GESTRA®

Conductivity Electrodes

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

EN
English

Installation & Operating Manual

819878-01

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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

Pre-wired cable:

- 0.5 m socket/pin 1501021
- 1.0 m socket/pin 1500969
- 2.0 m socket/pin 1500970
- 5.0 m socket/pin 1500971
- 10 m socket/pin 1500972
- 5.0 m socket/open 1500973
- 15 m socket/open 1500974
- 5.0 m pin/open 1500975
- 15 m pin/open 1500976
- 120 Ω terminating resistor, M12 connector 1500977
- 120 Ω terminating resistor, M12 socket 52598

How to use this Manual

This Installation & Operating Manual describes the correct use of LRG 16-60/LRG 16-61/LRG 17-60 conductivity electrodes. It applies to all persons who integrate this equipment into control systems, install, bring into service, operate, maintain and dispose of this equipment. Anyone carrying out the above-mentioned activities must have read this Installation & Operating Manual and understood its contents.

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

Availability of this Installation & Operating Manual

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

Illustrations and symbols used

1. Action to be taken
2.

- Lists
  - ◆ Bullet points in lists

Ⓐ Keys to illustrations

	Additional information
	Read the relevant Installation & Operating Manual
	Press the rotary knob

Hazard symbols in this Manual

	**Danger zone/Dangerous situation**
	**Danger of death from electric shock**

Types of warning

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ ATTENTION

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

Specialist terms/Abbreviations

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

IEC 61508

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

SIL (safety integrity level)

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

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 liquids.

LRG 1x-6x conductivity electrodes are used in combination with the URS 60/URS 61 safety control unit as conductivity limiters and in combination with an LRR 1-60 conductivity controller as continuous blowdown controllers and limit indicators in steam boiler and hot water installations.

- 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 18 and "Example name plate/Identification of the LRG 1x-60" on page 21.
- Visualisation and operation take place via a URB 60 or SPECTOR*control* operating terminal.

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 01.03.2019 and are no longer updated. They have been 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 integrity level

In accordance with standards EN 12952, EN 12953 and IEC 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 limiters	Control unit as continuous blowdown controller, limit indicator or automatic intermittent blowdown	Operating unit
SIL 2 to IEC 61508	LRG 16-60 LRG 17-60 LRG 16-61	URS 60 URS 61	–	URB 60, SPECTOR *control*
Without SIL as per IEC 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, please 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: www.gestra.com

Improper use

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

Do not use the equipment in potentially explosive atmospheres.

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

The name plate indicates the technical features of the equipment.

Basic safety notes

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 a **boiler pressure of 0 bar**.

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 when the conductivity electrodes have been allowed to cool.

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

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

Danger to life from faulty LRG 1x-6x conductivity electrodes due to the sudden escape of hot steam or hot water.

Jolts or impacts during transport or installation can damage the LRG 1x-6x conductivity electrodes, 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 completely undamaged.
- When bringing it into service, check that it is leak-tight.

Attempts to repair the equipment will cause the plant 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

A lack of proper maintenance and cleaning can result in damage to the conductivity electrodes and/or false 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 66.

Required personnel qualifications

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

Fig. 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 elements of a safety circuit up to SIL 2 as per IEC 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 shutdown)

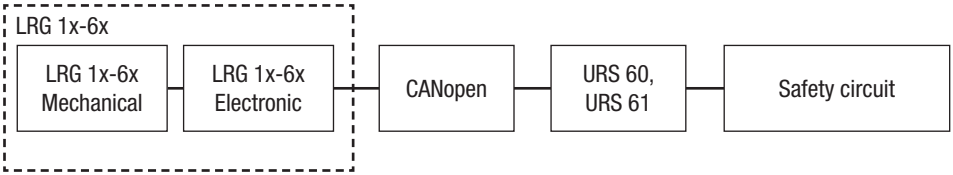


Fig. 3

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 is initiated on site using the rotary knob integrated in the terminal box, see page 58.

In addition, the test function can be triggered remotely on the URS 60/URS 61 or the external URB 60 or SPECTOR*control* operating units.

Reliability data to IEC 61508

Description	Characteristic values	
Type of electrode	**LRG 1x-60**	**LRG 16-61**
Safety integrity level	SIL 2	SIL 2
Architecture	1oo1	1oo1
Type of equipment	Type B	Type B
Hardware fault tolerance	HFT = 0	HFT = 0
Overall failure rate for dangerous undetected failures	$\lambda_{DU} = < 20 * 10^{-8}$ 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
Mean time to failure	MTTF > 10 a	MTTF > 10 a
Diagnostic interval	T2 = 1 hour	T2 = 1 hour
Performance level (to ISO 13849)	PL = d	PL = d
Probability of 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 electrically conductivity of conductive fluids.

