GESTRA®

Conductivity Transmitter

LRGT 16-3n
LRGT 16-4n
LRGT 17-3n

EN
English

Original Installation &
Operating Manual
850878-01

Contents

Contents

Content of this Manual

Product:

- Conductivity transmitter LRGT 16-3n
- Conductivity transmitter LRGT 16-4n
- Conductivity transmitter LRGT 17-3n

First edition:

BAN 850878-00/05-2022cm

Scope of delivery/Product package

- 1 x conductivity transmitter LRGT 1x-xn
- 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 16-3n, LRGT 17-3n and LRGT 16-4n when installing for the first time

- 1 x cable jack, Phoenix Contact SACC-M12FS-5PL-SH

How to use this Manual

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

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

Availability of this Installation & Operating Manual

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

Illustrations and symbols used

1. Action to be taken
2.

- Lists
  - ◆ Bullet points in lists

Ⓐ Keys to illustrations

Additional information

Read the relevant Installation & Operating Manual

Hazard symbols in this Manual

Danger zone / Dangerous situation

Types of warning

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ ATTENTION

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

Specialist terms / Abbreviations

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

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

Equipment and type designations of GESTRA AG.

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 pressurised steam boiler, for example, these parameters would be output, capacity, pressure and temperature.

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

A boiler that is operated at 10 bar and 180 °C may be designed for a pressure of 60 bar and a temperature of 275 °C, for example, which is not necessarily its operating point.

Usage for the intended purpose

LRGT 16-3n, LRGT 16-4n and LRGT 17-3n conductivity transmitters can be used as conductivity limiters and continuous blowdown controllers to continually monitor conductivity in steam boiler 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 4-20 mA actual value output 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 plants.
- The equipment may only be used within the admissible pressure and temperature ratings, see "Technical data" on page 13 and "Example name plate/identification" on page 16.

Usage for the intended purpose

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 proper use in all applications, 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: http://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 information

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 **0 bar boiler pressure**.

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 the conductivity electrode 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 system before performing connection work.
- Check that the system is not carrying live voltage before commencing work.

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

Shocks and impacts during transport or installation can result in damage to or leaks in 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 lead to non-availability of the system.

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

Basic safety information

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

- Once a year, check the conductivity electrode by performing reference 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 52.

Required personnel qualifications

Activity	Personnel	
Integration in control system	Specialist staff	Plant designer
Installation/electrical connection/bringing into service	Specialist staff	The equipment may only be installed, wired and brought into service by qualified and competent staff.
Operation	Boiler service technician	Staff trained by the plant operator.
Maintenance work	Specialist staff	Maintenance and conversions 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

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

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 16-3n and LRGT 17-3n

LRGT 16-3n and LRGT 17-3n 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 16-4n

The LRGT 16-4n 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 an ambient 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.

These transmitters do 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

Display and signals, see page 43 / 47 *

LRGT 1x-xn 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 40, Sout parameter). When you select an appropriate measuring range, you can expect plausible measurement signals immediately after installation.

Behaviour in the event of malfunctions *

The error state or malfunction is shown on the display by an error code, e.g. E.005. For more on error codes, see page 47 / 48.

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

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.

Electrode faults cannot be acknowledged.

When a fault is corrected, the message disappears from the display, and the LRGT 16-3n, LRGT 17-3n or LRGT 16-4n 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-xn 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 43 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 conditions at the plant. You can set parameters and change factory settings using a rotary knob on the terminal box, see page 36 ff.

Technical data

Model and mechanical connection

■ LRGT 16-3n, LRGT 16-4n, LRGT 17-3n	Thread G1 A, EN ISO 228-1, see Fig. 6, 7 and 8

Nominal pressure rating, admissible service pressure and temperature

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

Materials

■ Terminal box	3.2581 G AlSi12, powder-coated
■ Cover tube	1.4301 X5 CrNi 18-10
■ Measuring electrodes	1.4571 X6CrNiMoTi17-12-2
■ Electrode insulation	PTFE
■ Screw-in body:	
◆ Measuring tube/screw of LRGT 16-3n, LRGT 17-3n	1.4571, X6CrNiMoTi17-12-2
◆ Spacer disc of LRGT 16-3n, LRGT 16-4n, LRGT 17-3n	PEEK

Available electrode lengths (do not shorten)

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

Temperature sensor

■ Resistance thermometer	Pt1000
■ Fluid temperature measuring range	0 to 280 °C

Conductivity range at 25 °C

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

■ for 1 second

Technical data

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

- **LRGT 1x-3n**

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

- **LRGT 16-4n**

Resolution for internal processing *		**Measurement error**	**Linearity error**
◆ Range 1:	10 µS - 100 µS	2%	2%
◆ Range 2:	100 µS - 2000 µS	2%	1.5%
◆ Range 3:	2000 µS - 50000 µS	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 16-3n, LRGT 17-3n	9 seconds	14 seconds
■ LRGT 16-4n	11 seconds	19 seconds

Temperature compensation

- The temperature compensation process is linear and can be set via parameter tC, see page 39.

Supply voltage

- 24 V DC +/-20%

Power consumption

- Max. 7 W

Current input

- Max. 0.35 A

Internal fuse

- T2A (slow blow)

Safety cutout at excessive ambient temperature

- The cutout takes place at an excessive ambient temperature of Tamb. = 75 °C

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 µS/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 16-3n, LRGT 16-4n, LRGT 17-3n approx. 2.1 kg

