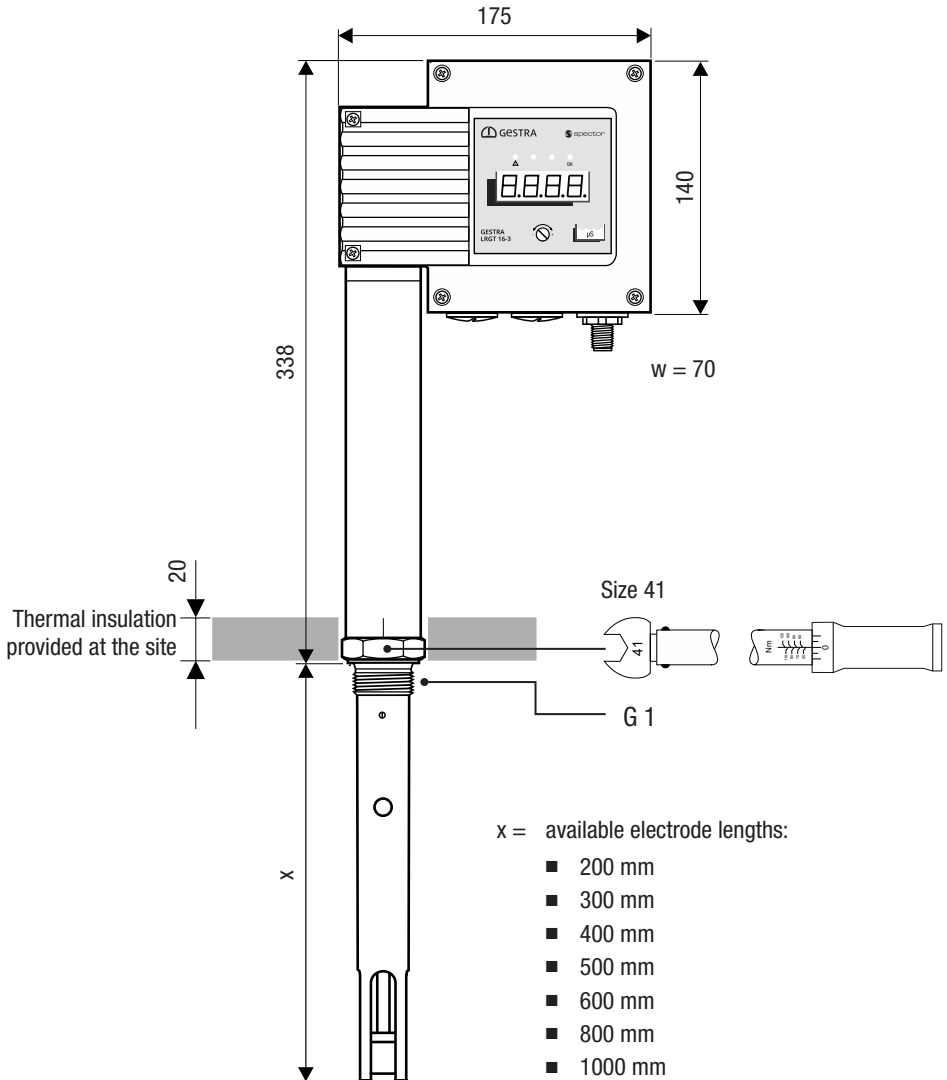


Fig. 6

All lengths and diameters in mm

Dimensions of the LRGT 16-4

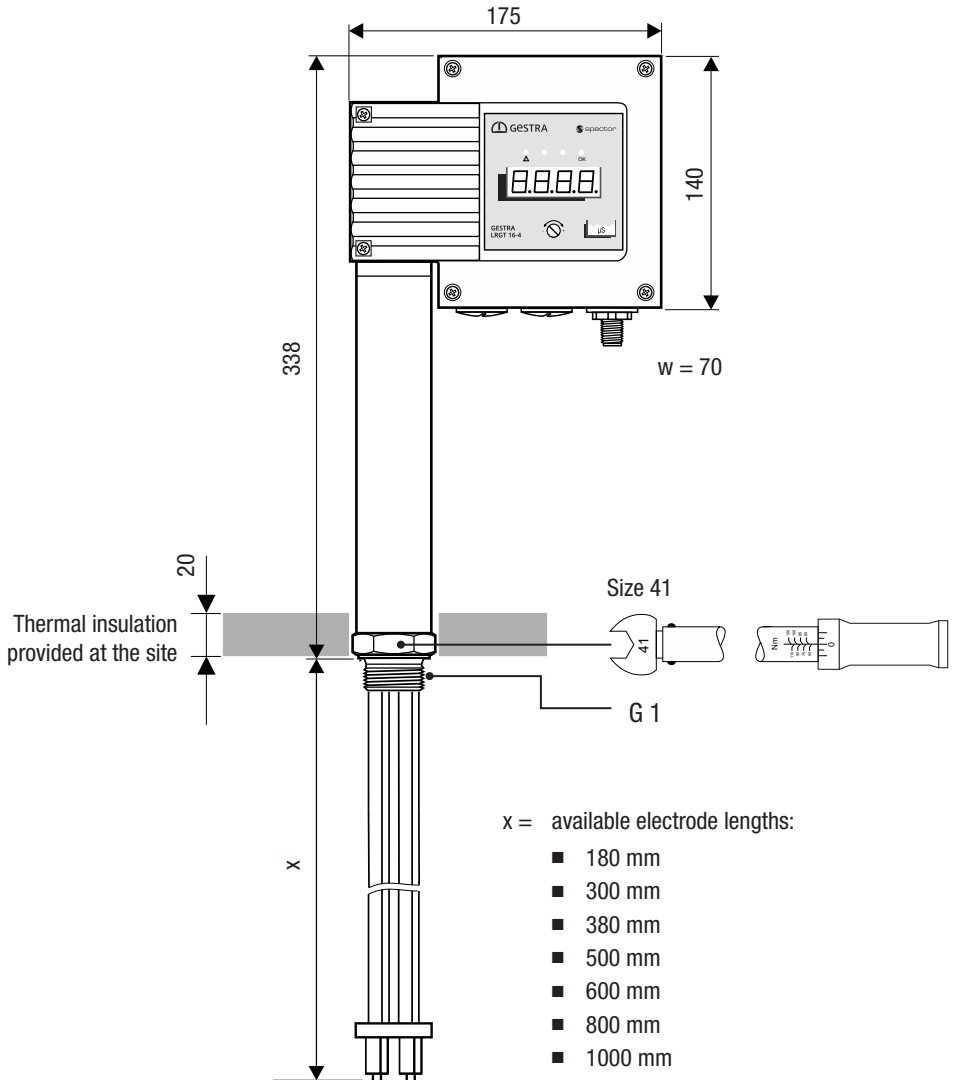


Fig. 7 All lengths and diameters in mm

Dimensions of the LRGT 17-3

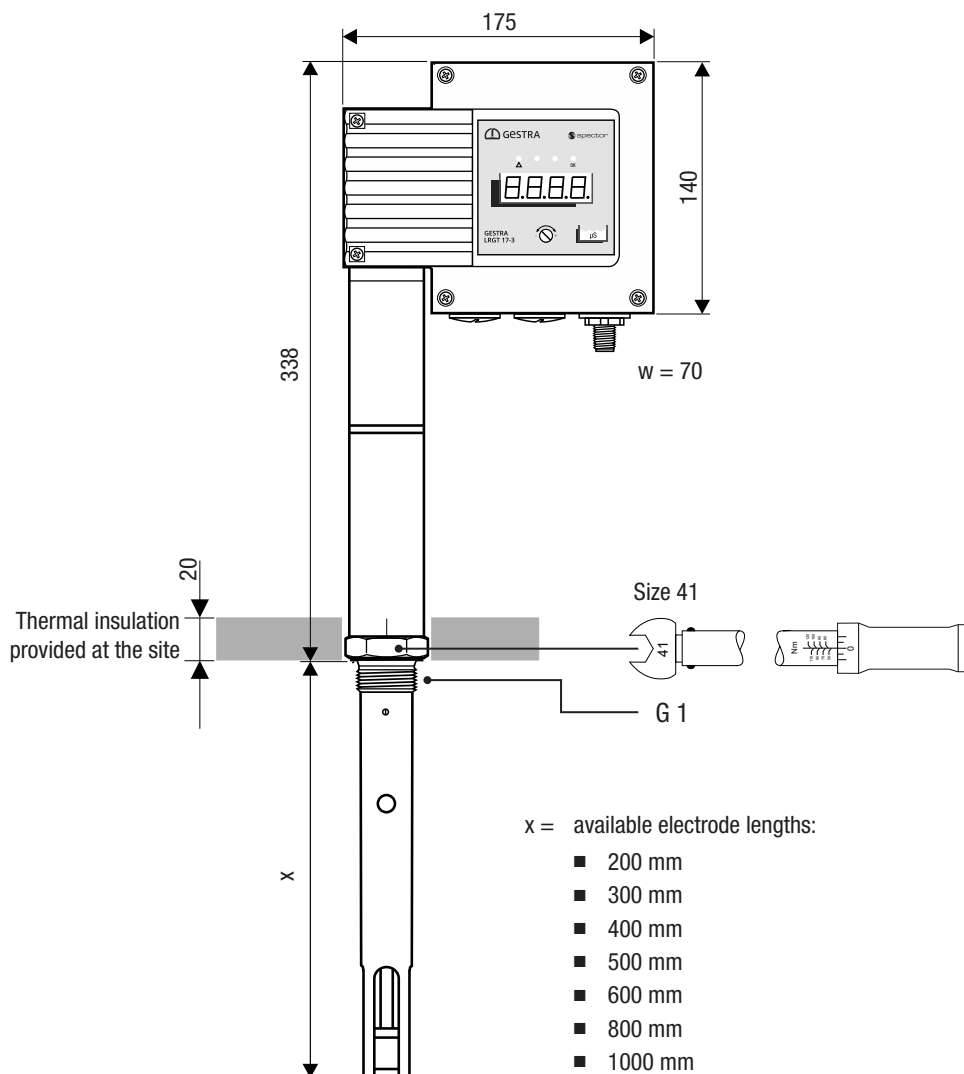


Fig. 8 All lengths and diameters in mm

Installation



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

- Pay attention to the admissible ambient conditions in the technical data, see page 17.
- Do not operate the equipment if the temperature is below freezing.
 - ◆ At temperatures below freezing, use a suitable heat source (e.g. control cabinet heater, etc.).
- Connect all plant parts to a central earthing point to prevent equalisation currents.
- Use a cover to protect the equipment from direct sunlight, condensation and heavy rain.
- Use UV-resistant cable ducts for routing the connecting cable.
- Take further measures to protect the equipment from harmful environmental influences such as lightning, insects and animals, and salty air.

You will need the following tools:

- Torque wrench (with size 41 open-ended spanner attachment), see pages 22 to 24 and page 28.



DANGER



Danger to life from scalding caused by the sudden escape of hot steam.

Hot steam or water can escape suddenly if the conductivity electrode is unscrewed under pressure.

- Reduce the boiler pressure to 0 bar and check the boiler pressure before you unscrew the conductivity electrode.
- Only remove the conductivity electrode at a boiler pressure of 0 bar.



WARNING



The hot conductivity electrode can cause severe burns.

Conductivity electrodes are extremely hot during operation.

- Always let the conductivity electrode cool down before performing installation and maintenance work.
- Remove the conductivity electrode only when it has cooled down.

Installation

ATTENTION



Incorrect installation can lead to malfunctions in the plant or the conductivity electrode.

- Inspect the sealing surfaces of the tank standpipe or flange cover to ensure they are perfectly machined, see Fig. 9.
