GESTRA®

Conductivity Electrodes

LRG 16-60
LRG 16-61
LRG 17-60

EN
English

Original Installation & Operating Manual

819878-00

Contents

Contents

Content of this Manual

Product:

- Conductivity electrode LRG 16-60
- Conductivity electrode LRG 16-61
- Conductivity electrode LRG 17-60

First edition:

BAN 819878-00/08-2019cm

Scope of delivery/Product package

- 1 x Conductivity electrode LRG 1x-6x
- 1 x Sealing ring, D 33 x 39, form D, DIN 7603-2.4068, bright annealed
- 1 x Installation & Operating Manual

Accessories

- 1 x M12 CAN bus connector, 5-pole, A-coded, with 120 Ω terminating resistor

How to use this Manual

This Installation & Operating Manual describes how to correctly use LRG 16-60/LRG 16-61/LRG 17-60 conductivity electrodes. 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 equipment 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.

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.

CAN (Controller Area Network) bus

Data transmission standard and interface for connecting electronic equipment, sensors and control systems. Data can be sent and received.

LRG .. / URS .. / URB .. / SRL .. / NRG .. / etc.

Equipment and type designations of GESTRA AG, see page 9.

SELV

Safety Extra Low Voltage

Usage for the intended purpose

LRG 16-60/LRG 16-61/LRG 17-60 conductivity electrodes may only be used for measuring electrical conductivity in liquid media.

LRG 1x-6x conductivity electrodes are used in combination with the URS 60/URS 61 safety control unit as a conductivity limiter and in combination with an LRR 1-60 conductivity controller as a continuous blowdown regulator and limit indicator in steam boiler systems and hot-water plants.

- To guarantee trouble-free operation, observe the water quality requirements as specified in the Technical Rules (TRD) and EN standards for steam boiler systems.
- The equipment may only be used within the admissible pressure and temperature limits; see "Technical data" on page 18 and "Rating plate/Identification" on page 21.
- Visualisation and operation take place via an operating unit of type URB 60 or SPECTOR*control*.

Applicable directives and standards

LRG 16-60/LRG 16-61/LRG 17-60 conductivity electrodes have been tested and approved for use in the area governed by the following directives and standards:

Directives:

■ Directive 2014/68/EU	EU Pressure Equipment Directive
■ Directive 2014/35/EU	Low Voltage Directive
■ Directive 2014/30/EU	EMC Directive
■ Directive 2011/65/EU	RoHS II Directive

Standards:

■ EN 12953-09	Shell boilers, requirements for limiting devices
■ EN 12952-11	Water-tube boilers, requirements for limiting devices
■ EN 60730-1	Automatic electrical controls – Part 1: General requirements
■ EN 61508	Functional safety of electronic systems

Standards documents:

- VdTÜV Bulletin BP WAUE 0100-RL
  Requirements for the testing of water monitoring equipment

Technical rules for steam boilers - as a knowledge base:

This Manual occasionally refers to the TRD regulations as a knowledge base.

These regulations have not been in force since 1 March 2019 and are no longer updated. They are replaced by the TRBS (German Technical Rules for Industrial Health & Safety).

Always observe the current regulations (EU directives, EN standards, information from employers' liability insurance associations, etc.) in order to comply with the current state of the art.

Usage for the intended purpose

Admissible system components, dependent on the required safety level

In accordance with EU Pressure Equipment Directive 2014/68/EU and standards EN12952, EN12953, EN 61508, and the technical rules of VdTÜV Bulletin BP WAUE 0100-RL, the conductivity electrodes can be operated with the following system components, depending on the required safety level.

	Conductivity electrodes	Safety control unit for limiter	Control unit as continuous blowdown controller, limit indicator or automatic intermittent blowdown	Operating unit
SIL 2 as per EN 61508	LRG 16-60 LRG 17-60 LRG 16-61	URS 60 URS 61	–	URB 60, SPECTOR *control*
without safety level in line with EN 61508	LRG 16-60 LRG 17-60 LRG 16-61	–	LRR 1-60	URB 60, SPECTOR *control*

Fig. 1

Key to Fig. 1:

LRG = Conductivity electrode

URS = Safety control unit

URB = Visual display and operating unit

LRR = Conductivity controller

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

- You will find the latest Installation & Operating Manuals for the system components named in Fig. 1 on our website:
  http://www.gestra.com/documents/brochures.html

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

There is a 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**.

There is a risk of severe burns when working on conductivity electrodes that have 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 on conductivity electrodes that have been allowed to cool.

There is a danger to life from electric shock when working 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 faulty LRG 1x-6x conductivity electrodes due to the sudden escape of hot steam or hot water.

Impacts or knocks during transportation or installation can cause the 1x-6x conductivity electrodes to become damaged, whereby hot steam or hot water can escape through the pressure relief hole.

- Avoid damage, for example from strong knocks to the electrode rods, during transportation and installation.
- Before and after installation, check that the conductivity electrode is completely undamaged. When bringing it into service, check that it is leak-tight.

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

- LRG 1x-6x conductivity electrodes may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

Basic safety notes

Deficient maintenance and cleaning can lead to the conductivity electrodes becoming damaged and/or to incorrect measurement results and false alarms.

- Once a year, perform a check on the conductivity electrodes using comparative measurements.
- Adhere to the maintenance and cleaning intervals; see page 59.

Required personnel qualifications

Activity	Personnel	
Integration in control system	Specialist staff	Plant designer
Installation/electrical connection/bringing into service	Specialist staff	The device 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.
Operation	Boiler service technician	Staff trained by the plant operator.
Maintenance work	Specialist staff	Maintenance and modifications may only be performed by authorised staff who have undergone specific training.
Modifications	Specialist staff	Persons trained by the plant operator to work with pressure and temperature.

Fig. 2

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)

In combination with the URS 60/URS 61 safety control unit, LRG 16-60/LRG 16-61/LRG 17-60 conductivity electrodes are suitable for use with safety functions up to SIL 2.

They are each elements of a safety circuit up to a rating of SIL 2 as per EN 61508 in the SPECTOR*connect* system, and can transmit alarm notifications.

Combining them with accessories produces a type B subsystem. The following information on the technical and safety characteristics in Fig. 4 are based solely on LRG 1x-6x conductivity electrodes.

Breakdown of safety function failure rates (safety shutoff)

LRG 1x-6x

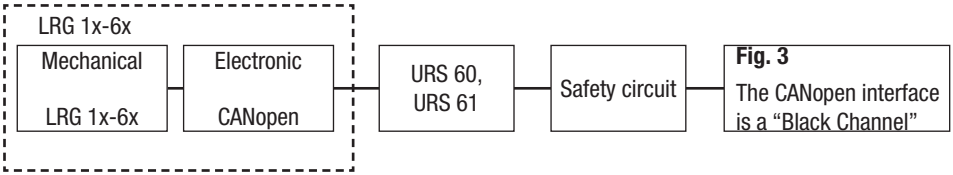


Fig. 3
The CANopen interface is a “Black Channel”

type, and can

be ignored during calculation due to the low failure rate of < 1FIT.

Check the safety function regularly

The functioning of the conductivity electrode must be monitored once a year by triggering the test function (T1 = 1 year). The test function can be triggered on site via the integrated rotary knob of the terminal box; see page 52.

Furthermore, it is possible to trigger the test function remotely from URS 60/URS 61 or the external operating units URB 60 or SPECTOR*control* system.

Reliability data as per EN 61508

Description	Characteristic values	
Electrode type	**LRG 1x-60**	**LRG 16-61**
Safety integrity level	SIL 2	SIL 2
Architecture	1oo1	1oo1
Equipment type	Type B	Type B
Hardware error tolerance	HFT = 0	HFT = 0
Overall failure rate for dangerous undetected failures	$\lambda_{DU} = < 20 * 10^{-8}$ 1/h	$\lambda_{DU} = < 35 * 10^{-8}$ 1/h
Overall failure rate for dangerous detected failures	$\lambda_{DD} = < 5000 * 10^{-9}$ 1/h	$\lambda_{DD} = < 5000 * 10^{-9}$ 1/h
Safe failure fraction	SFF > 96.0 %	SFF > 95.0 %
Test interval	T1 = 1 year	T1 = 1 year
Probability of dangerous failure on demand	$PFD < 100 * 10^{-5}$	$PFD < 160 * 10^{-5}$
Diagnostic coverage. Percentage of dangerous failures detected by a test.	DC > 95.0 %	DC > 91.0 %
Mean time to dangerous failure	$MTTF_d > 30$ a	$MTTF_d > 30$ a
Diagnostic interval	T2 = 1 hour	T2 = 1 hour
Performance level (as per ISO 13849)	PL = d	PL = d
Probability of dangerous failure per hour	$PFH < 20 * 10^{-8}$ 1/h	$PFH < 35 * 10^{-8}$ 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. 4

Function

The equipment measures the electrical conductivity in electroconductive liquid media.

Measuring process - LRG 16-60/LRG 17-60

The LRG 16-60/LRG 17-60 conductivity electrodes work as per the conductometric two-electrode measuring process. A measuring current is passed through the medium with a frequency adapted to the measuring range. This causes a potential gradient between the electrode and measuring tube, which is evaluated as measuring voltage.

Measuring process - LRG 16-61

The LRG 16-61 conductivity electrode works as per the conductometric four-electrode measuring process. It consists of two current and two voltage electrodes. From the current electrodes, a measuring current with a set frequency is introduced into the medium. This causes a potential gradient between these electrodes. This potential gradient is picked up in the media by the voltage electrodes and is evaluated as measuring voltage.

Temperature compensation of the measured values based on a reference temperature (25 °C)

The electrical conductivity is a function of the temperature. In order to base the measured values on a reference temperature, an integrated resistance thermometer therefore measures the medium's temperature. The electrical conductivity is calculated from the measuring current and the measuring voltage and is based on the reference temperature of 25°C through temperature compensation.