Example name plate/identification

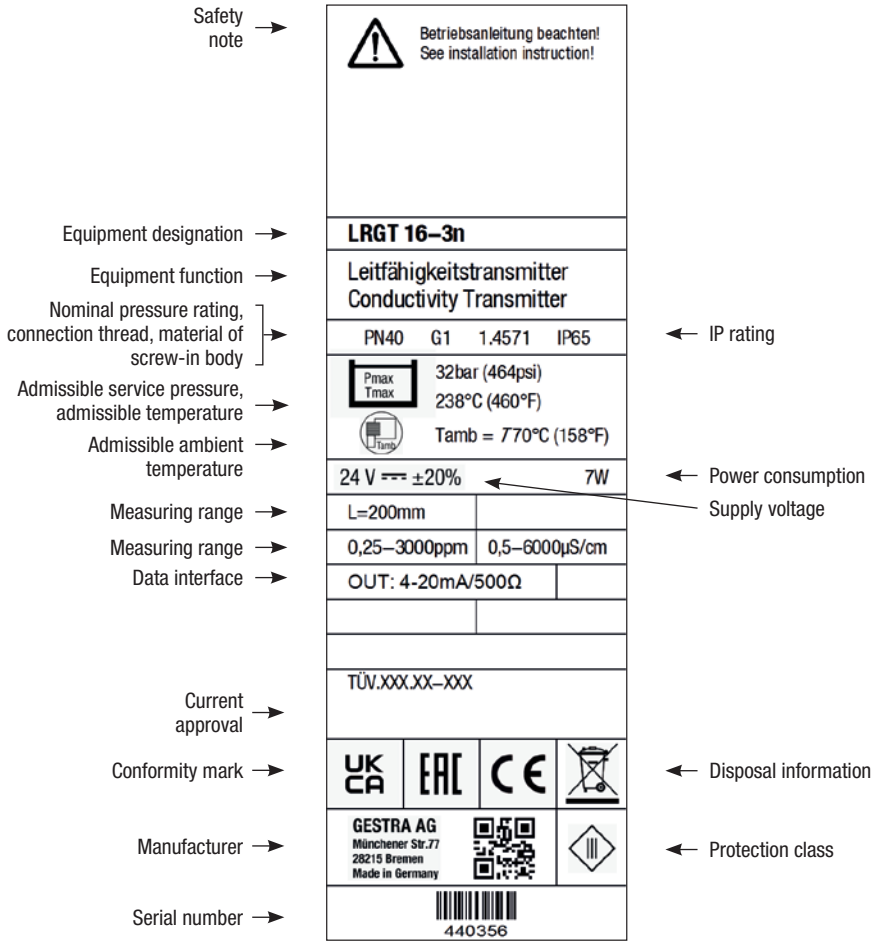


Fig. 2

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

Example name plate/identification

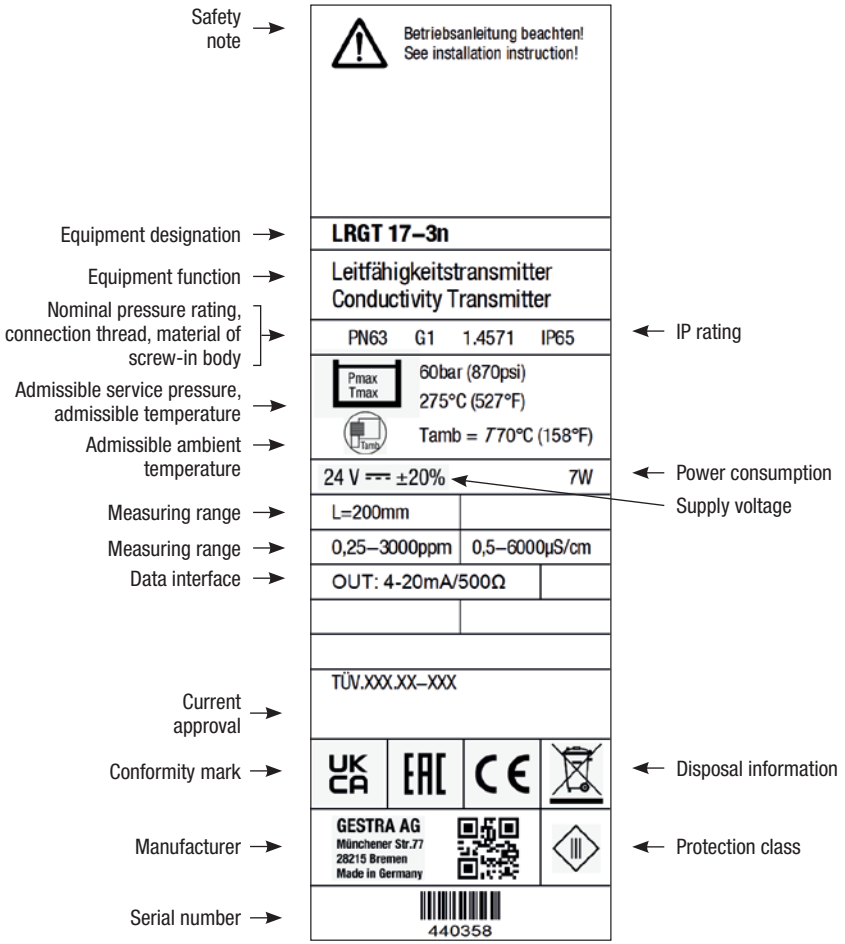


Fig. 3

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

Example name plate/identification

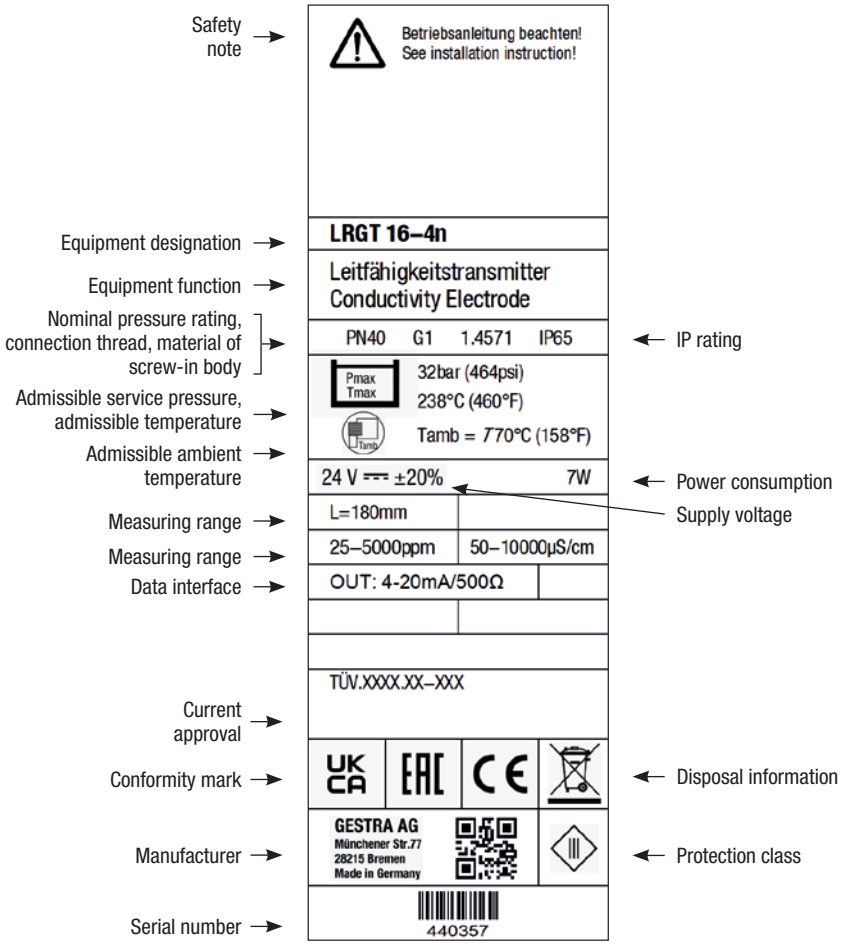


Fig. 3

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

Factory settings

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

Parameter	Menu display	Unit	Parameter values	
			LRGT 16-3n LRGT 17-3n	LRGT 16-4n
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	