- Take care not to bend the electrode rods during installation!
- Do not subject the measuring electrodes to hard knocks during installation.
- Do **not** install the body **A** or sheath **E** of the measuring electrode in the boiler thermal insulation!
- Pay attention to the mounting dimensions of the conductivity electrode, see installation examples on pages 31 to 34.
- Check the boiler standpipe and flange during the preliminary boiler inspection.
- Tighten to the specified torques.

Additional notes for installation

ATTENTION



If the electrode is not fully immersed in the fluid, measurement results may be false and there is a risk to plant safety.

- Install the conductivity electrode in such a way that the measuring electrodes are always fully immersed in the fluid.
- As far as possible, always install the conductivity electrode below the admissible LW mark.



Earthing points (metal objects) between the boiler wall and the electrode have an adverse effect on measurement. False measurement results are a risk to plant safety.

Therefore, always adhere to the distances stated below.

LRGT 16-3, LRGT 17-3

- Provide spacing of approx. 30 mm between the lower end of the measuring tube and the boiler wall, the smoke tubes and any other metallic fittings, and the low water level (LW).
- Do not shorten the measuring electrode or measuring tube.

LRGT 16-4

- Provide spacing of approx. 60 mm between the lower end of the measuring electrode and the boiler wall, the smoke tubes and other metal fittings, and the low water level (LW).

Installation

1. Inspect the sealing surfaces of the tank stand-pipe or flange cover.

Sealing surfaces must be perfectly machined, as shown in Fig. 9.

Sealing surface dimensions for LRGT 16-3, LRGT 16-4, LRGT 17-3

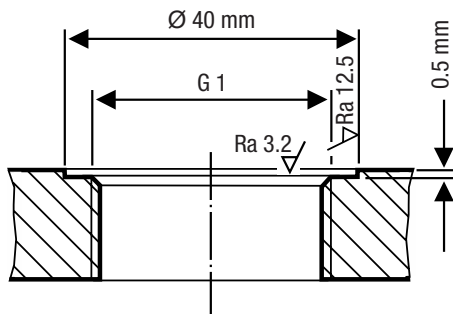


Fig. 9

2. Push the supplied sealing ring **G** onto the seal seat **F** of the electrode, or lay it on the sealing surface of the flange.

Example, LRGT 16-3

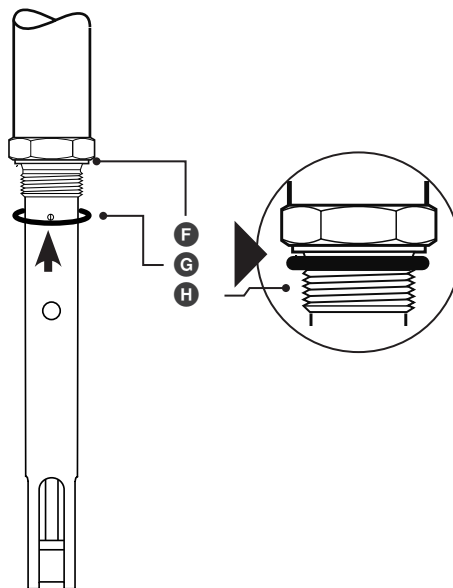


Fig. 10

! DANGER



Danger to life from escaping hot steam if incorrect or defective seals are used.