Compensation process

The measured value of the conductivity is corrected linearly depending on a set temperature coefficient. The coefficient (standard is 2.1%/°C) is usually used for steam generating units with constant pressure. The conductivity is determined for an ambient temperature (25 °C).

The gradients are then verified at operating pressure with a calibrated conductivity measuring device.

Application

LRG 1x-6x conductivity electrodes are used in combination with the URS 60/URS 61 safety control unit as a conductivity limiter and in combination with an LRR 1-60 control unit as a continuous blowdown regulator in steam boiler systems and hot-water plants.

Automatic self-test

An automatic self-test cyclically monitors the safety and function of the conductivity electrode and measured value recorder.

The data are transferred to the URS 60/URS 61 safety control unit in the form of a Black Channel data telegram using the CANopen protocol on the basis of a CAN bus as per ISO 11898.

Function

The following information is transferred as data telegrams:

- Measured value of the conductivity, temperature-compensated
- The temperature of the medium
- MAX limit value setting limiter
- Temperature coefficient (tC) and cell constant (CF)
- Limiter test command
- Status and fault information
  - Alarm signals from the conductivity electrode if the limit values are exceeded
  - Error messages in the event of faults in electronic or mechanical parts
  - Temperature in the terminal box of the conductivity electrode

Displays and signals; see page 49 / 54*

The LRG 1x-6x conductivity electrodes have a 4-digit green 7-segment display for showing measured value and status information as well as fault codes. Several coloured LEDs are used to display alarm states and the set unit.

Behaviour in the event of alarms *

The alarm state for an exceeded limit value is shown on the display as "**Hi.C**" alternately with the **actual value** of the conductivity.

The alarm is transferred to the URS 60 or URS 61 safety control unit via CAN data telegram. Once the time delay has elapsed, the alarm signal triggers the safety shutoff in the safety control unit. The URS 60 or URS 61 safety control unit does not lock automatically for this.

The LEDs 1 and 4 signal the corresponding MAX alarm case see page 51 .

The safety circuit is interrupted without a delay if the following faults occur:

- Fault in the sensors (open circuit, short circuit, faulty component, excessive temperature)
- Communication failure

Behaviour in the event of faults *

The safety functions of the equipment are monitored in the sensors through periodic self-tests. Fault messages are updated with each self-test and are permanently stored in the fault memory. If there are no faults, only the list of current faults and their display is deleted.

Alarm and fault signals are indicated by LEDs and shown on the 7-segment display of the conductivity electrodes and are transferred to the URS 60/URS 61 safety control unit via CAN data telegram.

Electrode alarms and errors faults cannot be acknowledged.

When the alarm or error is cancelled the display also goes blank, and the URS 60/URS 61 safety control unit closes the safety contacts again.

Function

Simulating the alarm state *

The triggering of an alarm can be simulated by a keystroke on the rotary knob of the LRG 1x-6x, by pressing the appropriate button on the URS 60/URS 61, or by using the URB 60. The device combination will then behave as if a normal alarm had been triggered.

* The tables from page 49 clearly show the relationship between the equipment status, the display and the alarm LEDs.

Parametrising or changing the factory settings

If necessary, you can adapt the conductivity electrode to the system conditions on site. You can set the parameters or change the factory settings by means of a rotary knob on the terminal box; see page 40.

Technical data

Model and mechanical connection

■ LRG 16-60, LRG 16-61, LRG 17-60	Thread G1 A, EN ISO 228-1, see Fig. 9, 10, 11

Nominal pressure rating, admissible service pressure and temperature

■ LRG 16-60	PN 40	32 bar (g) at 238 °C
■ LRG 16-61	PN 40	32 bar (g) at 238 °C
■ LRG 17-60	PN 63	60 bar (g) at 275 °C

Materials

■ Terminal box	3.2581 G AlSi12, powder-coated
■ Sheath	1.4301 X5 CrNi 18-10
■ Measuring electrodes	1.4571 X6CrNiMoTi17-12-2
■ Electrode insulation	PTFE
■ Screw-in body:	
◆ Measuring tube, measuring screw LRG 16-60, LRG 17-60	1.4571, X6CrNiMoTi17-12-2
◆ Spacer LRG 16-60, LRG 16-61, LRG 17-60	PEEK

Deliverable installation lengths of the electrodes (cannot be shortened)

■ LRG 16-60, LRG 17-60	200, 300, 400, 500, 600, 800, 1000 (mm)
■ LRG 16-61	180, 300, 380, 500, 600, 800, 1000 (mm)

Temperature sensor

■ Resistance thermometer	Pt 1000
■ Measuring range for the temperature of the medium	0 to 280 °C

Conductivity range at 25 °C

■ LRG 16-60, LRG 17-60	0.5 µS/cm to 6,000 µS/cm, 0.25 - 3000 ppm *
◆ Preferred measuring range	up to 1000 µS/cm
■ LRG 16-61	50 µS/cm to 10,000 µS/cm, 25 - 5000 ppm *
◆ Preferred measuring range	from 500 µS/cm
** Conversion µS/cm in ppm (parts per million):*	*1 µS/cm = 0.5 ppm*

Measuring cycle

■ 1 second

Technical data

Measuring quality (information for value ranges between the factory calibrating points)

- **LRG 1x-60**

Triggering internal processing *		**Measurement deviation**	**Linearity deviation**
◆ 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 %

- **LRG 16-61**

Triggering internal processing *		**Measurement deviation**	**Linearity deviation**
◆ 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 %

** Triggering internal processing based on 15 bit with sign before (16 bit).*

The aforementioned values are related to uncompensated conductivity.

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

	Temperature	**Conductivity**
■ LRG 16-60, LRG 17-60	9 seconds	14 seconds
■ LRG 16-61	11 seconds	19 seconds

Temperature compensation

- The temperature compensation process is linear and is adjustable via parameter tC; see page 44.

Supply voltage

- 24 V DC +/-20 %

Power consumption

- max. 7 VA

Current input

- max. 0.35 A

Internal fuse

- T 2 A

Safety cutout at excessive ambient temperature

- The cutout takes place at excessive ambient temperatures Tamb. = 75 °C

Electrode voltage

- < 500 mV (RMS) at no load

Technical data

Input/output

- Interface for CAN bus as per ISO 11898, CANopen, insulated
- M12 CAN bus connector, 5-pole, A-coded
- M12 CAN bus socket, 5-pole, A-coded

Indicators and controls

- 1 x 4-digit green 7-segment display for showing measured values and status information
- 1 x red LED for indicating an alarm state
- 3 x green LED for indicated the unit µS/cm / ppm and the OK state
- 1 x rotary knob IP65 with button for menu navigation and test function

Protection class

- III Safety Extra Low Voltage (SELV)

IP rating as per 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

- LRG 16-60/LRG 16-61/LRG 17-60 approx 2.1 kg

Name plate/Identification

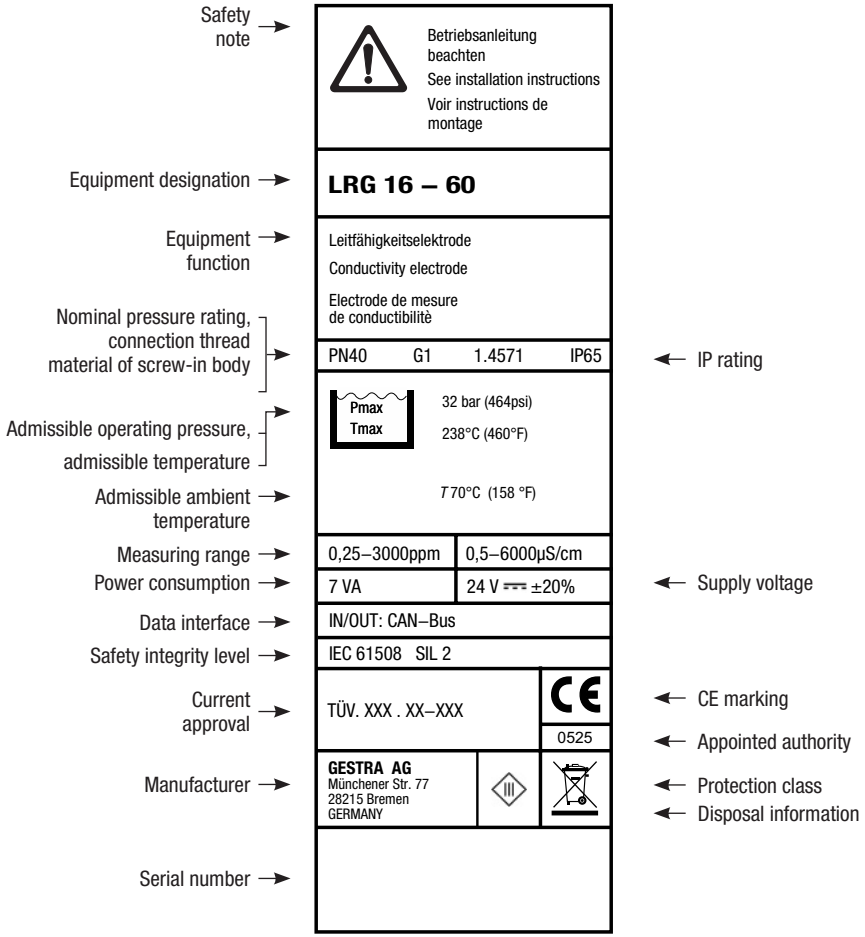


Fig. 5

The production date (quarterly and annual) is stamped in at the screw-in body of each conductivity electrode.