Fig. 4

Measuring ranges of the LRGT 1x-3n based on the setting of the "Sout" parameter

Conductivity measuring ranges/ actual value output	Measuring ranges (µS/cm at 25 °C)	Current output (mA = µS/cm)	
Set via the rotary knob on the operating panel by the boiler manufacturer service or by specialist personnel authorised by the boiler manufacturer. Maximum output load for actual value output: 500 ohms.		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

With the LRGT 1x-3n, 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. Please check the parameter and adjust it if necessary.

Overall view

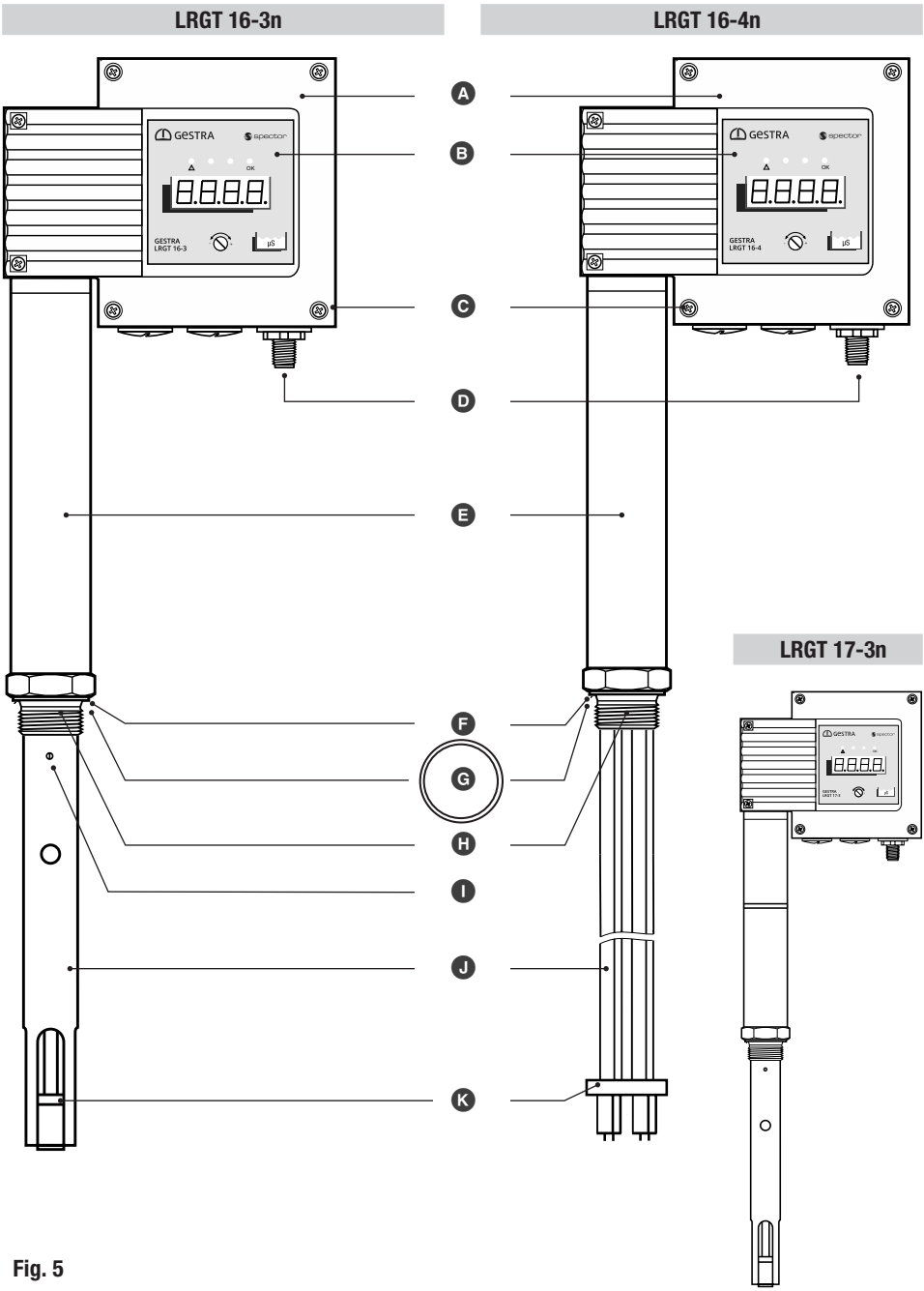


Fig. 5

Overall view

Key to Fig. 5

- Ⓐ Terminal box
- Ⓑ Operating panel with 4-digit LCD, alarm LEDs and rotary knob, see page 43
- Ⓒ Cover screws M4 x 16 mm
- Ⓓ M12 connector, 5-pole, A-coded
- Ⓔ Cover tube
- Ⓕ Seal seat for sealing ring
- Ⓖ Sealing ring D 33 x 39, form D, DIN 7603-2.4068, bright annealed
- Ⓗ Electrode thread
- Ⓘ Threaded pin M2.5 mm (LRGT 16-3n, LRGT 17-3n)
- Ⓙ Measuring tube with measuring electrode (LRGT 16-3n, LRGT 17-3n), measuring electrodes (LRGT 16-4n)
- Ⓚ Spacer disc