- Only use the supplied sealing ring for sealing the electrode thread **H**.
- ◆ **Sealing ring D 33 x 39**
DIN 7603-2.4068, bright annealed

Prohibited seal materials:

- Hemp, PTFE tape
- Conductive paste or grease

Installation

3. If necessary, apply a small quantity of silicone grease (e.g. Molykote® P40) to the electrode thread .
4. Screw the conductivity electrode into the tank standpipe or flange cover, and tighten securely using a torque wrench (with size 41 open-ended spanner attachment).

Tightening torque when cold:

- LRGT 16-3, LRGT 16-4, LRGT 17-3 = 250 Nm

Installation examples with dimensions, see Fig. 12, Fig. 13, Fig. 14 on page ... 31

Detaching the terminal box from the electrode

When installing or removing the conductivity electrode (e.g. when installing for the first time, during annual cleaning/maintenance or when taking out of service), you may need to detach the terminal box from the electrode because of space issues.



A self-locking nut connects the terminal box to the electrode. Therefore, before establishing the electrical connection, you can rotate the terminal box max. $\pm 180^\circ$ (a half turn) in the desired direction. This is often sufficient for alignment.

If, and only if, this option is not sufficient, detach the terminal box from the electrode and fit it again later on (see steps below).

DANGER



Danger to life if cleaning/maintenance or taking out of service/disassembly is performed incorrectly.

Follow all safety notes and instructions in the various sections of the Manual before you begin the work of detaching the terminal box.

- Cleaning the measuring electrodes of the conductivity transmitter, see page 58.
- Taking out of service/Disassembly, see page 57

ATTENTION



Avoid open circuits, damaging terminals and subsequent short circuits

- When screwing the conductivity electrode into or out of the standpipe, take care not to twist or trap the connecting cables from the electrode to the terminal box!
- Unplug the connector from the terminal block , see page 29

Installation

Detaching the terminal box from the electrode

You will need the following tools:

- Size 1 slotted screwdriver
- Size 19 open-ended spanner

1. Undo and remove the rear panel of the terminal box opposite the operating unit.

Interior view of terminal box (example LRGT 16-4):

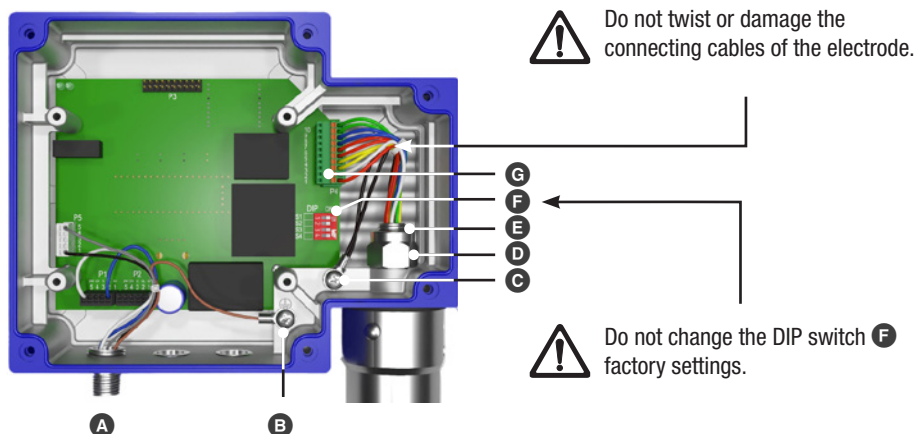


Fig. 11

Key:

- | | |
|--------------------------------|---|
| ● A M12 connector | ● E Cable gland for the connecting cable to the electrode |
| ● B Ring cable lug no. 2 | ● F Dip switch |
| ● C Ring cable lug no. 1 | ● G Terminal block with connector (detachable) |
| ● D Self-locking nut (size 19) | |

2. Unplug the connector from the terminal block ● G.
Do not detach the individual connecting cables.
3. Detach the ring cable lug ● C from the terminal box.
4. Slacken the nut ● D of the **electrode** using a size 19 open-ended spanner.
The terminal box now turns freely.

Installation

Detaching the terminal box from the electrode

5. During cleaning/maintenance (see page 58) or taking out of service (see page 57)

Unscrew the conductivity electrode from the tank standpipe.

6. When installing for the first time or after cleaning/maintenance

Screw the conductivity electrode into the tank standpipe.



To do so, proceed as described on pages 27 / 28 (points 1. to 4.) above and adhere to the stated tightening torques.

7. Rotate the terminal box so that it is correctly orientated.

8. Tighten the nut in the terminal box to a torque of 25 Nm.

9. Re-insert the connector in the terminal block **F** until you hear it click into place.

The connector cannot be inserted the wrong way round. If necessary, use cable ties to tie the connecting cables together in the terminal box.

10. Screw the ring cable lug **C** firmly onto the terminal box.

11. Finally, check the wiring one more time.

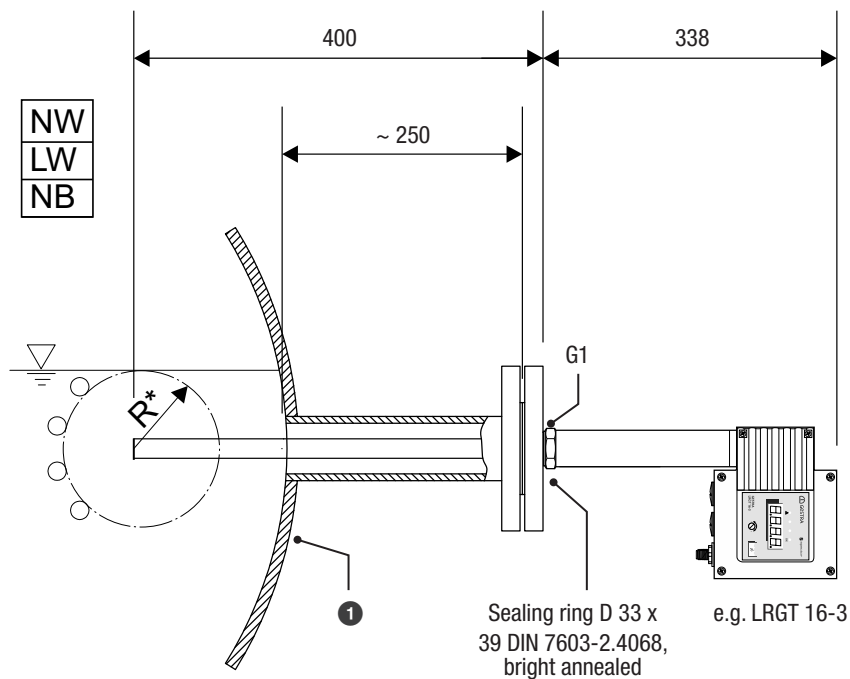
12. Close the rear panel of the electrode terminal box and screw back on.

Installation examples with dimensions

Conductivity measurement

Installing conductivity transmitters via a flange on the side.