Name plate/Identification

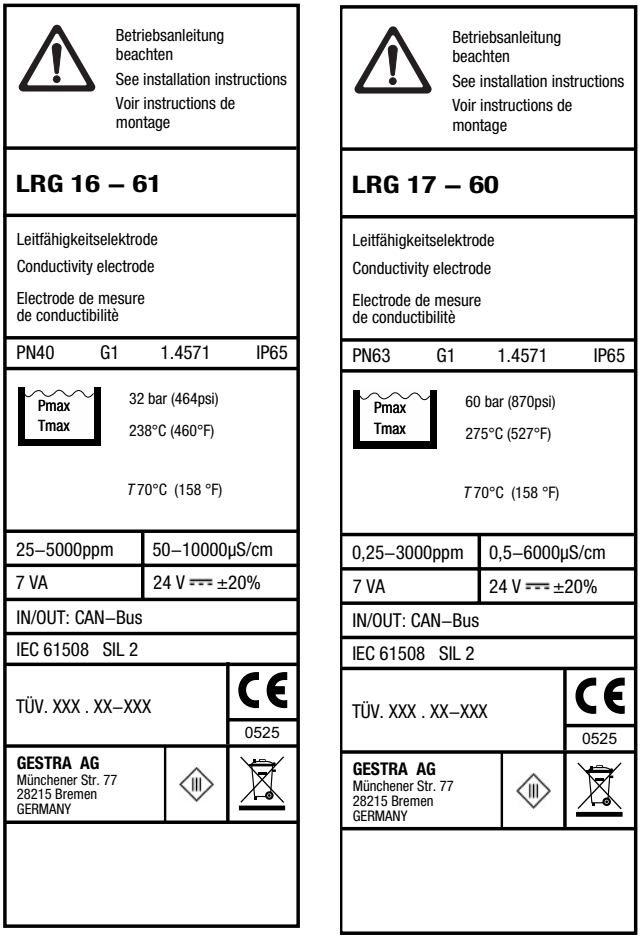


Fig. 6

Factory settings

LRG 1x-6x conductivity electrodes are delivered ex works as follows.

Parameter	Display in menu	Unit	Parameter values	
			LRG 16-60 LRG 17-60	LRG 16-61
Limiter ID	Id.Hi		OFF	
Controller group	GrP		0001	
Baud rate	bd.rt	kBit/s	0050	
Alarm limit value	AL.Hi	µS/cm	3000	5000
Cell constant	CF		0.210	
Temperature coefficient	tC	%/°C	002.1	
Filter constant (damping)	FiLt	Seconds	0025	
Scale of current output LRR 1-60	Sout	µS	0500	7000
Display unit	Unit		µS	

Fig. 7

Overall view

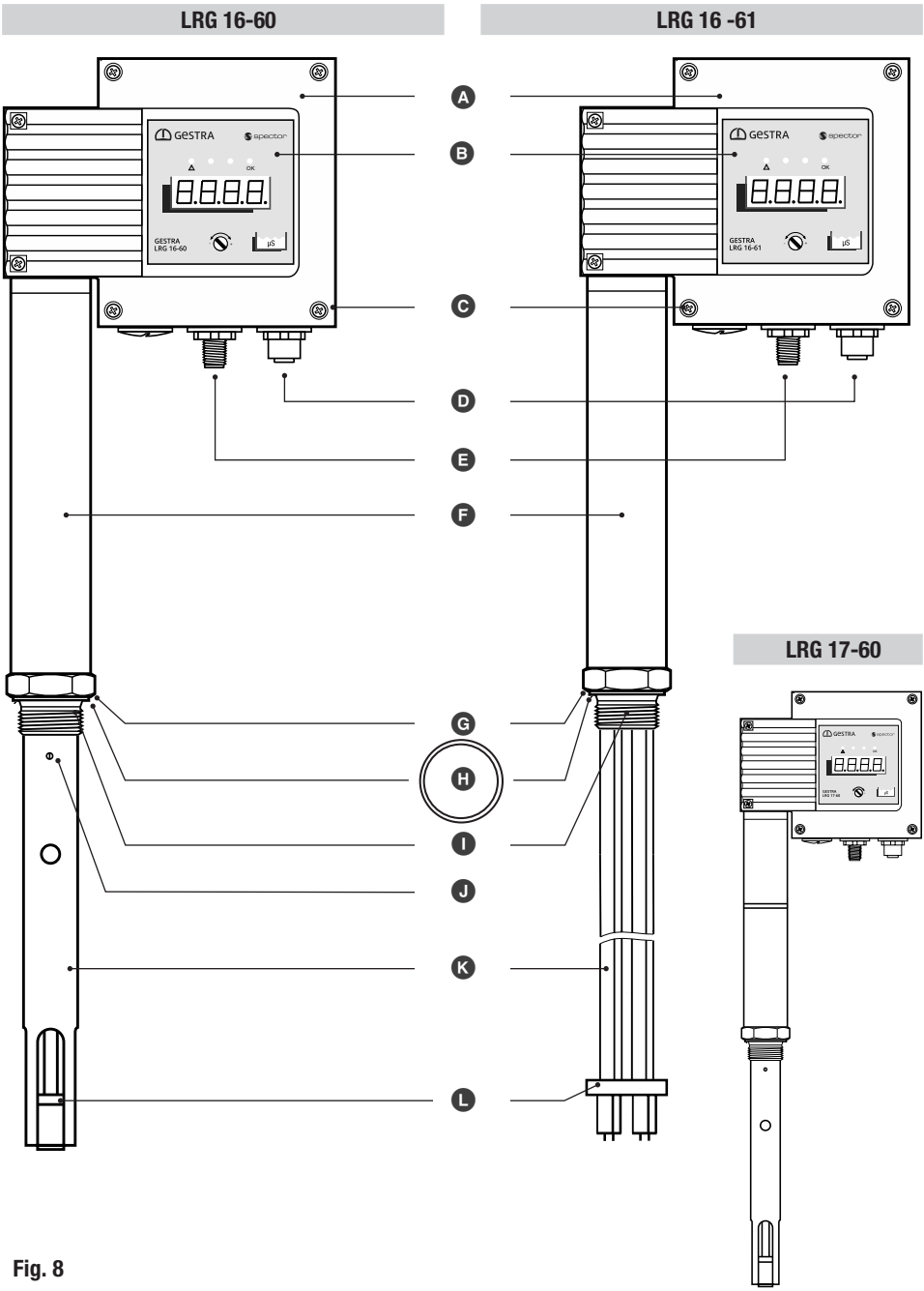


Fig. 8

Overall view

Key to Fig. 8

- Ⓐ Terminal box
- Ⓑ Operating panel with 4-digit LCD display/alarm LEDs and rotary knob; see page 49
- Ⓒ Cover screws M4 x 16 mm
- Ⓓ M12 CAN bus socket, 5-pole, A-coded
- Ⓔ M12 CAN bus connector, 5-pole, A-coded
- Ⓕ Sheath
- Ⓖ 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 (LRG 16-60/LRG 17-60)
- Ⓚ Measuring tube with measuring electrode (LRG 16-60/LRG 17-60), measuring electrodes (LRG 16-61)
- Ⓛ Spacer