Dimensions of the LRGT 16-3n

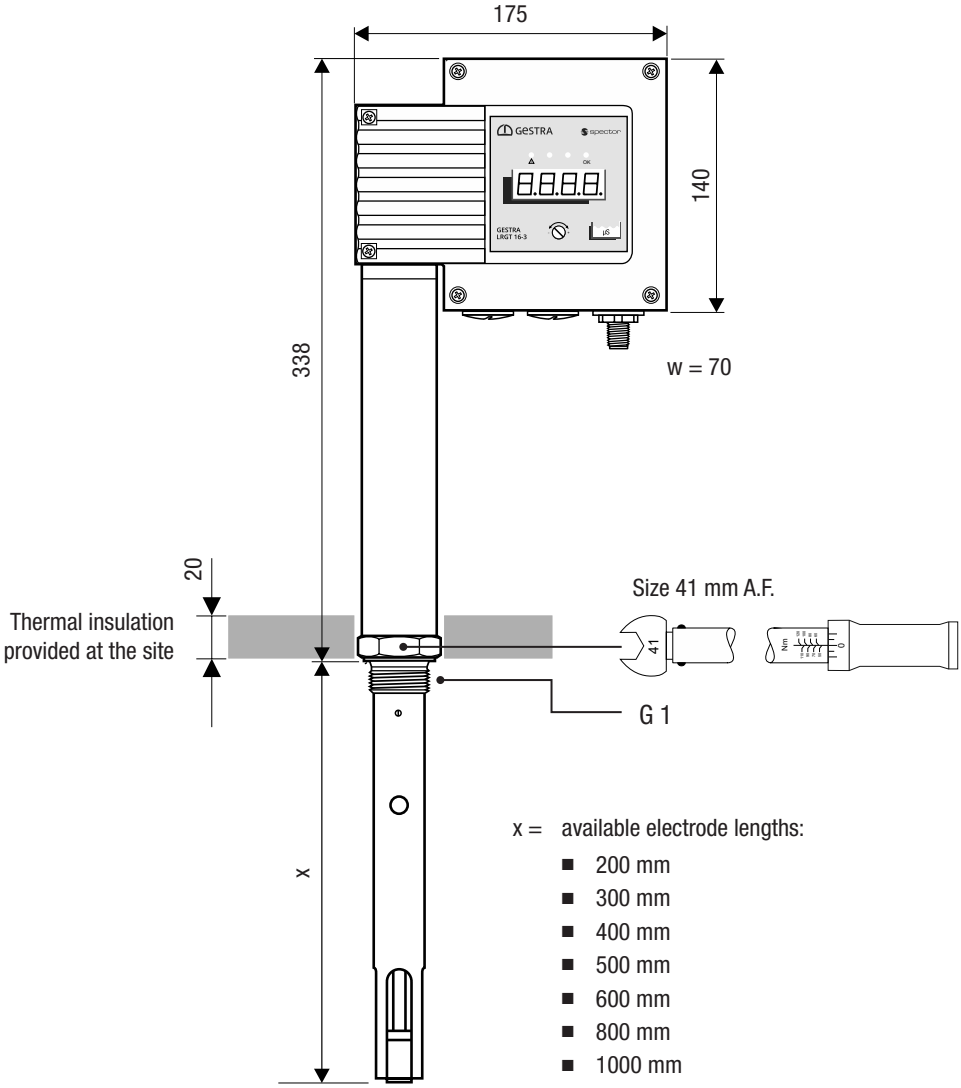


Fig. 6 All lengths and diameters in mm

Dimensions of the LRGT 16-4n

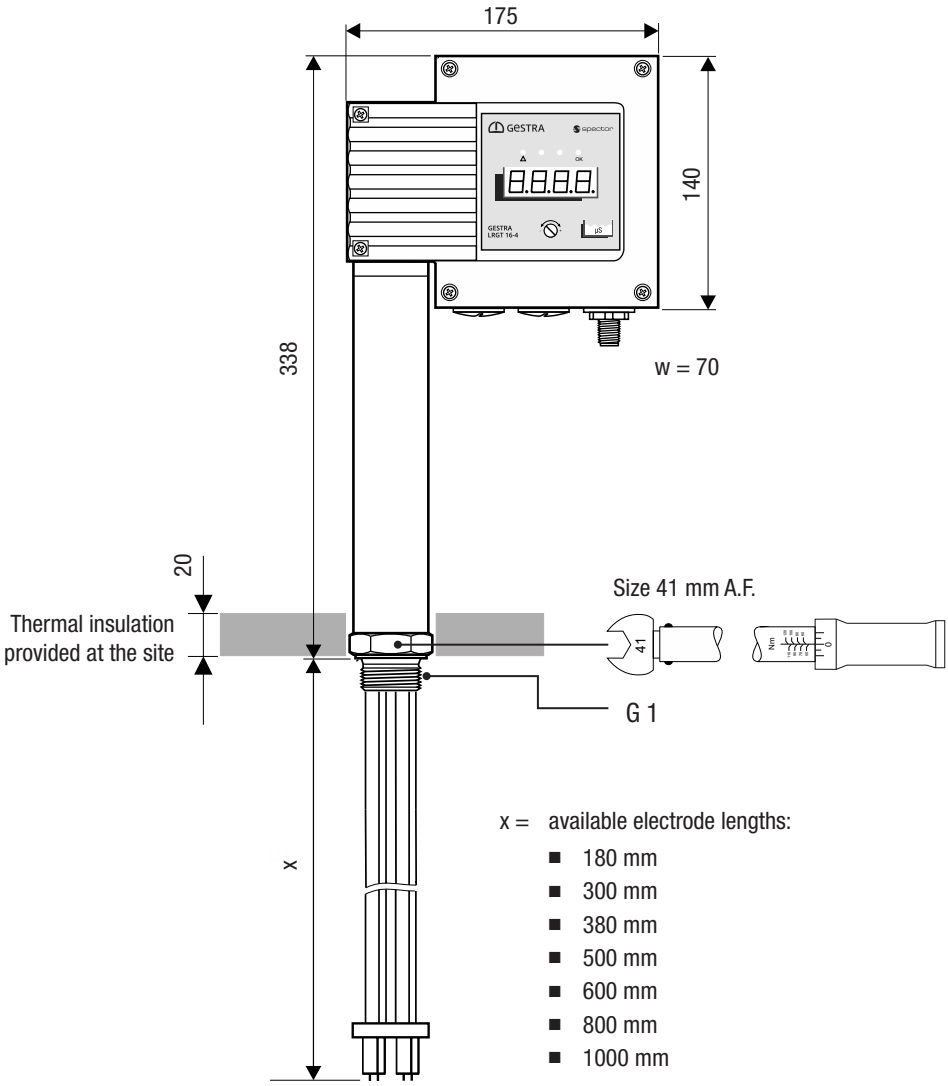


Fig. 7 All lengths and diameters in mm

Dimensions of the LRGT 17-3n

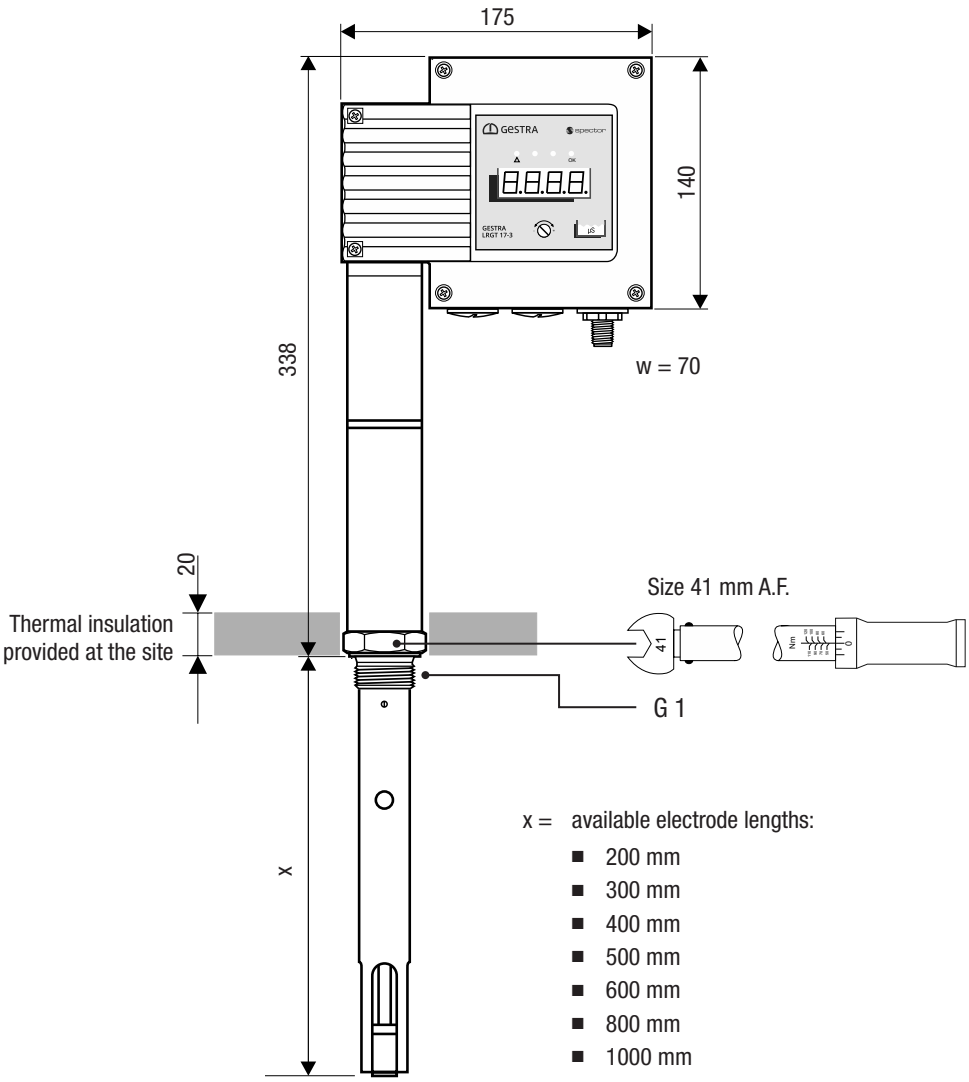


Fig. 8 All lengths and diameters in mm

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 15.
- Do not operate the equipment if the temperature is below freezing.
  - ◆ At temperatures below freezing, use a suitable heat source (e.g. control cabinet heater, etc.).
- Connect all parts of the system 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 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 hot water can escape suddenly if the conductivity electrode is unscrewed while 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.

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 system 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 measuring electrodes to hard impacts during installation.
- Do **not** install the body Ⓐ or cover tube Ⓔ of the measuring electrode in the boiler thermal insulation!