Key, see page 34



* Minimum distances (R)

- LRGT 16-3 / LRGT 17-3 R = 30 mm
- LRGT 16-4 R = 60 mm

Fig. 12

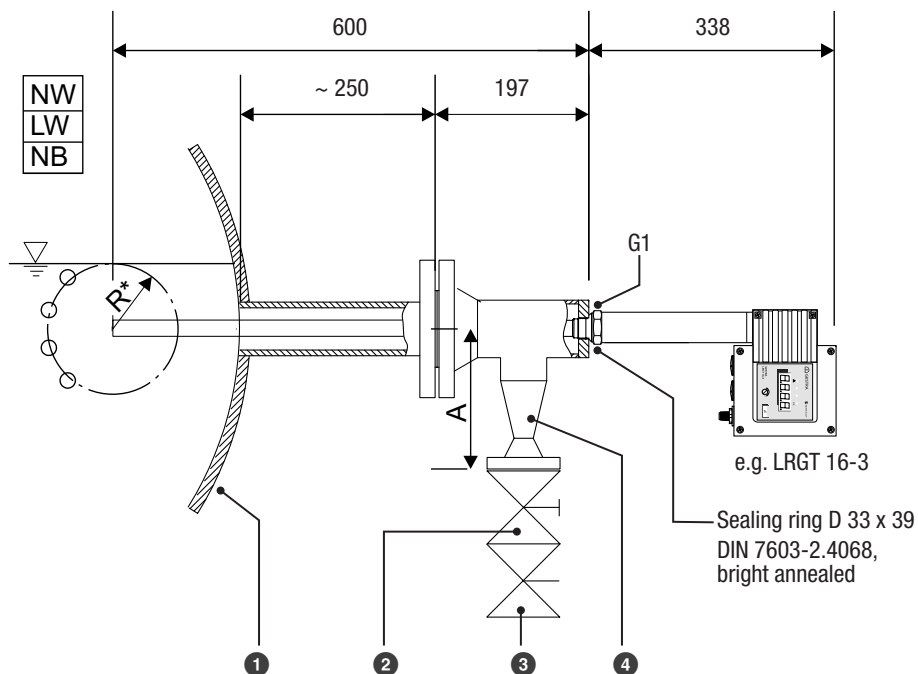
All lengths and diameters in mm

Installation examples with dimensions

Conductivity measurement and continuous blowdown control

Installing the conductivity transmitter via a level pot with continuous blowdown valve connection.

Key, see page 34



* Minimum distances (R):

- LRGT 16-3 / LRGT 17-3
- LRGT 16-4

R = 30 mm

R = 60 mm

Distance (A), depending on connection flange:

- DN 15 mm A = 182 mm
- DN 20 mm A = 184 mm
- DN 25 mm A = 184 mm
- DN 40 mm A = 189 mm

Fig. 13

All lengths and diameters in mm

Installation examples with dimensions

Conductivity measurement and continuous blowdown control via a separate level pot

Installing the conductivity transmitter in the blowdown line via a separate level pot.

Key, see page 34

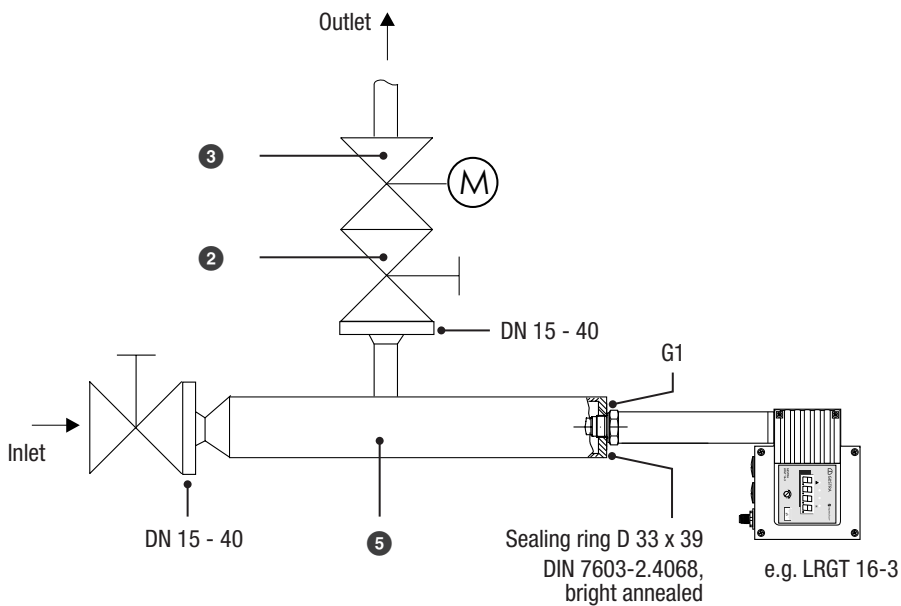


Fig. 14

All lengths and diameters in mm

Installation examples with dimensions

Key Fig. 12 to Fig. 14

- ❶ Boiler drum
- ❷ Stop valve GAV
- ❸ Continuous blowdown valve BAE
- ❹ T-type connector
- ❺ Level pot

Aligning the terminal box

If necessary, you can orientate the display in the desired direction by rotating the terminal box.

ATTENTION



Rotating the terminal box $\geq 180^\circ$ will damage the conductivity transmitter's internal wiring.

- Never rotate the terminal box more than 180 degrees in either direction.



If the terminal box needs to be rotated by **$>180^\circ$** , proceed as described on pages 28 to 30.

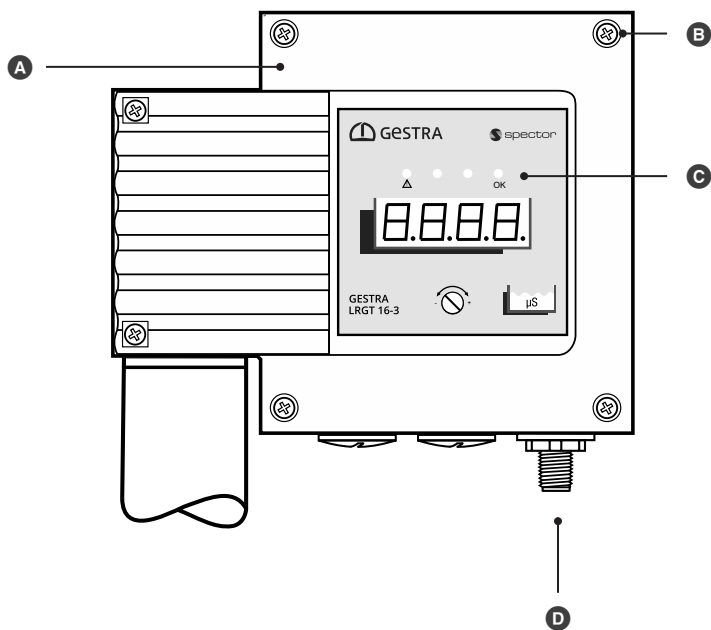


Fig. 15

- A** Terminal box
- B** Cover screws M4 x 16 mm
- C** Operating panel with 4-digit LCD/malfunction and status LEDs and rotary knob, see page 48
- D** M12 connector, 5-pole, A-coded

Electrical connection

Notes on electrical connection

- Use a shielded, multi-core control cable with a minimum conductor size of 0.5 mm², e.g. LiYCY 4 x 0.5 mm².
- Pre-wired control cables (with connector and coupling) are available as accessories in various lengths.

Connecting the 24 V DC power supply

- LRGT 16-3, LRGT 17-3 and LRGT 16-4 conductivity transmitters are supplied with 24 V DC.
- A safety power supply unit that delivers a Safety Extra Low Voltage (SELV) and is isolated from connected loads must be used to supply the equipment with 24 V DC.

Connecting the actual value output (4-20 mA)

- Please note the maximum output load of 500 Ω .
- Maximum cable length = 100 m.

Pin assignment of the M12 connector for non pre-wired control cables

If non pre-wired control cables are used, you must wire the cable to match the pin assignment of the M12 connector.