Dimensions of LRG 16-60

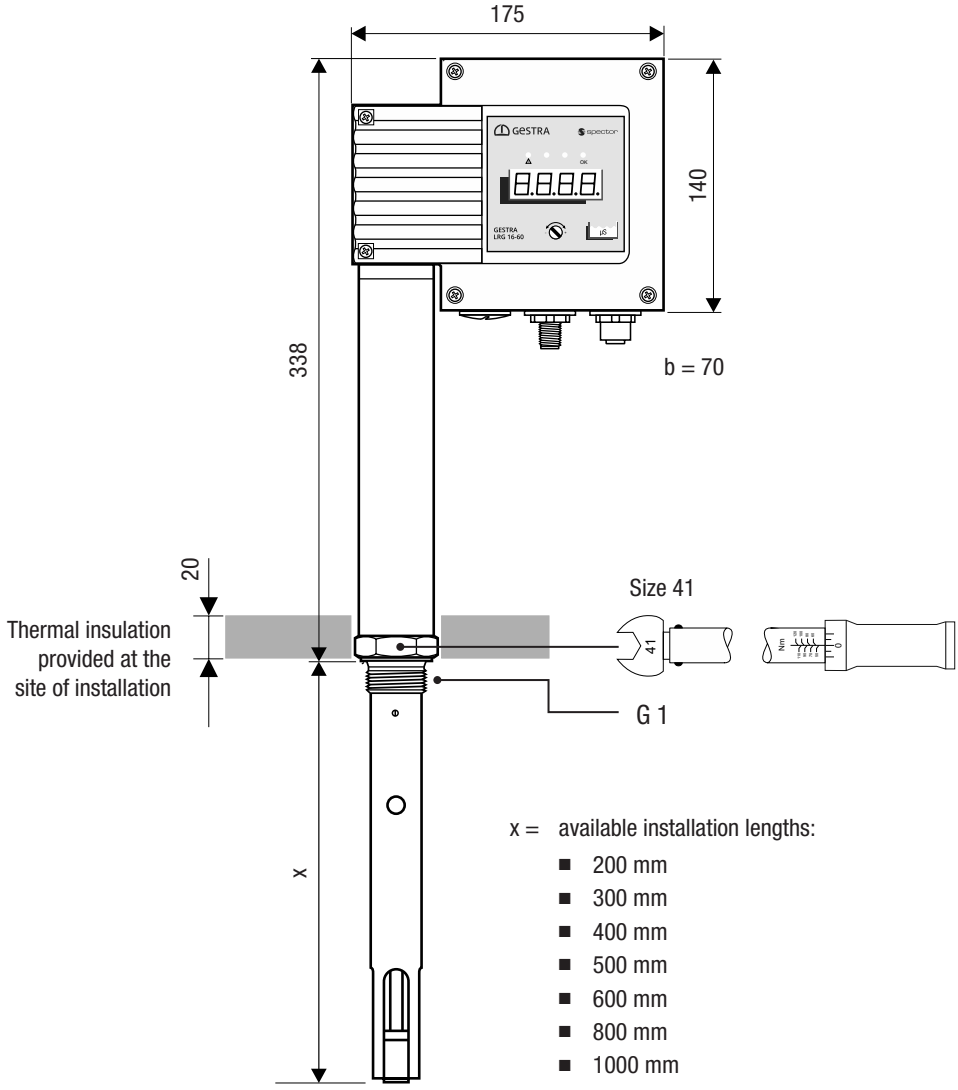


Fig. 9 All lengths and diameters in mm

Dimensions of LRG 17-60

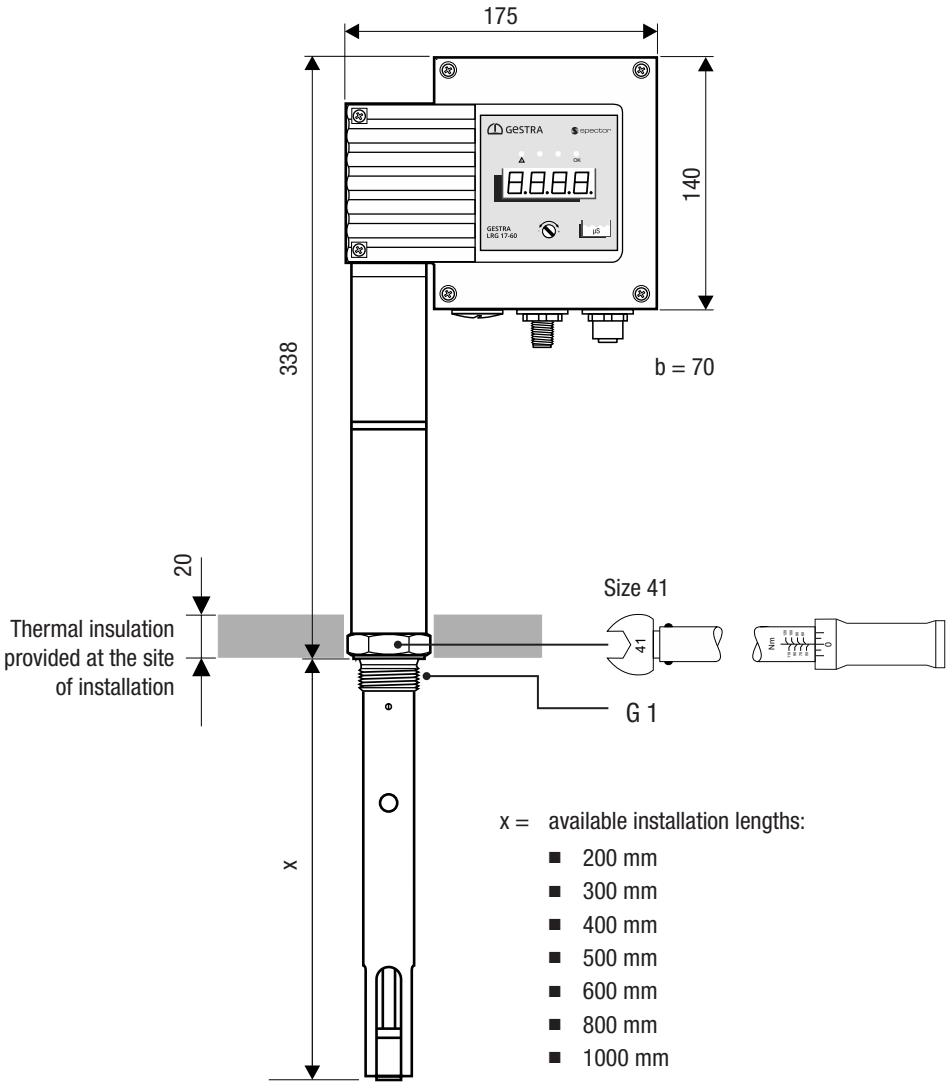


Fig. 10 All lengths and diameters in mm

Dimensions of LRG 16-61

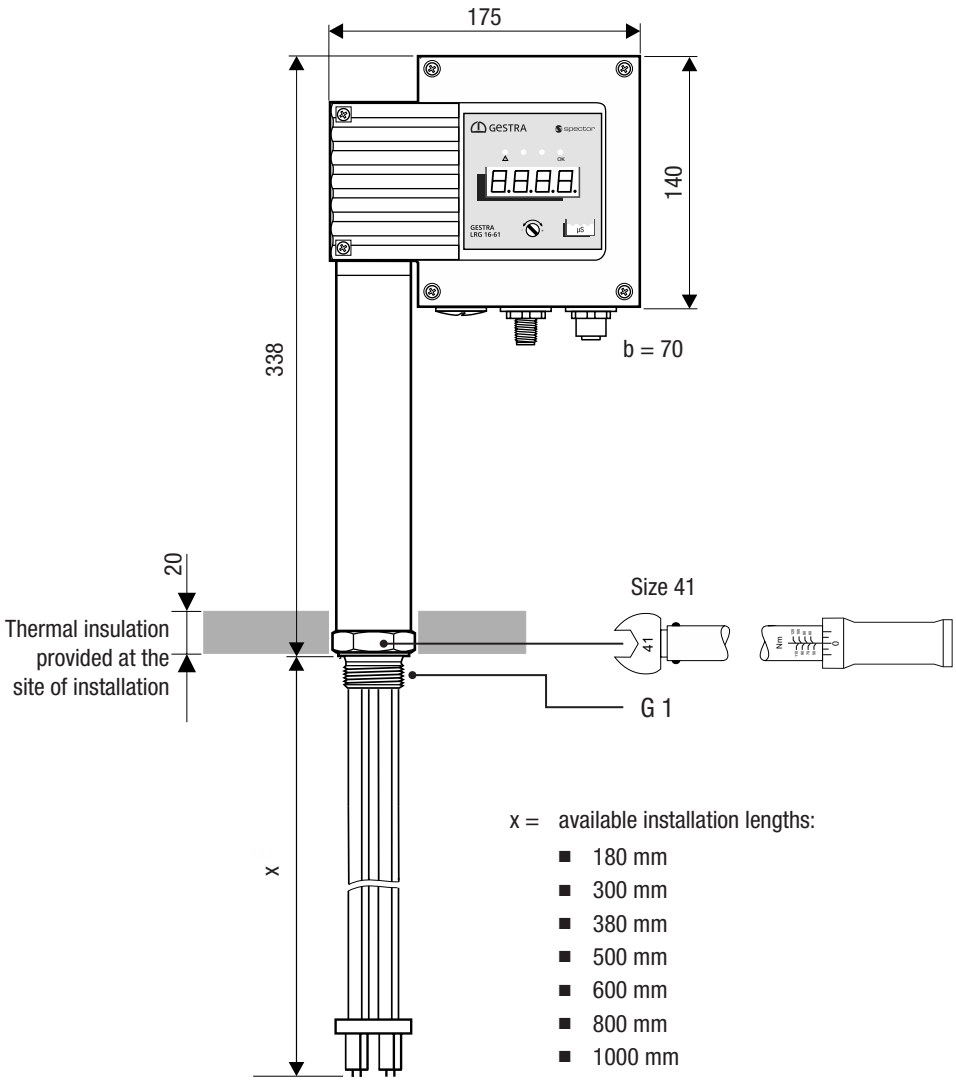


Fig. 11 All lengths and diameters in mm

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 20.
- 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 system 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 lightning, insects and animals, and salty air.

You will need the following tools:

- Torque wrench (with size 41 open-ended spanner attachment), see pages 26 to 28 and page 32.

⚠ DANGER

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

Hot steam or hot water can escape suddenly if conductivity electrodes are unscrewed under pressure.

- Reduce the boiler pressure to 0 bar and check the pressure before unscrewing the conductivity electrodes.
- Only remove conductivity electrodes at a boiler pressure of 0 bar.

⚠ WARNING

Hot conductivity electrodes can cause severe burns.

Conductivity electrodes are extremely hot during operation.

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

⚠ ATTENTION

Incorrect installation can lead to destruction of the system or the conductivity electrode.

- Inspect the sealing surfaces of respective tank threaded standpipes or flange covers to ensure they are perfectly machined; see Fig. 12.
- Take care not to bend conductivity electrodes during installation!
- Avoid hard knocks against the measuring electrodes during installation.
- You must **not** install the terminal box Ⓐ and the sheath Ⓕ of the measuring electrode in the thermal insulation of the boiler!
- Please note the installation dimensions of the conductivity electrode; see installation examples on pages 33 to 36.
- Check the boiler connection and flange during the preliminary boiler inspection.
- Adhere to the specified tightening torques.

Additional installation notes

⚠ ATTENTION

An electrode that is not fully immersed in the medium leads to incorrect measurement results and jeopardises system safety.

- Install the conductivity electrode such that it is always fully immersed in the medium.
- As far as possible, always install the conductivity electrode below the admissible LW mark.

Measuring points (metallic objects) between the boiler wall and electrode impair the measurement. Incorrect measurement results jeopardise the system's safety.

Therefore, adhere to the distances mentioned subsequently.

LRG 16-60/LRG 17-60

- Provide spacing of approx. 30 mm between the lower end of the measuring tube and the boiler wall, the smoke tubes, other metallic fittings and the low water level (LW).
- The measuring electrodes and the measuring tube cannot be shortened.

LRG 16-61

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

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

   Sealing surfaces must be perfectly machined according to Fig. 12.