- Pay attention to the mounting dimensions of the conductivity electrode, see installation examples on pages 29 to 32.
- 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.

- 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.

Therefore, always adhere to the distances stated below.

LRGT 16-3n, LRGT 17-3n

- 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 16-4n

- Provide spacing of approx. 60 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).

1. Inspect the sealing surfaces of the tank standpipe or flange cover.

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

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

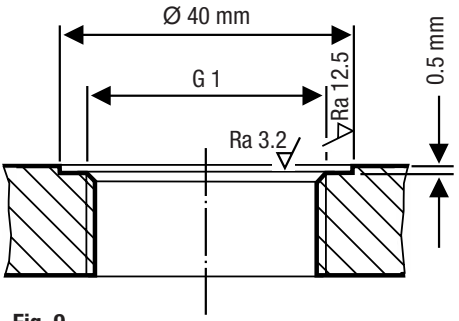


Fig. 9

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

Example LRGT 16-3n

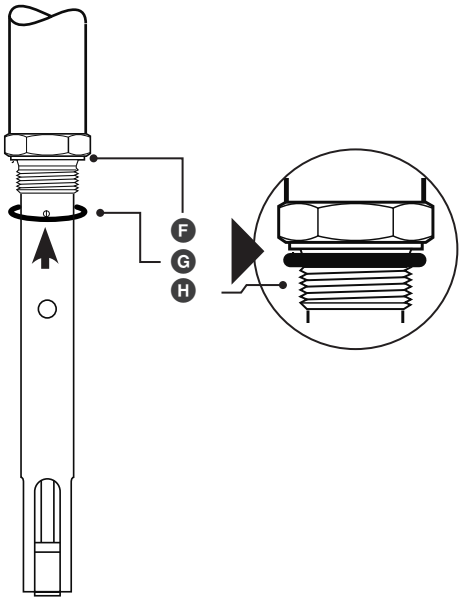


Fig. 10

⚠ 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 Ⓗ.
  - **Sealing ring D 33 x 39** DIN 7603-2.4068, bright annealed

Prohibited seal materials:

- Hemp, PTFE tape
- Conductive paste or grease

3. If necessary, apply a small quantity of ⓗ silicone grease (e.g. Molykote® III) 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 16-3n, LRGT 16-4n, LRGT 17-3n = 250 Nm