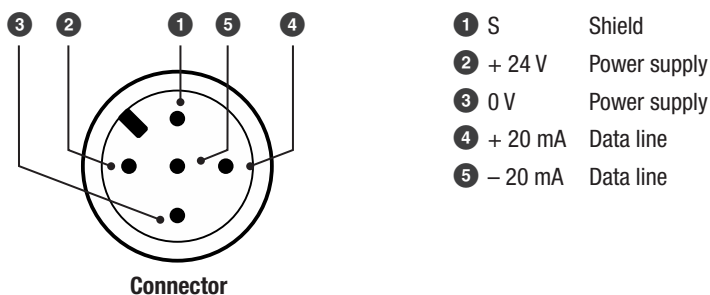


Fig. 16

Bringing into service

- Before bringing into service, check that the conductivity transmitter is correctly connected.
- Next, switch on the supply voltage.

Changing the factory settings if necessary

You will need the following tools

- Size 2.5 slotted screwdriver

Notes on bringing into service for the first time



When the equipment is brought into service for the first time, the scale of the current output is set to $500\ \mu\text{S} = 20\ \text{mA}$ for the LRGT 1x-3 and $7000\ \mu\text{S} = 20\ \text{mA}$ for the LRGT 16-4. After installation, first change the scale to suitable values for your specific system.

Changing parameters with password protection enabled



When password protection is enabled, you must enter the password before changing parameters, see page 38. Password protection applies only to the menu items with parameters that the user can actually change.



Menu items that can only display values (i.e. not parameters) are not covered by password protection. You can retrieve information about this at any time.

Password protection after restarting the equipment



Parameters are also password-protected when the equipment has been restarted, if password protection was previously enabled, see page 46.

Default ex-works password

The default password is “1902” and cannot be changed. Password protection is available from software version S-18 onwards.

Bringing into service

Selecting and setting a parameter:

1.  Using the screwdriver, turn the rotary knob clockwise or anti-clockwise until the desired parameter appears on the display. The set value is displayed after approx. 3 seconds.

The display alternates between the set parameter and its actual value, e.g. FilT. → “value” → FilT.

When you turn the rotary knob clockwise, the following parameters are shown in turn:

1234 → °C.in → °C.Pt → CF → tC → CAL → FilT → Sout → Unit → diSP → SGnL (*) → InFo → PW

* SGnL (LRGT16-4 only)

Key to parameters, see page 39.



If you do not enter anything for 30 seconds, the display automatically returns to the actual value.

2.  Once you have selected a parameter, press and hold the rotary knob until:
 - “PASS” appears on the display, prompting you to enter a password; move on to step 3.

or (password protection disabled)

 - the current parameter value flashes on the display; move on to step 8.

With password entry:

3. Release the rotary knob.
4.  Next, press and hold the rotary knob until “0000” appears on the display and the right-hand digit flashes.
5.  Enter the password “1902”. You can skip to the next flashing digit by briefly pressing the rotary knob.
 - / + reduce/increase the value.
6.  After the final digit, press and hold the rotary knob until “donE” is displayed. The display then alternates between the selected parameter and its current value.
7.  Press and hold the rotary knob until the current parameter value flashes on the display. Move on to step 8.

Bringing into service

Without password entry:

8.  Set the desired value.
- / + reduce/increase the value

Each parameter has an individual, admissible value range.

By pressing the knob briefly, you can skip to the next digit. This is a more convenient way of making large changes to values.



If you do not set a parameter within 10 seconds, the process is aborted (“quit”) and the old parameter value is retained.

9.  Save your settings by pressing the rotary knob for approx. 1 second.
The message “done” is shown and the parameter appears on the display once more.

Pay attention to the time limit for password entry



Disabled password protection is re-enabled after 30 minutes without any activity (rotary knob) and the password must then be entered again.

Key to parameters:

- 1234 = actual value display (normal operating state, example)
- °C.in = display ambient temperature of terminal box
- °C.Pt = display temperature of monitored fluid
- CF = cell constant of electrode
- tC = temperature coefficient of monitored fluid
- CAL = calibration function for calibrating the display based on a reference value (sample)
- FiLt = filter constant
- Sout = scale of 4-20 mA actual value output
- Unit = display unit (µS or ppm)
- diSP = initiate a display test
- SGnL = view signal reserve (**LRGT16-4 only**)
- InFo = view software version and equipment type
- PW = enable/disable password protection

Bringing into service

Display test for safety-relevant parameters

An initial display test takes place for safety-relevant parameters CF, tC, CAL, FiLt and Sout. Its aim is to prevent the entry of an incorrect value due to undetected faulty display segments. For this test, the user is required to keep an eye on the display segments during the test, to determine whether any segments are faulty.



When the first safety-relevant parameter is selected, the one-off display test opens a 10-minute time window, during which time several safety-relevant parameters can be entered without the display test having to be repeated when the next parameter is selected.

Replacing faulty equipment



Faulty equipment jeopardises plant safety.

- If numbers or decimal points are displayed incorrectly or not at all, you must replace the conductivity transmitter with an identical one from GESTRA.
-

Manually initiating a display test.

Alternatively, initiate the display test by pressing “diSP”, see page 45.

Bringing into service

Changing the cell constant

Notes on calibrating the cell constant

The cell constant of the LRGT 1x-x conductivity transmitter is precisely set at the factory. If recalibration is necessary at the installation site due to the conditions there, (see page 47, comparing the reading with a reference reading), you may change the cell constant on site.

Requirements for recalibration:

- To calibrate cell constants, there must be sufficient water in the boiler.
- Only perform reference reading comparisons at low boiler capacity, in order to minimise false results due to vapour bubbles.

This parameter can be used to manually adjust the display value in line with a reference reading from a reliable sample at the site.

Alternatively, you can perform recalibration using the convenient “**CAL**” function, see page 42.

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Select the parameter “**CF**”.
2. Press and hold the rotary knob until the current value flashes on the display.
3. Set the desired value (0.050 – 5.000).
4. Save your setting by pressing the rotary knob for approx. 1 second.



Raising the “CF” value increases the display value.

The display value will have decreased due to soiling. You can compensate for this by increasing the “CF” value, as described above in items 1 to 4.

Bringing into service

Changing the temperature coefficient



You can adjust the temperature coefficient of the monitored fluid manually, as long as an appropriate value has been established.

The factory setting of “2.1” is normally used for steam generating units with a constant pressure. For newly installed electrodes, this figure may need to be adapted in line with the temperature coefficient of the boiler water.

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Select the parameter “**tC**”.
2. Press and hold the rotary knob until the current value flashes on the display.
3. Set the desired value (000.0 – 003.0).
4. Save your set value by pressing the rotary knob for approx. 1 second.



Raising the value of “tC” lowers the display value.

Using the “CAL” function

The CAL function enables convenient readjustment of the cell constant “CF” when the electrode gets increasingly soiled during operation. Here, the reference reading of a reliable sample is converted into the display value at the operating point. The internal processor then automatically recalculates and corrects the cell constant “CF”.



ATTENTION



If the “CF” (cell constant) value of 003.0 is exceeded, the warning message “CF.Hi” will appear.

- The electrode urgently needs cleaning, see page 58.
- Continued operation is possible.

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Using a reliable sample, establish a reference reading of the current conductivity at the plant's operating point.
2. Select the parameter “**CAL**”.
First of all, the current cell constant “CF” is displayed.
3. Press and hold the rotary knob until the current conductivity value flashes on the display.
4. Set the reference value you previously established (conductivity from the reference sample) as the new display value.
5. Save your set value by pressing the rotary knob for approx. 1 second.

Bringing into service

Using the “Filt” feature



The aim of this feature is to “smooth” the 4-20 mA actual value output of the conductivity transmitter for use on the controller.

- The adjustable time constant (1-100 seconds) influences both the current output and the display of the conductivity transmitter.
- The filter time has been changed from 30 to 100 seconds (as of software version S-22).