Sealing surface dimensions for LRG 16-60/LRG 16-61/LRG 17-60

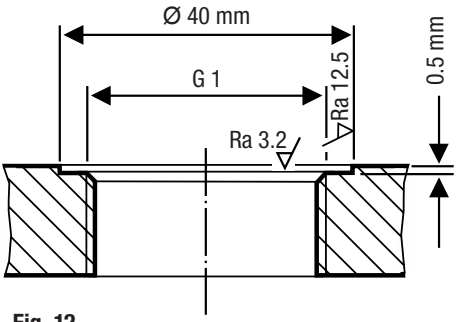


Fig. 12

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

Example LRG 1x-60

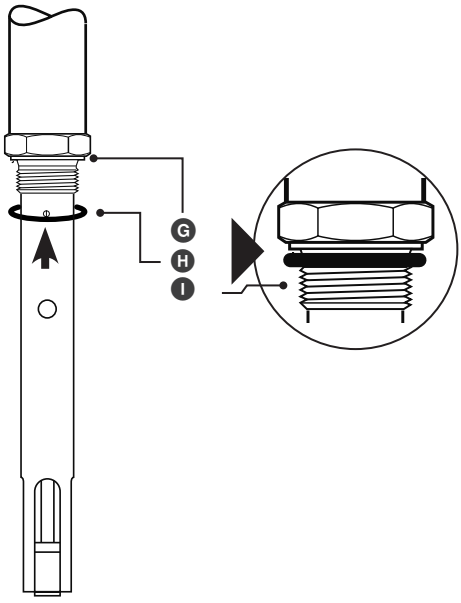


Fig. 13

⚠ 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 ❾.
  - **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 ❶.
4. Screw the conductivity electrode into the threaded standpipe of the tank or flange cover, and tighten securely using a torque wrench (with size 41 open-ended spanner attachment).

Tightening torque when cold:

- LRG 16-60/LRG 16-61/LRG 17-60 = 250 Nm

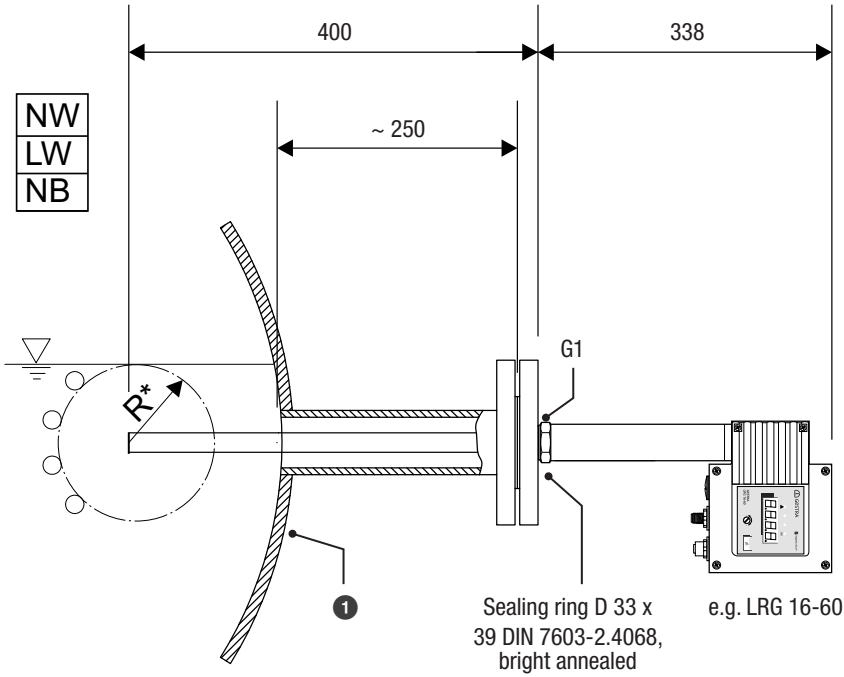
Installation examples with dimensions, see Fig. 14, Fig. 15, Fig. 16, from page 33

Installation examples with dimensions

Conductivity measurement

Installation of conductivity electrodes via a side flange.

Key, see page 36



*** Minimum distances (R)**

- LRG 16-60/LRG 17-60 R = 30 mm
- LRG16-61 R = 60 mm

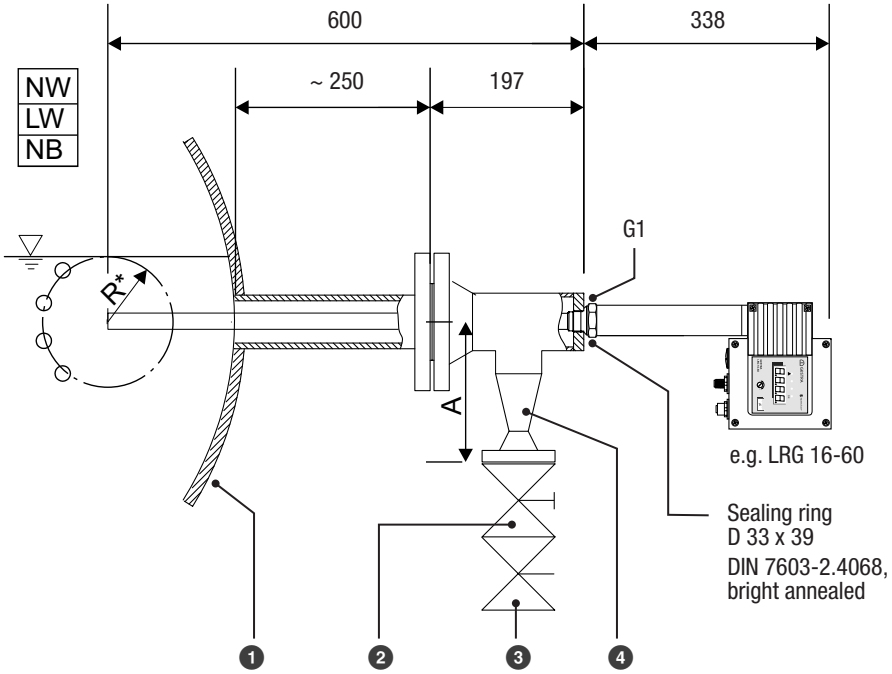
Fig. 14 All lengths and diameters in mm

Installation examples with dimensions

Conductivity measurement and continuous blowdown control

Installation of the conductivity electrode via a measuring vessel with connection of a continuous blow-down valve.

Key, see page 36



*** Minimum distances (R):**

- LRG 16-60/LRG 17-60 R = 30 mm
- LRG16-61 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. 15 All lengths and diameters in mm

Installation examples with dimensions

Conductivity measurement and continuous blowdown control via a separate measuring vessel

Installation of conductivity electrode in the continuous blowdown line via a separate measuring vessel.

Key, see page 36

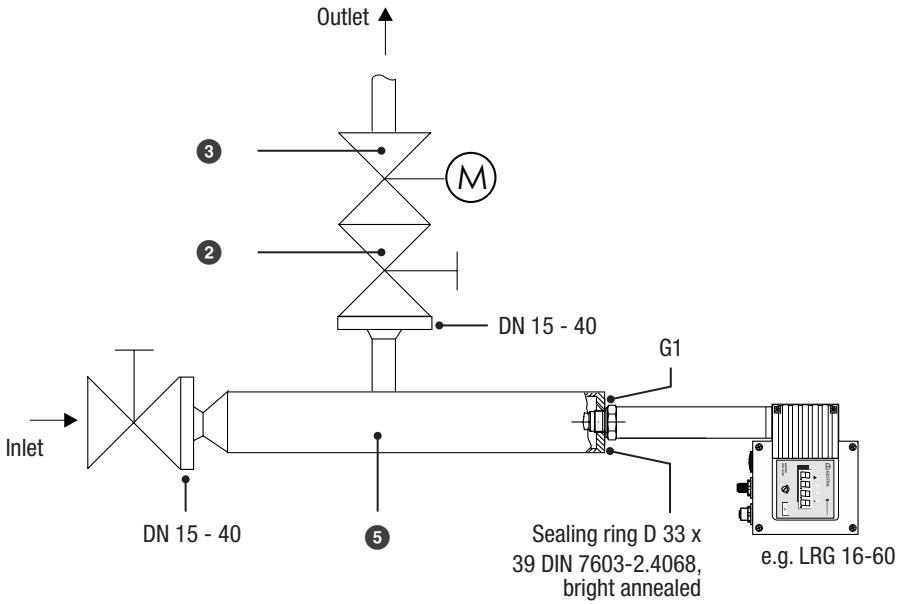


Fig. 16 All lengths and diameters in mm

Installation examples with dimensions

Key Fig. 14 to Fig. 16

1. Boiler drum
2. Stop valve GAV
3. Continuous blowdown valve BAE
4. Connection piece in T-shape
5. Measuring vessel

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 electrode's internal wiring.

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

Functional elements

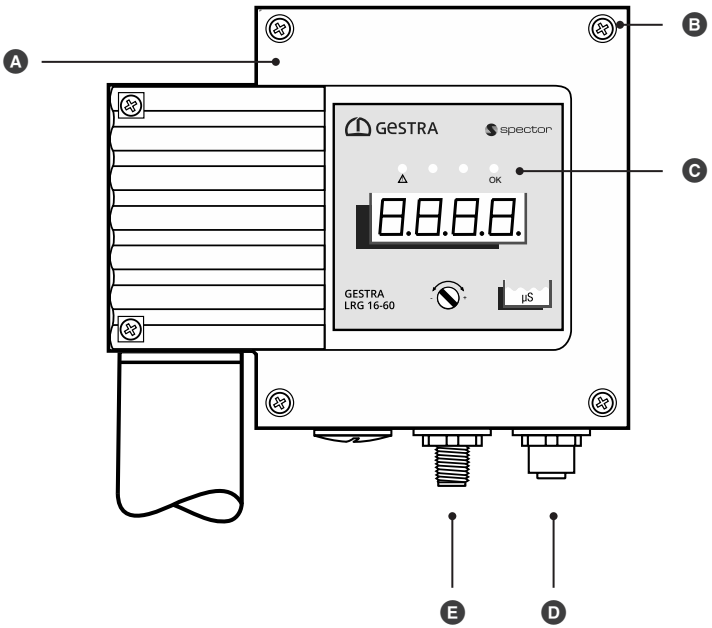


Fig. 17

- **A** Terminal box
- **B** Cover screws M4 x 16 mm
- **C** Operating panel with 4-digit LCD display/alarm and status LEDs and rotary knob, see page 49
- **D** M12 CAN bus socket, 5-pole, A-coded
- **E** M12 CAN bus connector, 5-pole, A-coded

Connecting the CAN bus system

Bus line, cable length and cross-section

- A shielded, multi-core, twisted-pair control cable, e.g. UNITRONIC® BUS CAN 2 x 2 x .. mm² or RE-2YCYV-fl 2 x 2 x .. mm² must be used as the bus line.
- Pre-wired control cables (with plug and coupling) are available as accessories in various lengths.
- The baud rate (transfer rate) is determined by the cable length between the bus terminal devices, and the wire cross-section is determined by the overall power input of the measuring sensors.
- 0.2 A at 24 V is required per sensor. With 5 sensors, there is therefore a voltage drop of approx. 8 V per 100 m when using cables of 0.5 mm². In this case, the system is operating at its limits.
- With 5 sensors or more and a cable length of ≥ 100 m, the wire cross-section needs to be doubled to 1.0 mm².
- At larger distances of > 100 m, the 24 V DC supply can also be connected on site.