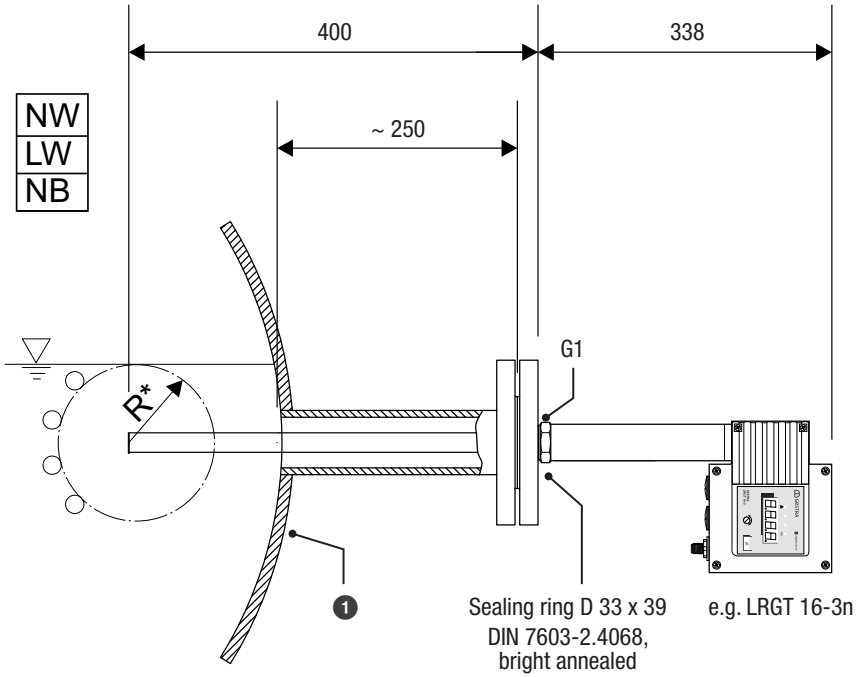
Installation examples with dimensions, see Fig. 11, Fig. 12, Fig. 13 29

Installation examples with dimensions

Conductivity measurement

Installing conductivity transmitters via a flange on the side.

Key, see page 32



*** Minimum distances (R)**

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

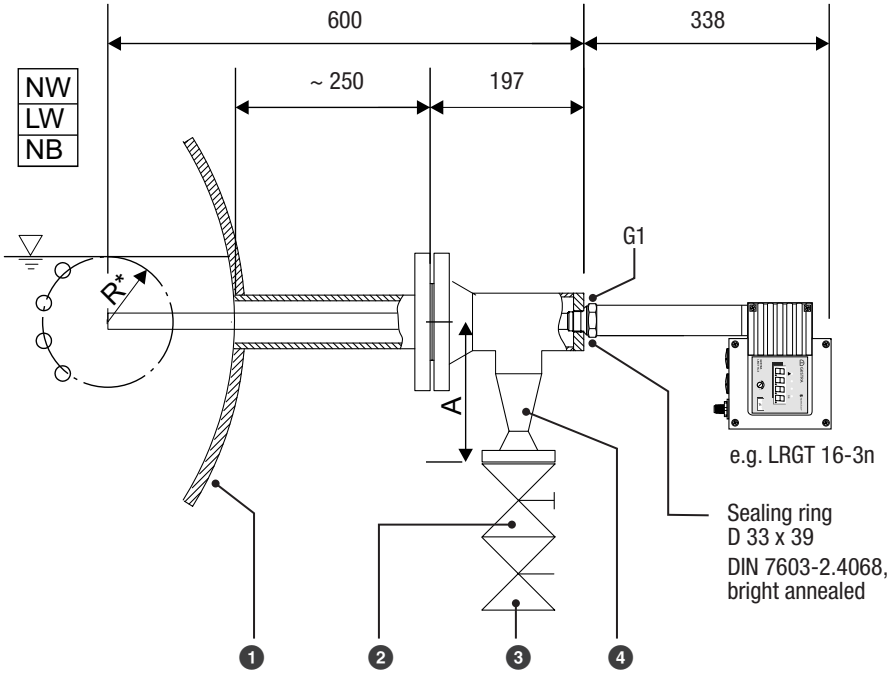
Fig. 11 All lengths and diameters in mm

Installation examples with dimensions

Conductivity monitoring and continuous blowdown control

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

Key, see page 32



*** Minimum distances (R):**

- LRGT 16-3n / LRGT 17-3n R = 30 mm
- LRGT 16-4n 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. 12 All lengths and diameters in mm

Installation examples with dimensions

Conductivity monitoring and continuous blowdown control via a separate level pot

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

Key, see page 32

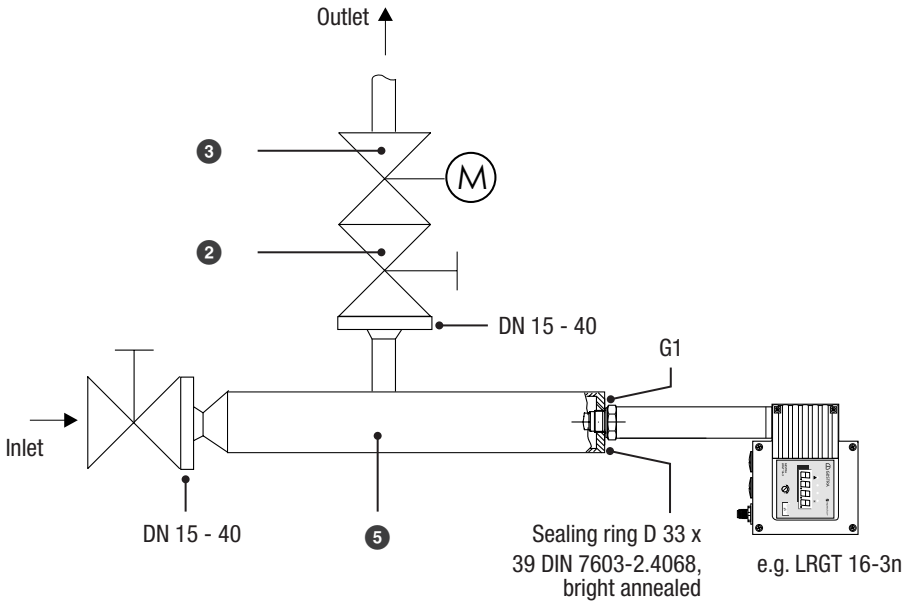


Fig. 13 All lengths and diameters in mm

Installation examples with dimensions

Key Fig. 11 to Fig. 13

1. Boiler drum
2. Stop valve GAV
3. Continuous blowdown valve BAE
4. T-type connector
5. 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 ≥ 180° will damage the conductivity transmitter's internal wiring.