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Select the parameter “**Filt**”.
First of all, the current filter constant is displayed.
2. Press and hold the rotary knob until the current value flashes on the display.
3. Set the desired value.
4. Save your set value by pressing the rotary knob for approx. 1 second.

Changing the scale of the 4-20 mA actual value output

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Select the parameter “**Sout**”.
2. Press and hold the rotary knob until the current value flashes on the display.
3. Set the desired value.

Choose from the following measuring ranges:

- LRGT 1x-3: see Fig. 17 (page 44)
- LRGT 16-4: see Fig. 18 (page 44)

4. Save your set value by pressing the rotary knob for approx. 1 second.

Bringing into service

Measuring ranges of the LRGT 1x-3 based on the setting of the “Sout” parameter

Conductivity measuring ranges/ actual value output	Measuring ranges ($\mu\text{S/cm}$ at 25 °C)	Current output (mA = $\mu\text{S/cm}$)	
Adjustable via the rotary knob on the operating panel. This setting may only be undertaken by the boiler manufacturer's service personnel or specialist personnel it has authorised. Maximum output load for actual value output = 500 ohm.		4 mA equals	20 mA equals
	0.5 - 20	0.5	20
	1.0 - 100	0.5	100
	2.0 - 200	0.5	200
	5.0 - 500	0.5	500
	10.0 - 1000	0.5	1000
	20.0 - 2000	0.5	2000
	60.0 - 6000	0.5	6000

Fig. 17



With the LRGT 1x-3, the lower measuring range is directly dependent on the setting of the “Sout” parameter. If the parameter is set too high or is still at the factory setting (500 μS), the error **E.002** may appear on the display if the conductivity of the fluid is low. If the actual value is less than 1% of the set upper limit of the measuring range (Sout), the error code above is displayed. Please reduce the Sout.

Measuring ranges of the LRGT 1x-4 based on the setting of the “Sout” parameter

Conductivity measuring ranges/ actual value output	Measuring ranges ($\mu\text{S/cm}$ at 25 °C)	Current output (mA = $\mu\text{S/cm}$)	
Adjustable via the rotary knob on the operating panel. This setting may only be undertaken by the boiler manufacturer's service personnel or specialist personnel it has authorised. Maximum output load for actual value output = 500 ohm.		4 mA equals	20 mA equals
	50-3000	50	3000
	50-5000	50	5000
	50-7000	50	7000
	50-9999	50	9999

Fig. 18



If the reading falls below the lower limit of the measuring range, the error code **E.002** appears on the display. Please check the conductivity of the fluid.

Bringing into service

Changing the display unit ($\mu\text{S}/\text{cm}$ or ppm)

You can choose between $\mu\text{S}/\text{cm}$ and ppm (parts per million) for the unit shown on the display.
The conversion for $\mu\text{S}/\text{cm}$ to ppm is: $1 \mu\text{S}/\text{cm} = 0.5 \text{ ppm}$

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Select the parameter **"Unit"**.
2. Press and hold the rotary knob until the current value flashes on the display.
3. Set the desired display unit (μS or ppm).

Viewing the set unit via the LEDs (see "Fig. 19" on page 48):

- **LED 3** (green) = $\mu\text{S}/\text{cm}$
 - **LED 4** (green) = ppm
4. Save your set value by pressing the rotary knob for approx. 1 second.

Manually initiating a display test

Pay attention to the setting instructions on page 38 / 40 and proceed as follows:

1. Select the parameter **"diSP"**.
2. Press and hold the rotary knob until the display test starts and **"...."** is shown.
3. The following numbers and decimal points run across the display from right to left:
"...., 1, 2, 3, 4, 5, 6, 7, 8, 9,"
4. Check that all numbers and decimal points are displayed correctly.
The display test runs automatically until it has finished, and cannot be interrupted.
5. The display test ends with **"donE"**.

Replacing faulty equipment



Faulty equipment jeopardises plant safety.

- If numbers or decimal points are displayed incorrectly or not at all, you must replace the conductivity transmitter with an identical one from GESTRA.

Bringing into service

Viewing the signal reserve “SGnL” (for LRGT 16-4 only)

Pay attention to the setting instructions on page 38 and proceed as follows:

1. Select the parameter “SGnL”.
2. The signal quality is shown in 0-100%. This continually decreases as the electrode tips become more soiled.



When the signal quality is < 10% (factory setting), the LCD shows the “Actual value” alternating with “SG.Lo”, see “System malfunctions” section on page 56.

Viewing the software version and equipment type “InFo”

Pay attention to the setting instructions on page 38 and proceed as follows:

1. Select the parameter “InFo”.
2. The display shows the software version “S-xx” alternating with “InFo”.

Then view the equipment type (see 3. and 4.) or quit the menu (see 5.):

3. Press and hold the rotary knob until the software version is continuously displayed.
4. Turn the rotary knob clockwise or anti-clockwise to view the equipment type.
5. You can quit the menu by pressing and holding (message “done”) or by waiting (message “quit”).

Enabling/disabling password protection

The default ex-works password cannot be changed

- The default password is “1902”.
- Password protection is available from software version S-18 onwards.

Pay attention to the setting instructions on page 38 and proceed as follows:

1. Select the parameter “PW”.
“PW” alternates with the current status, e.g. “oFF or on”, on the display.
2. Press and hold the rotary knob until “PASS” is displayed.
3. Release the rotary knob.
4. Next, press the rotary knob until “0000” appears and the right-hand digit flashes.
5. Enter the password “1902”. You can skip to the next flashing digit by briefly pressing the rotary knob.
6. After the final digit, press and hold the rotary knob until “done” is displayed.

Bringing into service

The following may appear on the display:

- **donE** The correct password was entered
- **FAiL** The wrong password was entered
- **quit** Timeout. Password entry has been aborted.

7. Release the rotary knob.

“PW” alternates with the current status, e.g. “**oFF or on**”, on the display.

8. Press the rotary knob again until “**oFF or on**” flash on the display.

9. Turn the rotary knob and set the desired status.

- **on** = password protection is enabled
- **oFF** = password protection is disabled

10. Press and hold the rotary knob until “**donE**” is displayed.

11. Release the rotary knob.

“PW” alternates with the set status, e.g. “**oFF or on**”.

12. You can quit the menu by waiting (message “**quit**”) or by turning the rotary knob to the actual value.

Note for bringing into service

After a new or clean conductivity electrode has been installed, set the parameter “**tC**” in line with the boiler water. Check the value of the cell constant “**CF**”, which should be 0.210.

Comparing the reading with the reference measurement of a reliable sample



ATTENTION



Incorrectly installed or bent conductivity electrodes result in a loss of function that can jeopardise plant safety.

Whenever the LRGT 1x-x conductivity electrode is brought into service or replaced, proceed as follows:

- Establish the current conductivity of the boiler water with the aid of a reference measurement of a controlled sample at the desired plant operating point.
- Compare the indicated reading with the current reference reading.
- Never start up any plant that has not passed the above conductivity check.
- If electrodes are new or have been cleaned and errors are detected, change parameter “**tC**” until the indicated reading matches the reference measurement. Also see the description of parameter “**tC**” on page 42.
- LRGT 1x-x conductivity transmitters may only be repaired by the manufacturer, GESTRA.
- Only replace faulty equipment with identical equipment from GESTRA.