Example

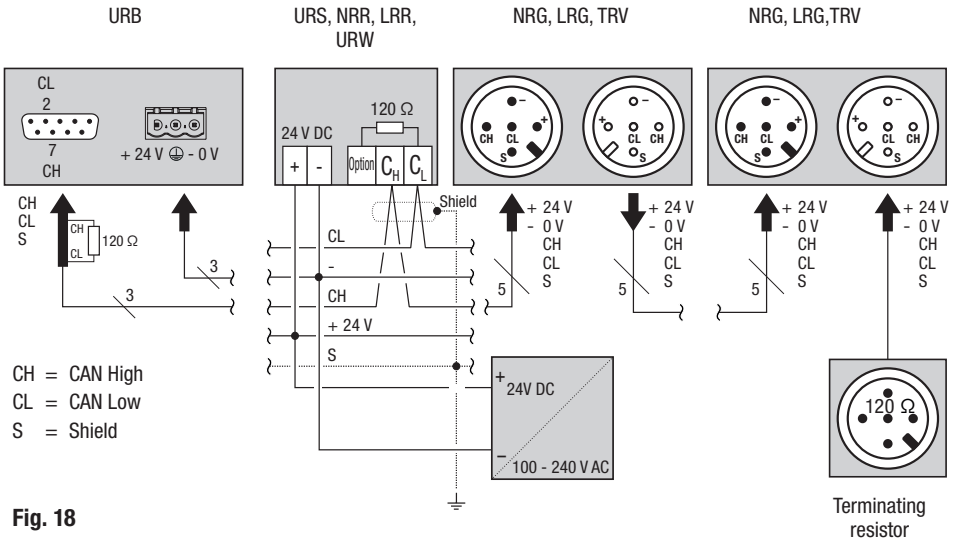


Fig. 18

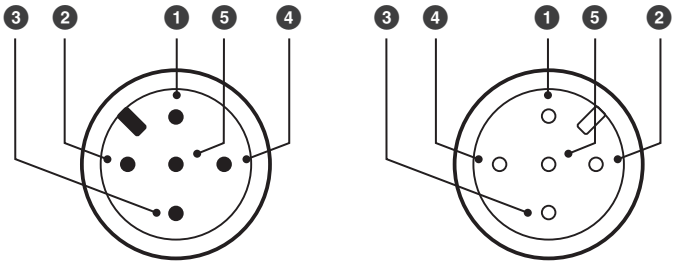
Connecting the CAN bus system

Important notes on connecting the CAN bus system

- A dedicated 24 V DC SELV power supply unit that is isolated from connected loads must be used to supply the SPECTOR*connect* system.
- Make sure wiring is in line, not in a star!
- Avoid potential differences in system parts by connection to a central earthing point.
  - Connect the bus line shields to one another all the way along, and connect them to the central earthing point (CEP).
- If two or more system components are connected in a CAN bus network, a 120 Ω terminating resistor must be connected to the **first** and **last** devices between terminals C_L / C_H.
- Use the CAN bus connector with terminating resistor if you are using the conductivity electrode as the first or last device.
- Only **one** URS 60 and **one** URS 61 safety control unit may be used in the CAN bus network.
- The CAN bus network must not be interrupted during operation!
  If it is, an alarm signal is triggered.

Pin assignment of the CAN bus connector and coupling for non pre-wired control cables

If non pre-wired control cables are used, you must wire the CAN bus connector and couplings as shown in the wiring diagram **Fig. 19**.



Connector **Coupling**

Fig. 19

1	S	Shield (screen)
2	+ 24 V	Power supply
3	– 0 V	Power supply
4	CH	CAN High data line
5	CL	CAN Low data line

Bringing into service

Before bringing into service, check that all equipment is correctly connected:

- Is the polarity of the CAN bus control line correct throughout?
- Is a 120 Ω terminating resistor connected to the terminal devices of the CAN bus line?

Next, switch on the supply voltage.

Changing the factory settings if necessary

You will need the following tools

- Slotted screwdriver, size 2.5

Select and set 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 following parameters are shown one after the other when you turn the rotary knob clockwise:

1234 → Id.Hi → GrP → bd.rt → °C.in → °C.Pt → AL.Hi → CF → tC → CAL → FiLt → Sout → Unit → diSP

Key to parameters, see page 41.

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

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.

- / + Reducing/increasing 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 set value by pressing the rotary knob for approx. 1 second.

The message “donE” is shown and the parameter appears on the display again.

Key to parameters:

- 1234 = Measuring value display (normal operating state, example)
- Id.Hi = Identifier for the limiter function (effect on the safety control unit URS 6x)
- GrP = Controller group, identifier of regulation function (effect on URB 60/SPECTOR*control*)
- bd.rt = Baud rate
- °C.in = Display ambient temperature of housing
- °C.Pt = Display temperature of measuring medium
- AL.Hi = Set alarm limit value of limiter function
- CF = Cell constant of electrode
- tC = Temperature coefficient of measuring medium
- CAL = Calibration function to compare the display with a comparative value (sample)
- FiLt = Filter constant
- Sout = Scaling of 4-20 mA actual output at controller LRR 1-60
- Unit = Unit of display value (µS or ppm)
- diSP = Trigger a display test

Upstream display test for safety-relevant parameters

There is a display test upstream of some safety-relevant parameters (e.g. AL.Hi). This is intended to prevent an incorrect value being entered due to faulty display segments that have not yet been noticed.

Setting example, see page 43

Using the alarm limit value for the limiter function (AL.Hi) as an example, we show you the procedure for setting the parameters incl. the display test. This is representative of all safety parameters.

A display test performed once opens a 10 minute input window in which several safety-relevant parameters can then also be changed without the display test repeating itself.

Triggering a display test manually.

Alternatively, you can also specifically trigger the display test with "**diSP**"; see page 47.

Bringing into service

Notes on changing communication parameters “bd.rt, Id.Hi or GrP”

All CAN bus devices from GESTRA AG have preset communication parameters, which enable a standard system to be brought into operation without making any changes.

Please follow the steps below if you need to make changes to communication parameters:

- Set the same baud rate for all bus participants.
- To apply changed communication parameters, perform the steps below on the URB 60 visual display and operating unit or the SPECTOR*control*:
  - **Device list - Reimport**

To do this, please read the instructions in the Installation & Operating Manual of the URB 60 visual display and operating unit or the SPECTOR*control*.

Changing the baud rate

Note the setting instructions on page 40 and proceed as follows:

1. Select the parameter “**bd.rt**”.
2. Press and hold the rotary knob until the current baud rate flashes on the display.
3. Set the desired baud rate (50 kBit/s / 250 kBit/s).
4. Save your set value by pressing the rotary knob for approx. 1 second.

Changing the limiter ID

To set the limiter ID, please also read the instructions in the Installation & Operating Manual of the URS 60/URS 61 safety control unit.

Note the setting instructions on page 40 and proceed as follows:

1. Select the parameter “**Id.Hi**”.
2. Press and hold the rotary knob until the current limiter ID flashes on the display.
3. Set the desired ID (0001 to 0008).
4. Save your set value by pressing the rotary knob for approx. 1 second.

Bringing into service

Changing the controller group

To set the controller group, please also observe the instructions in the Installation & Operating Manual of the LRR 1-60 conductivity controller.

Note the setting instructions on page 40 and proceed as follows:

1. Select the parameter "**GrP**".
2. Press and hold the rotary knob until the currently assigned controller group flashes on the display.
3. Set the desired ID (0001 to 0004).
4. Save your set value by pressing the rotary knob for approx. 1 second.

Changing the alarm limit value of the limiter function

Notes on setting the alarm limit value "AL.Hi"

This setting only concerns the limit value for the safety shutoff via the URS 60/URS 61 safety control unit.

The limit value indicator contacts of the LRR 1-60 conductivity controller are independent from this.

For this, also observe the information in the relevant Installation & Operating Manual.

Note the setting instructions on page 40 and proceed as follows:

1. Select the parameter "**AL.Hi**".
2. Press and hold the rotary knob until the display test starts by showing "**....**".
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 the message "**donE**".
6. When the display test is complete, the last digit of the limit value flashes.
7. Set the following required limit values:
   - LRG 1x-60: 0000 – 6000
   - LRG 16-61: 0000 - 9999
8. Save your set value by pressing the rotary knob for approx. 1 second.

A display test performed once opens a 10 minute input window in which several safety-relevant parameters can then also be changed without the display test repeating itself.

Replacing faulty equipment

Faulty equipment jeopardises system safety.

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

Changing the cell constant

Notes on adjusting the cell constant

The cell constants of each LRG 1x-6x conductivity electrode is finely adjusted ex works. If the installation situation at the installation location makes a readjustment necessary, (see page 48, comparison of the measured value with a reference measured vale), the cell constant can be changed on site.