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

Functional elements

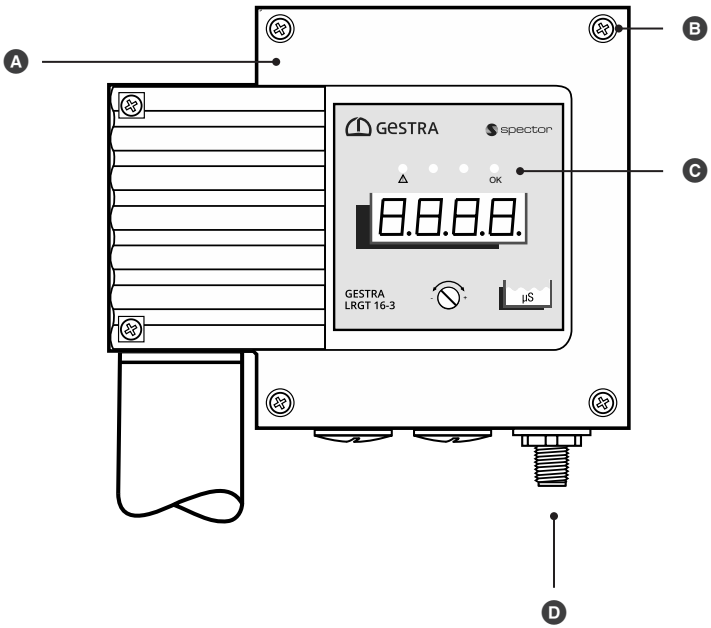


Fig. 14

- **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 43
- **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 plug and coupling) are available as accessories in various lengths.

Connecting the 24 V DC power supply

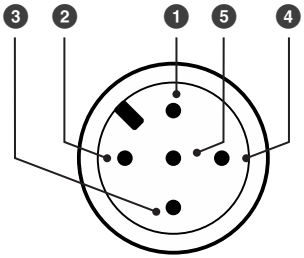
- LRGT 16-3n, LRGT 17-3n and LRGT 16-4n conductivity transmitters are supplied with 24 V DC.
- A safety power supply unit that delivers a Safety Extra Low Voltage (SELV) and is isolated from connected loads must be used to supply the equipment with 24 V DC.

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.



Connector

1	S	Shield
2	+ 24 V	Power supply
3	– 0 V	Power supply
4	+ 20 mA	Data line
5	– 20 mA	Data line

Fig. 15

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

- Slotted screwdriver, size 2.5

Notes for 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 µS = 20 mA for the LRGT 1x-3n and 7000 µS = 20 mA for the LRGT 16-4n.

After installation, first change the scale to suitable values for your specific system.

With the LRGT 1x-3n conductivity transmitter, the lower end of the measuring range depends upon the set Sout range (see table).

Conductivity measuring ranges/ actual value output	Measuring ranges (µS/cm at 25 °C)	Current output (mA = µS/cm)	
Set via the rotary knob on the operating panel by the boiler manufacturer service or by specialist personnel authorised by the boiler manufacturer. Maximum output load for actual value output: 500 ohms.		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

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 one after the other:

1234 ➞ °C.in ➞ °C.Pt ➞ CF ➞ tC ➞ CAL ➞ FiLt ➞ Sout ➞ Unit ➞ diSP

Key to parameters, see page 37.

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 the current value of this parameter flashes on the display.

3. 

Set the desired value.

- / + reduce/increase the value

Each parameter has an individual, admissible value range.

By pressing the knob briefly, you can jump 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.

4. 

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.

Key to parameters:

- 1234 = actual value display (normal operating state, example)
- °C.in = display ambient temperature of terminal box
- °C.Pt = display temperature of measured fluid
- CF = cell constant of electrode
- tC = temperature coefficient of measured 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

Display test

An initial display test takes place for 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 parameter is selected, the one-off display test opens a 10-minute time window, during which time several parameters can be entered without the display test having to be repeated when the next parameter is selected.

Replacing faulty equipment

Faulty equipment is a risk to system availability.

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

Manually initiate a display test.

Alternatively, initiate the display test by pressing "**diSP**", see page 41.

Bringing into service

Changing the cell constant

Notes on calibrating the cell constant

The cell constant of the LRGT 1x-xn conductivity transmitters is precisely set at the factory. If recalibration is necessary at the installation site due to the conditions there, (see page 42, 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 on site in line with a reference reading from a reliable sample.

Alternatively, you can perform recalibration using the convenient "**CAL**" function, see page 39.

Pay attention to the setting instructions on page 36 / 37 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 become lower 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 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 36 / 37 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 setting by pressing the rotary knob for approx. 1 second.

Raising the “tC” value 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 requires cleaning, see page 52.
- Continued operation is possible.

Pay attention to the setting instructions on page 36 / 37 and proceed as follows:

1. Using a reliable sample, establish a reference reading of the current conductivity at the system’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 setting 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 - 30 seconds) influences both the current output and the display of the conductivity transmitter.

Pay attention to the setting instructions on page 36 / 37 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 setting 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 36 / 37 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-3n: 0.5 - 20, 100, 200, 500, 1000, 2000 or 6000 µS/cm
   - LRGT 16-4n: 50 - 3000, 5000, 7000 or 9999 µS/cm
4. Save your setting by pressing the rotary knob for approx. 1 second.

Bringing into service

Changing the display unit (µS/cm or ppm)

You can choose between µS/cm and ppm (parts per million) for the unit shown on the display.

The conversion for µS/cm to ppm is: 1 µS/cm = 0.5 ppm

Pay attention to the setting instructions on page 36 / 37 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. 16" on page 43):

   - **LED 3** (green) = µS/cm
   - **LED 4** (green) = ppm
4. Save your setting by pressing the rotary knob for approx. 1 second.

Manually initiating a display test

Pay attention to the setting instructions on page 36 / 37 and proceed as follows:

1. Select the parameter "**diSP**".
2. Press and hold the rotary knob until the display test starts and shows "**....**".
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 is a risk to system availability.

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

Bringing into service

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 reading from a reliable sample

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

Whenever the LRGT 1x-xn 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 reading from a controlled sample at the desired system operating point.
- Compare the indicated reading with the current reference reading.
- Never start up any system that has not passed a conductivity value check.
- If electrodes are new or have been cleaned and errors are detected, change parameter "**tC**" until the indicated reading matches the reference reading. Also see the description of parameter "**tC**" on page 39.
- LRGT 1x-xn conductivity transmitters may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

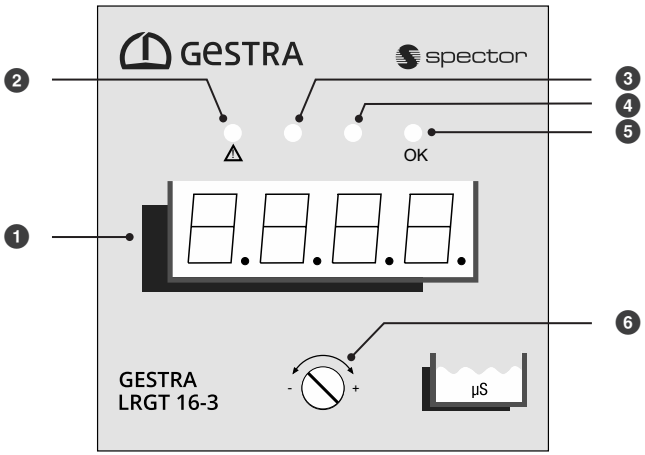


Fig. 16

The operating panel:

1. Actual value display/error code/limit value, green, 4 digits
2. LED 1, fault, red
3. LED 3, unit µS/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 47 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 the supply voltage	All LEDs light up - Test **Display:** S-xx = software version t-09 = equipment type LRGT 1x-3n t-10 = equipment type LRGT 16-4n	The system is started and tested. The LEDs and display are tested.