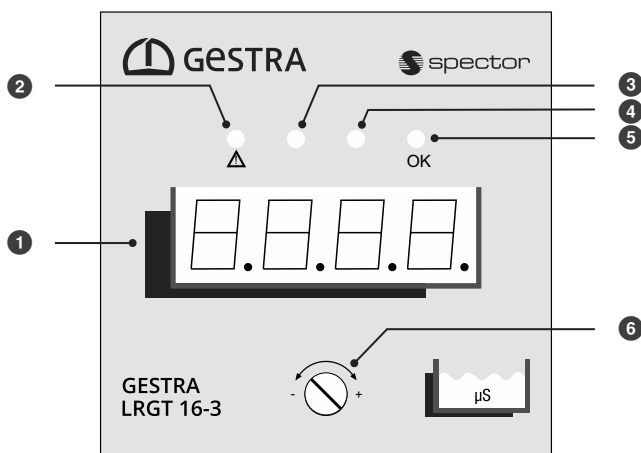


Fig. 19

The operating panel:

- ① Actual value display/error code/limit value, green, 4 digits
- ② LED 1, fault, red
- ③ LED 3, unit $\mu\text{S}/\text{cm}$, green
- ④ LED 4, unit ppm , green
- ⑤ LED 2, function OK, green
- ⑥ Rotary knob/pushbutton for operation and settings

Notes on the priority of the various indications



Fault indications are displayed based on their priority. Indications with higher priority are shown continuously before those with low priority. If several indications need attention, the display does not alternate between them.

Priority of error code display

Higher priority error codes overwrite lower ones on the display! See page 52 ff. for fault indications and the error code table.

Starting, operation and testing

Relationship between display and LEDs and the operating state of the conductivity transmitter:

Starting		
Switch on supply voltage	All LEDs light up - Test Indication: S-xx = software version t-09 = equipment type LRGT 1x-3 t-10 = equipment type LRGT 16-4	The system is started and tested. The LEDs and display are tested.

Normal operation		
The measuring electrodes of the conductivity transmitter are immersed	Indication: 1234	The momentary temperature-compensated conductivity is displayed
	LED 1: is Off	The set unit is displayed
	LED 3 or 4: lights up green	
	LED 2: flashes green	The unit performs a self-test *
	LED 2: lights up green	The self-test is complete - the unit is OK



* The reading is not updated during the self-test phase.

Behaviour in the event of a malfunction (error code display)		
The measuring electrodes of the conductivity transmitter are immersed or not immersed. There is a fault.	Indication: e.g. E005	An error code is displayed continuously, error code display see page 52
	LED 1: Alarm LED lights up red	There is an active fault
	LED 3 or 4: lights up green	The set unit is displayed
	LED 2: flashes green	The unit performs a self-test
	LED 2: is OFF	Fault or internal error
■ In the event of a fault or error state, an analogue value of 0 mA is displayed.		



Electrode faults cannot be acknowledged.

When a fault is corrected, the message disappears from the display, and the conductivity transmitter returns to normal operation.

See the following page for more information and tables.

Starting, operation and testing



When password protection is enabled, you must enter the password before running the test function.

Testing		
Checking the safety function via simulation in operating mode		
In operating mode: Press the rotary knob on the LRGT 1x-x and hold until the end of the test.	Indication: 9999	
	LED 1: Fault LED is OFF	Test function is active
	LED 3 or 4: lights up green	The set unit is displayed
	LED 2: flashes green	The unit performs a self-test
	LED 2: lights up green	Test function is active
■ 20 mA is output at the current output of the conductivity electrode. The downstream control can be checked based on the MAX alarm, for example. ■ When the rotary knob is released, the test ends.		



Faulty equipment jeopardises plant safety.

- If the conductivity transmitter does not behave as described above, the equipment may be faulty.
- Perform failure analysis.
- LRGT 1x-x conductivity transmitters may only be repaired by the manufacturer, GESTRA.
- Only replace faulty equipment with identical equipment from GESTRA.

System malfunctions

Causes

System malfunctions occur as the result of incorrect installation, overheating of equipment, radiated interference to the supply network, or faulty electronic components.

Check the installation and configuration before systematic troubleshooting

Installation:

- Check that the installation location complies with the admissible ambient conditions in terms of temperature, vibration, interference sources, minimum distances, etc.

Wiring:

- Does the wiring conform to the wiring diagrams?
- Does the 4-20 mA current loop have the correct polarity and is it closed?
- Is the 4-20 mA current loop below the overall output load of 500 Ω ?

ATTENTION



An open circuit in the 4-20 mA current loop can cause a system shutdown and a malfunction is indicated.

- Bring the system into a safe operating state before commencing work on the installation.
 - Switch off the voltage to the plant and secure so that it cannot be switched back on.
 - Check that the plant is not carrying live voltage before commencing work.
 - If the current loop is open or has reversed polarity, error E.013 is shown on the display.
-

System malfunctions

Indication of system malfunctions using error codes

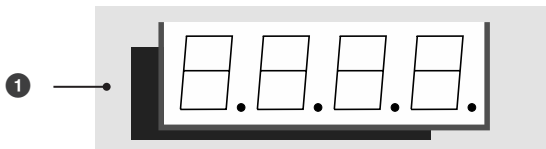


Fig. 20

1 Actual value display/error code/limit value, green, 4 digits

Error code table			
Error code	Internal designation	Possible errors	Remedy
E.001	LFKurzschlussErr	Short circuit in conductivity measurement (electrode wires)	Check the installation location. Have the minimum distances been adhered to? Is the electrode immersed? Are the electrode tips soiled? (LRGT16-4 in particular) > clean electrode tips Replace the conductivity transmitter
E.002	LFKabelbruchErr	Open circuit in conductivity measurement (electrode wires)	Check the installation location. Is the electrode immersed? Are the electrode tips soiled? (LRGT16-4 in particular) > clean electrode tips Is the "Sout" parameter correctly set? Replace the conductivity transmitter
E.003	Ch1Ch2LFDiffErr	Excessive difference between redundant conductivity measurement channels	Replace the conductivity transmitter
E.004	PtMinTempErr	Pt1000 below minimum temperature or short circuit	Check the installation location. Compare the measured temperature reading with the plant temperature via the menu item "°C.Pt". Replace the conductivity transmitter
E.005	PtMaxtempErr	Pt1000 above maximum temperature or open circuit	Check the installation location. Compare the measured temperature reading with the plant temperature via the menu item "°C.Pt". Replace the conductivity transmitter
E.006	Ch1Ch2PtDiffErr	Excessive difference in redundant Pt1000 measurement	Replace the conductivity transmitter

System malfunctions

Error code table			
Error code	Internal designation	Possible errors	Remedy
E.007	USIGTSTErr	Test signal measuring voltage outside tolerance	Replace the conductivity transmitter
E.008	ISIGTSTErr	Test signal measuring current outside tolerance	Replace the conductivity transmitter
E.009	ADCTSTErr	Pt1000 test measuring voltage outside tolerance	Replace the conductivity transmitter
E.010	ICONErr	Pt1000 test measuring current outside tolerance	Replace the conductivity transmitter
E.011	ADVTSTErr	Comparison between 12-bit/16-bit A/D converter outside tolerance	Check the installation location. Is the electrode immersed? Are the electrode tips soiled? (LRGT16-4 in particular) > clean electrode tips
E.012	FREQTSTErr	Test signal frequency outside tolerance	Replace the conductivity transmitter
E.013	VMessErr	Control voltage of 4-20 mA output (LRGT models only)	Is the current loop open or does it have reversed polarity? Check the pin assignment of the M12 connector. Check the current signal with a multimeter.
E.014	ADSReadErr	16-bit A/D converter does not respond	Replace the conductivity transmitter
E.015	UnCalibErr	Calibration invalid	The electrode is not calibrated and must be recalibrated by the manufacturer Contact the Service department.
E.017	ENDRVErr	Second shutdown path of 4-20 mA analogue output faulty	Replace the conductivity transmitter
E.018	V12NegErr	System voltage -12 V outside limits	Replace the conductivity transmitter
E.019	V6Err	System voltage 6 V outside limits	Replace the conductivity transmitter
E.020	V5Err	System voltage 5 V outside limits	Replace the conductivity transmitter
E.021	V3Err	System voltage 3 V outside limits	Replace the conductivity transmitter
E.022	V1Err	System voltage 1 V outside limits	Replace the conductivity transmitter