Requirements for performing the readjustment:

- There must be a sufficient boiler fill level to compare the cell constants.
- The comparison with a reference measurement may only be performed at a low boiler output in order to minimise distortion from steam bubbles.

By means of this parameter, the display value can be correlated manually with a reference measured value from a reliable sample at the operation site.

Alternatively, the readjustment can be performed using a convenient solution by means of the "**CAL**" function; see page 45.

Note the setting instructions on page 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 set value by pressing the rotary knob for approx. 1 second.

Increasing the "CF" value causes the display value to increase.

With increased contamination, the display value will have decreased. This is to be compensated by increasing the "CF" value as described previously in points 1 to 4.

Changing the temperature coefficient

The temperature coefficient of the measuring medium can be adjusted manually as long as a corresponding value has been determined.

The factory setting of "2.1" is usually set for steam generating units with constant pressure. For newly implemented electrodes, this value is to be adjusted to the temperature coefficients of the boiler water if necessary.

Bringing into service

Note the setting instructions on page 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.

Increasing the "tC" value causes the display value to decrease.

Using the "CAL" function

The CAL function allows the cell constants "CF" to be conveniently updated when the electrodes are increasingly contaminated in operation. For this, the reference measured value of a reliable sample is made the display value at the operating point. The internal evaluation then automatically calculates the cell constants "CF" again and corrects it.

⚠ ATTENTION

If the "CF" value (cell constant) 003.0 is exceeded, there is a warning message "CF.Hi".

- Clean the electrode as a matter of urgency, see page 59.
- Operation continues to be possible.

Note the setting instructions on page 40 and proceed as follows:

1. Determine a reference measured value for the current conductivity by means of a reliable sample in the operating point of the system.
2. Select the parameter "**CAL**".

   After this, the current value of the cell constant "CF" is shown first.
3. Press and hold the rotary knob until the current conductivity value flashes on the display.
4. Set the previously determined reference value (conductivity from the comparative sample) as the new display value.
5. Save your set value by pressing the rotary knob for approx. 1 second.

An adjustment to the "CF" to values over 005.0 is cancelled. "Quit" then appears on the display and the display reverts to the menu item "cal".
Now, it is compulsory to clean the electrodes as described on pages 58 and 59.

Bringing into service

Using the “FiLt” function

This function’s purpose is to “calm” the measured value for the controller function and the 4 - 20 mA actual output at the LRR1-60.

- If the limiter is deactivated (Id.Hi = 0), the adjustable time constant (1 - 30 seconds) also has an effect on the display at the conductivity electrode.
- If the limiter is activated (Id.Hi = 1 – 8), the filter does **not** have an effect on the limiter and no longer has an effect on the display. The time constant for the limiter is safety-relevant and fixed.

Note the setting instructions on page 40 and proceed as follows:

1. Select the parameter “**FiLt**”.

   After this, the current value of the filter constant is shown first.
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 scaling of 4 - 20 mA actual output at LRR 1-60

Note the setting instructions on page 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.

   The selectable measuring ranges are:

   - LRG1x-60: 0.5 - 20, 100, 200, 500, 1000, 2000 or 6000 µS/cm
   - LRG16-61: 50 - 3000, 5000, 7000, 9999 µS/cm
4. Save your set value by pressing the rotary knob for approx. 1 second.

Bringing into service

Changing the unit of the display value (µS/cm or ppm)

The unit of the displayed measured value can be switched between µS/cm and ppm (parts per million).

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

Note the setting instructions on page 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).

   Display of the set unit by means of LEDs:

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

Triggering a display test manually

Note the setting instructions on page 40 and proceed as follows:

1. Select the parameter "**diSP**".
2. Press and hold the rotary knob until the display test starts by showing "**....**".
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 the message "**donE**".

Replacing faulty equipment

Faulty equipment jeopardises system safety.

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

Bringing into service

Notes on bringing into service:

After installing a new or cleaned conductivity electrode, the parameter "**tC**" must be adapted to the boiler water. The value of the cell constant "**CF**" should be monitored and should have the value 0.210.

Comparing the measured value with the reference measurement of a reliable sample

Incorrectly installed or bent conductivity electrodes jeopardise the system safety through loss of function.

For each bringing into service and after each replacement of the LRG 1x-6x conductivity electrode, proceed as follows:

- Determine the current conductivity of the boiler water with a reference measurement from a monitored sample in the desired operating state of the system.
- Compare the measured value with the actual reference measured value.
- Never bring any system into operation without successfully checking the conductivity value.
- For new or cleaned electrodes and identified deviations, the parameter "**tC**" is to be changed until the displayed measured value corresponds with the reference measurement. Also see parameter description "**tC**" on page 44.
- LRG 1x-6x conductivity electrodes may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

Checking the alarm limit value Al.Hi by triggering a test function

Inspect the alarm limit value of the limiter function **Al.Hi** by triggering the test function by means of the rotary knob; see page 52.

In this case, the equipment must behave as if there were an alarm.

Lockout function

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

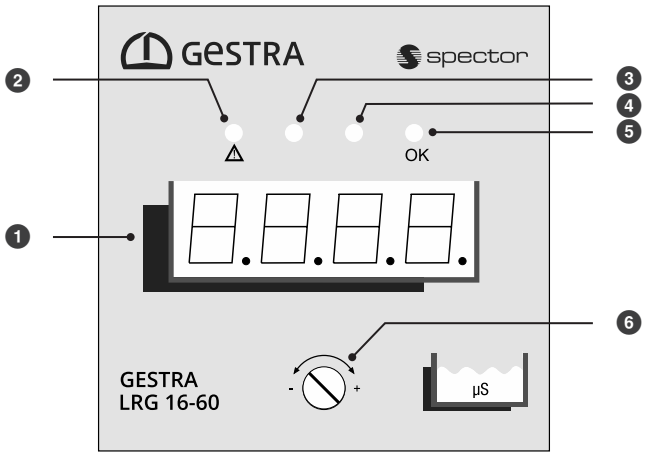


Fig. 20

The operating panel:

1. Display of actual value/fault code/limit value - green, 4 digits
2. LED 1, alarm/error, red
3. LED 3, unit µS/cm - green
4. LED 4, unit ppm - green
5. LED 2, function OK - green
6. Rotary knob/push-button for operation and settings

Notes on the display priority of the various messages

Error messages and alarms are displayed based on their priority. Messages with higher priority are shown continuously before those with low priority. if several messages need attention, the display does not alternate between them.

Priority 1 = Error messages according to fault code table, see page 54 ff.

Priority 2 = Conductivity MAX alarm

Priority of fault code display

Higher priority fault codes overwrite lower ones on the display!

Start, operation, alarm and test

Allocation of display and LEDs to each operating state of the conductivity electrode:

Start		
Switch on supply voltage	All LEDs light up - test **Display:** S-xx = Software version t-04 = Equipment type LRG 1x-60 t-05 = Equipment type LRG 16-61	The system is started and tested. The LEDs and display are tested.

Normal operation		
The conductivity electrode is immersed	**Display:** 1234 **LED 1:** is Off **LED 3 or 4**: lights up green	Display of the current, temperature-compensated conductivity Display of the set unit
	LED 2: flashes green	The equipment is performing a self-test *
	LED 2: lights up green	The self-test is complete - the equipment is OK
	* During the self-test phase, the measured value is not updated.	

See the following pages for more information and tables.

Behaviour on the occurrence of alarms		
The conductivity electrode is immersed The conductivity limit value is exceeded = Alarm limit value AL.Hi	**Display:** Hi.C and 1234 alternately **LED 1**: Alarm LED lights up red	The alarm signal and the actual measured value are displayed alternately The MAX alarm is active
	LED 3 or 4: lights up green	Display of the set unit
	LED 2: flashes green	The equipment is performing a self-test
	LED 2: is OFF	MAX alarm occurrence
■ The alarm state is transferred to the URS 60/URS 61 safety control unit via CAN data telegram. ■ Once the time delay has elapsed, the alarm signal triggers the safety shutoff. ■ The signal outputs are activated. ■ The URS 60/URS 61 safety control unit does not automatically lock the safety contacts.		

Behaviour in the event of an error (fault code display)		
The conductivity electrode is immersed or not immersed. There is an error.	**Display:** e.g. E005 **LED 1**: Alarm LED lights up red	A fault code is permanently displayed; fault code display see page 54 There is an active error
	LED 3 or 43: lights up green	Display of the set unit
	LED 2: flashes green	The equipment is performing a self-test
	LED 2: is OFF	Error or internal fault
■ The error or fault state is transferred to the URS 60/URS 61 safety control unit via CAN data telegram. ■ The error causes this unit to execute the safety shutoff without a delay. ■ The URS 60/URS 61 safety control unit does not automatically lock the safety contacts.		

Electrode alarms and errors faults cannot be acknowledged.

When the alarm or error is cancelled the display also goes blank, and the URS 60/URS 61 safety control unit closes the safety contacts again.

<table>
<tr><th colspan="3">Test</th></tr>
<tr><th colspan="3">Checking the safety function by simulating the alarm state</th></tr>
<tr><td rowspan="5">In operating mode:
Press the rotary knob on the LRG 1x-6x and hold until the end of the test
or
press associated button 1, 2, 3 or 4 of the URS 60/URS 61 safety control unit and hold until the end of the test
or
trigger the limiter test for the LRG 1x-6x conductivity electrode on the URB 60
or
trigger the test function at the SPECTORcontrol.</td><td>Display:
Hi.C and 1234 alternately
LED 1:
Alarm LED lights up red</td><td>The alarm signal and the actual measured value are displayed alternately

The MAX alarm is active</td></tr>
<tr><td>LED 3 or 4: lights up green</td><td>Display of the set unit</td></tr>
<tr><td>LED 2: flashes green</td><td>The equipment is performing a self-test</td></tr>
<tr><td>LED 2: is OFF</td><td>MAX alarm occurrence</td></tr>
<tr><td colspan="2">■ The URS 60/URS 61 safety control unit or the device combination behaves as if there were a real alarm; see page 51.
■ After the test simulation has been cancelled (letting go of the test button), the test is concluded and the equipment goes back to normal operation.</td></tr>
</table>

Faulty equipment jeopardises system safety.