Normal operation		
The measuring electrodes of the conductivity transmitter are immersed	**Display:** 1234 **LED 1:** is Off **LED 3 or 4**: lights up green	Display of momentary temperature-compensated conductivity Display of set unit
	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.	**Display:** e.g. E005 **LED 1**: Alarm LED lights up red	An error code is permanently displayed, error code display see page 47 There is an active fault
	LED 3 or 4: lights up green	Display of set unit
	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.

<table>
<tr><th colspan="3">Test</th></tr>
<tr><th colspan="3">Checking function via simulation in operating mode</th></tr>
<tr><td rowspan="5">In operating mode:
Press the rotary knob on the LRGT 1x-xn and hold until the end of the test.</td><td>Display:
9999
LED 1:
Fault LED is OFF</td><td>Test function is active</td></tr>
<tr><td>LED 3 or 4: lights up green</td><td>Display of set unit</td></tr>
<tr><td>LED 2: flashes green</td><td>The unit performs a self-test</td></tr>
<tr><td>LED 2: lights up green</td><td>Test function is active</td></tr>
<tr><td colspan="2">■ 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.</td></tr>
</table>

Faulty equipment is a risk to system availability.

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

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 system and secure so that it cannot be switched back on.
- Check that the system 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

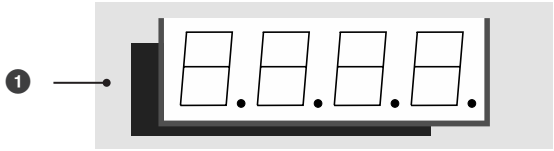


Fig. 17 ❶ Actual value display/error code/limit value, green, 4 digits

Error code table			
Error code	**Internal designation**	**Possible errors**	**Remedy**
E.001	LFKurzschlussErr (CondShortCircuitErr)	Short circuit in conductivity measurement (electrode wires)	Check installation location. Have the required minimum distances been complied with? Replace the conductivity transmitter
E.002	LFKabelbruchErr (CondOpenCircuitErr)	Open circuit in conductivity measurement (electrode wires)	Check installation location. Is the electrode immersed? 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 installation location. Via the menu item "°C.Pt", compare the measured temperature reading with the system temperature. Replace the conductivity transmitter
E.005	PtMaxtempErr	Pt1000 above maximum temperature or open circuit	Check installation location. Via the menu item "°C.Pt", compare the measured temperature reading with the system temperature. Replace the conductivity transmitter
E.006	Ch1Ch2PtDiffErr	Excessive difference from redundant Pt1000 measurement	Replace the conductivity transmitter
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 AD converter outside tolerance	Is the electrode immersed? Has the measuring range been scaled correctly via the Sout parameter? Are the sensor tips soiled? (4-rod electrode, in particular) Remedy: Clean the sensor tips. Replace the conductivity transmitter

System malfunctions

Error code table			
Error code	**Internal designation**	**Possible errors**	**Remedy**
E.012	FREQTSTErr	Test signal frequency outside tolerance	Replace the conductivity transmitter
E.013	VMessErr (VMeasErr)	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 AD converter is not responding	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 tolerance	Replace the conductivity transmitter
E.019	V6Err	System voltage 6 V outside tolerance	Replace the conductivity transmitter
E.020	V5Err	System voltage 5 V outside tolerance	Replace the conductivity transmitter
E.021	V3Err	System voltage 3 V outside tolerance	Replace the conductivity transmitter
E.022	V1Err	System voltage 1 V outside tolerance	Replace the conductivity transmitter
E.023	V12Err	System voltage 12 V outside tolerance	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 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 messages.

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

System malfunctions

Errors that do not provoke a shutdown

The indicated conductivity fluctuates, moisture in the area of the electrode cover tube	
Possible causes if no error messages appear	**Remedy**
Moisture is entering the cover tube from the outside.	■ Check the installation location for possible water leaks from which 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 AG.
The inner seals of the electrode rods are damaged.	■ Replace the conductivity transmitter with an identical unit from GESTRA AG.

The indicated conductivity very occasionally but repeatedly displays extreme values.	
Possible causes if no error messages appear	**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 °, 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.

The message 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-xn CF > 3.0	■ Remove the conductivity transmitter, see page 51. ■ Check and clean the electrode, see page 52

System malfunctions

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 45,
  when bringing into service and whenever the LRGT 1x-xn conductivity transmitter has been replaced.

System malfunctions of the LRGT 1x-xn conductivity transmitter 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 errors 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 hot water can escape suddenly if the conductivity electrode is unscrewed while 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.
5. Next, remove the conductivity electrode.

Cleaning the measuring electrodes of the conductivity transmitter

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 greater +/- 10 %, the conductivity transmitter must be calibrated using the "**CAL**" function, see page 39.

If reliable samples are taken more frequently for a specific system (e.g. every 3 days according to EN 12953-6, Table C1), the comparison and calibration should be carried out more frequently, too.

Cleaning interval

We recommend cleaning the electrode at least once a year, such as during maintenance work, depending on the operating conditions.

Before cleaning the measuring electrode(s), take the conductivity transmitter out of service and remove it, see page 51.

LRGT 16-3n, LRGT 17-3n

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

LRGT 16-4n

1. Clean the measuring electrodes ❷*.
2. Wipe off loose deposits with a fat-free cloth.
   Scrub off stubborn deposits using sandpaper (medium grain).
   Continue as described below:

*❶ / ❷ = *key to overall view, see page 21*

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

1. Install 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 35.
4. Compare the reading with the conductivity directly established from a reference measurement, see page 42.
5. Check the equipment using the test function of the conductivity transmitter, see page 45.

Disposal

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

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 AG.

The term media can refer to solid, liquid or gaseous substances or mixtures, as well as radiation.

GESTRA AG 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 outside of the return package, as processing will otherwise be impossible and the products will be returned to the sender at their expense.

Please proceed as follows:

1. Let GESTRA AG 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 AG.

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 and the relevant certificates.

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

GESTRA AG
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 and the certificates.

For your notes

For your notes

GESTRA®

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