System malfunctions

Error code table			
Error code	Internal designation	Possible errors	Remedy
E.023	V12Err	System voltage 12 V outside limits	Replace the conductivity transmitter
E.024	CANErr	Communication error (not LRGT models)	Check the baud rate, wiring and terminating resistors
E.025	ESMG1Err	µC error	Replace the conductivity transmitter
E.026	BISTErr	µC periphery self-test error	Replace the conductivity transmitter
E.027	OvertempErr	PCB/ambient temperature > 75 °C	Check the installation location. Lower the ambient temperature of the terminal box (cool if necessary)

Error code E.016 is just a reserve and is not documented.



Virtually all of the aforementioned error codes can be caused by EMC interference. This is less likely to be the case for permanent errors, but should be considered for sporadic error codes.



In this case, check that the installation shielding is correctly wired, and check the general EMC conditions before replacing the electrode.

System malfunctions

Faults that do not provoke a shutdown

The indicated conductivity fluctuates, moisture in the area of the electrode sheath	
Possible causes if no error codes are shown	Remedy
Moisture is entering the sheath from the outside.	■ Check the installation location for possible water leaks where water/water vapour could get into the conductivity electrode. ■ Check the conductivity transmitter for leaks. ■ Has the electrode been correctly insulated to prevent leakage? ■ Replace the conductivity transmitter with an identical unit from GESTRA.
The inner seals of the electrode rods are damaged.	■ Replace the conductivity transmitter with an identical unit from GESTRA.

The indicated conductivity very occasionally but repeatedly shows extreme values.	
Possible causes if no error codes are shown	Remedy
Electrode rods are not continuously immersed.	■ Check that the installation conforms to this Manual. ■ Pay attention to the installation examples and stated minimum distances.

Flashing values from t-71 to t-75 appear on the display	
Possible causes	Remedy
The ambient temperature of the electrode terminal box is high, between 71 °C and 75 °C. If the temperature rises above 75 °C, the error code E.027 (OvertempErr) appears and the current output delivers 0 mA.	■ Reduce the ambient temperature around the terminal box, e.g. by cooling. ■ Check the temperature via the menu item "°C.in".

The code "CF.Hi" flashes on the display	
Possible causes	Remedy
The cell constant is excessively high after the "CAL" calibration process or manual readjustment LRGT 1x-x CF > 3.0	■ Remove the conductivity transmitter, see page 57. ■ Check and clean the electrode, see page 58

System malfunctions

The code “SG.Lo” flashes on the display

Possible causes if no error codes are shown	Remedy
The measurement signal is low and below the defined limit (factory setting: 10%).	■ Remove the conductivity transmitter, see page 57 ■ Check and clean the electrode, see page 58 ■ LRGT16-4 only Check the signal quality using the menu item “SGnL” after cleaning and re-installing the electrode.

Checking installation and function

When you have remedied system malfunctions, perform a function test as follows.

- Check installation and function.
- Check the indicated reading and perform an equipment test, see page 50, when bringing into service and whenever a LRGT 1x-x conductivity transmitter has been replaced.



System malfunctions in LRGT 1x-x conductivity transmitters result in an output of 0 mA at the analogue output.

If you require assistance, please tell us the indicated error code.



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.

Taking out of service/Disassembly

DANGER



Danger to life from scalding caused by the sudden escape of hot steam.

Hot steam or water can escape suddenly if the conductivity electrode is unscrewed under pressure.

- Reduce the boiler pressure to 0 bar and check the pressure before you unscrew the conductivity electrode.
- Only remove the conductivity electrode at a boiler pressure of 0 bar.

WARNING



The hot conductivity electrode can cause severe burns.

The conductivity electrode becomes extremely hot during operation.

- Perform installation and maintenance work only when the conductivity electrode has been allowed to cool.
- Only remove conductivity electrodes that have cooled down.

Proceed as follows:

1. Reduce the boiler pressure to 0 bar.
2. Allow the conductivity electrode to cool to room temperature.
3. Switch off the supply voltage.
4. Detach the plug-in connection (M12 connector).
5. Next, remove the conductivity electrode.



If the terminal box needs to be rotated by **>180°** in relation to the electrode, proceed as described on pages 28 to 30 and detach the terminal box from the electrode.

Cleaning the measuring electrodes of the conductivity transmitter

Monthly comparison of readings

In accordance with the recommendations from standards EN 12952/12953 for the monitoring of equipment to protect water quality, readings must be compared with reliable samples once a month by a qualified specialist.

In the event of discrepancies, the conductivity transmitter must be calibrated using the “**CAL**” function, see page 42.

Cleaning interval

We recommend cleaning the electrode once a year or more, depending on the operating conditions, e.g. during maintenance work.



Before cleaning the electrode rod(s), take the conductivity transmitter out of service and remove it, see page 57.

LRGT 16-3, LRGT 17-3

1. Slacken the threaded pin **I** and manually unscrew the measuring tube **J**.
2. Clean the electrode rod and measuring surface.
3. Wipe off loose deposits with a grease-free cloth.
Scrub off stubborn deposits using sandpaper (medium grain).
4. Next, screw the measuring tube **J** back on and secure it with the threaded pin **I** *.

LRGT 16-4

1. Clean the measuring electrodes **J** *.
2. Wipe off loose deposits with a grease-free cloth.
Scrub off stubborn deposits using sandpaper (medium grain).

Move on to the points below:

* **I** / **J** = key to overall view, see page 21

LRGT 16-3, LRGT 17-3, LRGT 16-4

1. Fit the clean conductivity transmitter as described on page 25.
2. Switch on the supply voltage.
3. Bring the equipment or system into service, see page 37.
4. Compare the reading with the conductivity directly established from a reference measurement, see page 47.
5. Check the equipment using the test function of the conductivity transmitter, see page 50.

Disposal

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

Returning decontaminated equipment

If products have come into contact with media that are hazardous to health, they must be drained and decontaminated before being returned to GESTRA.

Such media include solid, liquid or gaseous substances, mixtures of these, or radiation.

GESTRA can accept returned products only if accompanied by a completed and signed return note and also a completed and signed declaration of decontamination.



The return confirmation and declaration of decontamination must be attached to the returned goods and be accessible from the outside. Otherwise, the goods cannot be dealt with and will be returned, carriage unpaid.

Please proceed as follows:

1. Let GESTRA know about the return beforehand by e-mail or phone.
2. Wait until you have received the return confirmation from GESTRA.
3. Fill out the return confirmation (and declaration of decontamination) and send it with the products to GESTRA.

Declaration of Conformity; Standards and Directives

You can find details on the conformity of the equipment and the applicable standards and directives in the Declaration of Conformity as well as relevant certificates and approvals.

You can download the latest version of the Declaration of Conformity from www.gestra.com and request relevant certificates and approvals by writing to the following address:

GESTRA GmbH

Münchener Straße 77

28215 Bremen

Germany

Tel. +49 421 3503 0

Fax +49 421 3503 393

E-mail info@de.gestra.com

Website www.gestra.com

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



You can find our authorised agents around the world at:

www.gestra.com

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