- If the conductivity electrode does not behave as described above, it may be faulty.
- Perform failure analysis.
- LRG 1x-6x conductivity electrodes may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

System errors

Causes

System errors occur if CAN bus components have been incorrectly installed or configured, if the equipment has overheated, if there is interference in the supply network or if electronic components are faulty.

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?
- Is the bus line polarity correct throughout?
- Is a 120 Ω terminating resistor terminated at the terminal devices of the CAN bus line?

Configuration of the conductivity electrodes:

- Is the conductivity electrode set to the correct limiter ID 1,2,3,4,5,6,7,8?
- Limiter IDs must not be assigned in duplicate.

Baud rate:

- Is the cable length correct for the set baud rate?
- Is the baud rate identical for all units?

⚠ ATTENTION

Interrupting the CAN bus causes a system shutdown and triggers an alarm.

- Bring the system into a safe operating mode before commencing work on the system 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.

System errors

Indication of system malfunctions using fault codes

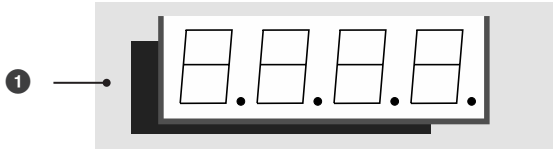


Fig. 21 ❶ Display of actual value/fault code/limit value - green, 4 digits

Fault code table			
Fault code	**Internal designation**	**Possible faults**	**Remedy**
E.001	LFKurzschlussErr	Short circuit in the LF measurement (electrode wires)	Replace the conductivity electrode
E.002	LFKabelbruchErr	Cable break in the LF measurement (electrode wires)	Check installation location. Is the electrode immersed? Replace the conductivity electrode
E.003	Ch1Ch2LFDiffErr	Difference of the redundant measuring channels of the LF measurement too high	Replace the conductivity electrode
E.004	PtMinTempErr	Minimum temperature at Pt1000 fallen below or short circuit	Check installation location. Replace the conductivity electrode
E.005	PtMaxtempErr	Maximum temperature at Pt1000 exceeded or cable break	Check installation location. Replace the conductivity electrode
E.006	Ch1Ch2PtDiffErr	Difference of redundant Pt1000 measurement too high	Replace the conductivity electrode
E.007	USIGTSTErr	Measuring voltage of test signal outside limits	Replace the conductivity electrode
E.008	ISIGTSTErr	Measuring current of test signal outside limits	Replace the conductivity electrode
E.009	ADCTSTErr	Measuring voltage of Pt1000 test outside limits	Replace the conductivity electrode
E.010	ICONErr	Measuring current of Pt1000 test outside limits	Replace the conductivity electrode
E.011	ADVTSTErr	Comparison of AD converter 12 bit/16 bit outside tolerance	Replace the conductivity electrode
E.012	FREQTSTErr	Frequency of test signal outside limits	Replace the conductivity electrode
E.013	VMessErr	Control voltage of 4-20 mA output (only LRGT models)	Replace the conductivity electrode

System errors

Fault code table			
Fault code	**Internal designation**	**Possible faults**	**Remedy**
E.014	ADSReadErr	16 bit AD converter not responding	Replace the conductivity electrode
E.015	UnCalibErr	Calibration invalid	Replace the conductivity electrode
E.017	ENDRVErr	Second shutoff path of 4-20 mA current output faulty	Replace the conductivity electrode
E.018	V12NegErr	System voltage -12 V outside limits	Replace the conductivity electrode
E.019	V6Err	System voltage 6 V outside limits	Replace the conductivity electrode
E.020	V5Err	System voltage 5 V outside limits	Replace the conductivity electrode
E.021	V3Err	System voltage 3 V outside limits	Replace the conductivity electrode
E.022	V1Err	System voltage 1 V outside limits	Replace the conductivity electrode
E.023	V12Err	System voltage 12 V outside limits	Replace the conductivity electrode
E.024	CANErr	Communication failure	Check the baud rate, wiring and terminating resistors
E.025	ESMG1Err	µC fault	Replace the conductivity electrode
E.026	BISTErr	µC periphery self-test fault	Replace the conductivity electrode
E.027	OvertempErr	PCB/ambient temperature > 75 °C	Check installation location. Lower the ambient temperature of the terminal box (cool if necessary)

All fault codes not listed here, e.g. E.016, are available as reserves

Virtually all of the aforementioned fault codes can be caused by EMC interference. This is less likely to be the case in the event of permanent faults, but should be considered for sporadic fault messages.

The installation should then be examined for a correctly wired shield and the general EMC before the electrode is replaced.

System errors

Errors without shutoff

The displayed conductivity fluctuates, moisture in the area of the cover tube of the electrode	
Possible causes if no fault messages are present	**Remedy**
From outside, moisture enters into the cover tube.	■ Check the installation location for possible water leakages from which the water/steam could enter into the conductivity electrode. ■ Check the seal of the conductivity electrode. ■ Is the containment of the electrode executed as per the specifications? ■ Only replace the conductivity electrode with equipment from GESTRA AG that is identical in construction.
The inner seals of the electrode rods are damaged.	■ Only replace the conductivity electrode with equipment from GESTRA AG that is identical in construction.

The displayed conductivity shows rare but sporadically recurring extreme values.	
Possible causes if no fault messages are present	**Remedy**
The electrode rods are not permanently immersed.	■ Check the executed installation using the Manual. ■ Note the installation examples and the specified minimum distances.

Flashing values from t-71 to t-75 appear on the display	
Possible causes	**Remedy**
The ambient temperature of the terminal box of the electrode is high, between 71 °C and 75 °C. If the temperature rises above 75 °C, the fault code E.027 (OvertempErr) appears and the system is shutoff.	■ The ambient temperature in the area of the terminal box must be reduced, e.g. by cooling.

The message CF.Hi flashes on the display	
Possible causes	**Remedy**
The cell constant is inadmissibly high after the calibration procedure “CAL” or after manual adjustment LRG 1x-6x CF > 3.0	■ Remove the conductivity electrode; see page 58. ■ Check and clean the electrode; see page 59

System errors

Checking installation and function

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

- Checking installation and function.
- Perform an equipment test; see page 52. In this case, the equipment must behave as if there were an alarm.
- When bringing into service and after each replacement of the LRG 1x-6x conductivity electrode the displayed measured value and the set alarm limit value must be checked and an equipment test must be performed.

System errors in the LRG 1x-6x conductivity electrode also trigger a system error in the URS 60/URS 61 safety control unit. The output contacts open without a delay and the relevant signal output is activated.

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

In the event of errors 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 sudden escape of hot steam.

Hot steam or hot water can escape suddenly if conductivity electrodes are unscrewed under pressure.

- Reduce the boiler pressure to 0 bar and check the pressure before unscrewing the conductivity electrodes.
- Only remove conductivity electrodes at a boiler pressure of 0 bar.

⚠ WARNING

Hot conductivity electrodes can cause severe burns.

The conductivity electrodes are extremely hot during operation.

- Perform installation and maintenance work only on conductivity electrodes that have 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. Unplug the connections of the CAN bus control lines and plug them into one another.
5. Next, remove the conductivity electrode.

An alarm is triggered when the CAN bus cable is interrupted.

Cleaning the conductivity electrode

Monthly comparison of the measured values

In line with the recommendations about monitoring the equipment to protect the water quality from standards DIN EN12952/12953, the measured values must be compared on a monthly basis with reliable samples by an appropriately qualified and competent person.

If a deviation is discovered, the conductivity electrode must be compared via the "**CAL**" function; see page 45.

Cleaning interval

Depending on the operating behaviours, it is recommended that the electrode is cleaned at least once a year, e.g. as part of maintenance work.

To clean the measuring electrode(s), the conductivity electrode must be taken out of operation and removed; see page 58.

LRG 16-60/LRG 17-60

1. Loosen the threaded pin Ⓙ and unscrew the measuring tube Ⓚ by hand.
2. Clean the electrode rod and the measuring surfaces.
3. Then screw the measuring tube Ⓚ back on and secure it with the threaded pin Ⓙ *.

LRG 16-61

1. Clean the measuring electrodes Ⓚ*.

   Continue with the following points:

   *Ⓙ / Ⓚ = *Key to the overall view; see page 25*

LRG 16-60, LRG 17-60, LRG 16-61

1. Use a fat-free cloth to wipe off loose deposits.

   Remove stubborn deposits with sandpaper (medium grade).
2. Install the cleaned conductivity electrodes according to the information on page 29.
3. Switch on the supply voltage.
4. Put the equipment or the system into operation; see page 40.
5. Compare the measured value with the directly determined conductivity from a reference measurement; see page 48.
6. Check the safety function by simulating the alarm state; see page 48 / 52.

Disposal

The statutory waste disposal provisions must be observed when disposing of conductivity electrodes.

Returning decontaminated equipment

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

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

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

The return confirmation and decontamination declaration 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 AG know about the return beforehand by e-mail or phone.
2. Wait until you have received the return confirmation from GESTRA.
3. Return the goods to GESTRA AG together with the completed return confirmation (and decontamination declaration).

EU Declaration of Conformity

We hereby declare that the LRG 1x-6x conductivity electrode conforms to the following European Directives:

- Directive 2014/68/EU EU Pressure Equipment Directive
- Directive 2014/35/EU Low Voltage Directive
- Directive 2014/30/EU EMC Directive
- Directive 2011/65/EU RoHS Directive

Please see our Declaration of Conformity for details on the conformity of our equipment with European Directives.

The current Declaration of Conformity can be found on the Internet at www.gestra.com or requested from us.

For your notes

GESTRA®

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