Measuring process of the LRG 16-60 and LRG 17-60

LRG 16-60 and LRG 17-60 conductivity electrodes 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 LRG 16-61

The LRG 16-61 conductivity electrode use 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 (25 °C).

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

Use

LRG 1x-6x conductivity electrodes are used in combination with the URS 60/URS 61 safety control unit as conductivity limiters and in combination with an LRR 1-60 control unit as continuous blowdown controllers in steam boiler and hot water installations.

Automatic self-test

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

The data are transferred to the URS 60/URS 61 safety control unit in the form of a black channel data telegram in the CANopen protocol via an ISO 11898 CAN bus.

Function

These data telegrams contain the following information:

- Conductivity reading, temperature-compensated
- Fluid temperature
- Limiter MAX setting
- Temperature coefficient (tC) and cell constant (CF)
- Limiter test command
- Status or error information
  - Conductivity electrode alarms if the limits are exceeded
  - Fault indications on the occurrence of faults in electronic or mechanical parts
  - Temperature in the terminal box of the conductivity electrode

Indications and signals, see page 55/60*

LRG 1x-6x conductivity electrodes have a green 4-digit, 7-segment display for showing readings, status information and error codes. Several coloured LEDs display the alarm state 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**" alternating with the conductivity **actual value**.

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 shutdown in the safety control unit. The URS 60 or URS 61 safety control unit does not perform lockout automatically.

LEDs 1 and 4 signal the corresponding MAX alarm, see page 56.

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 indications are updated with each self-test and are permanently stored in the error memory. If there are no faults, only the list of current faults and their display is deleted.

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

Electrode alarms and fault indications cannot be acknowledged.
When the alarm or fault indication is cancelled the display also goes blank, and the URS 60/ URS 61 safety control unit closes the safety contacts once more.

Function

Simulating the alarm state *

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

* The tables on page 55 ff. clearly show the relationship between the equipment status, the display and the alarm LEDs.

Setting parameters and changing factory settings

If necessary, you can adapt the conductivity electrode to suit conditions at the plant. You can set parameters and change factory settings using a rotary knob on the terminal box, see page 41.

Technical data

Model and mechanical connection

■ LRG 16-60, LRG 16-61, LRG 17-60	Thread G1 A, EN ISO 228-1, see Fig. 8, 10, 11

Nominal pressure rating, admissible service pressure and temperature

■ LRG 16-60	PN 40	32 bar (abs) at 238 °C
■ LRG 16-61	PN 40	32 bar (abs) at 238 °C
■ LRG 17-60	PN 63	60 bar (abs) 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, screw LRG 16-60, LRG 17-60	1.4571, X6CrNiMoTi17-12-2
◆ Spacer disc LRG 16-60, LRG 16-61, LRG 17-60	PEEK

Available electrode lengths (do not shorten)

■ 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
■ Fluid temperature measuring range	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 to 3000 ppm *
◆ Preferred measuring range	up to 1000 µS/cm
■ LRG 16-61	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

■ 1 second

Technical data

Measurement quality (figures for value ranges between the factory-set calibration points)

- **LRG 1x-60**

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%

- **LRG 16-61**

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**
■ 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 can be set via parameter tC, see page 47.

Supply voltage

- 24 V DC ± 20%

Power consumption

- Max. 7 W

Current input

- Max. 0.35 A

Internal fuse

- T2A

Safety cutout at excessive temperature

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

Electrode voltage

- < 500 mV (RMS) at no load

Technical data

Input/output

- Interface for CAN bus to 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 readings and status information
- 1 x red LED for indicating an alarm
- 3 x green LEDs for indicating the unit µS/cm or 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 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

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

Example name plate/Identification of the LRG 1x-60

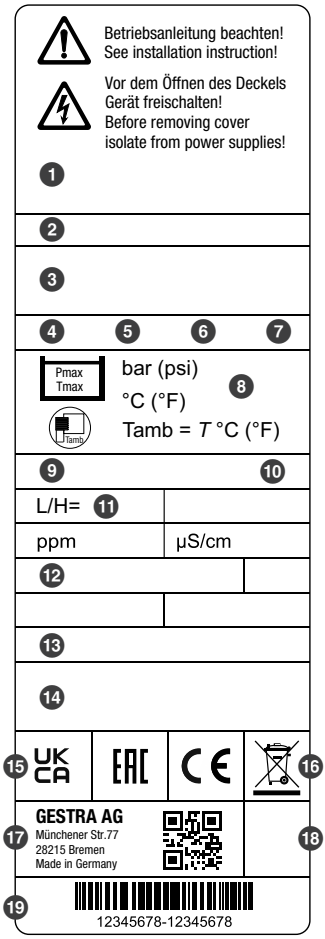


Fig. 5

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

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

Factory settings

LRG 1x-6x conductivity electrodes are delivered ex-works with the following settings.

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	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	
Password	PW	- - -	oFF	

Fig. 6

Overall view

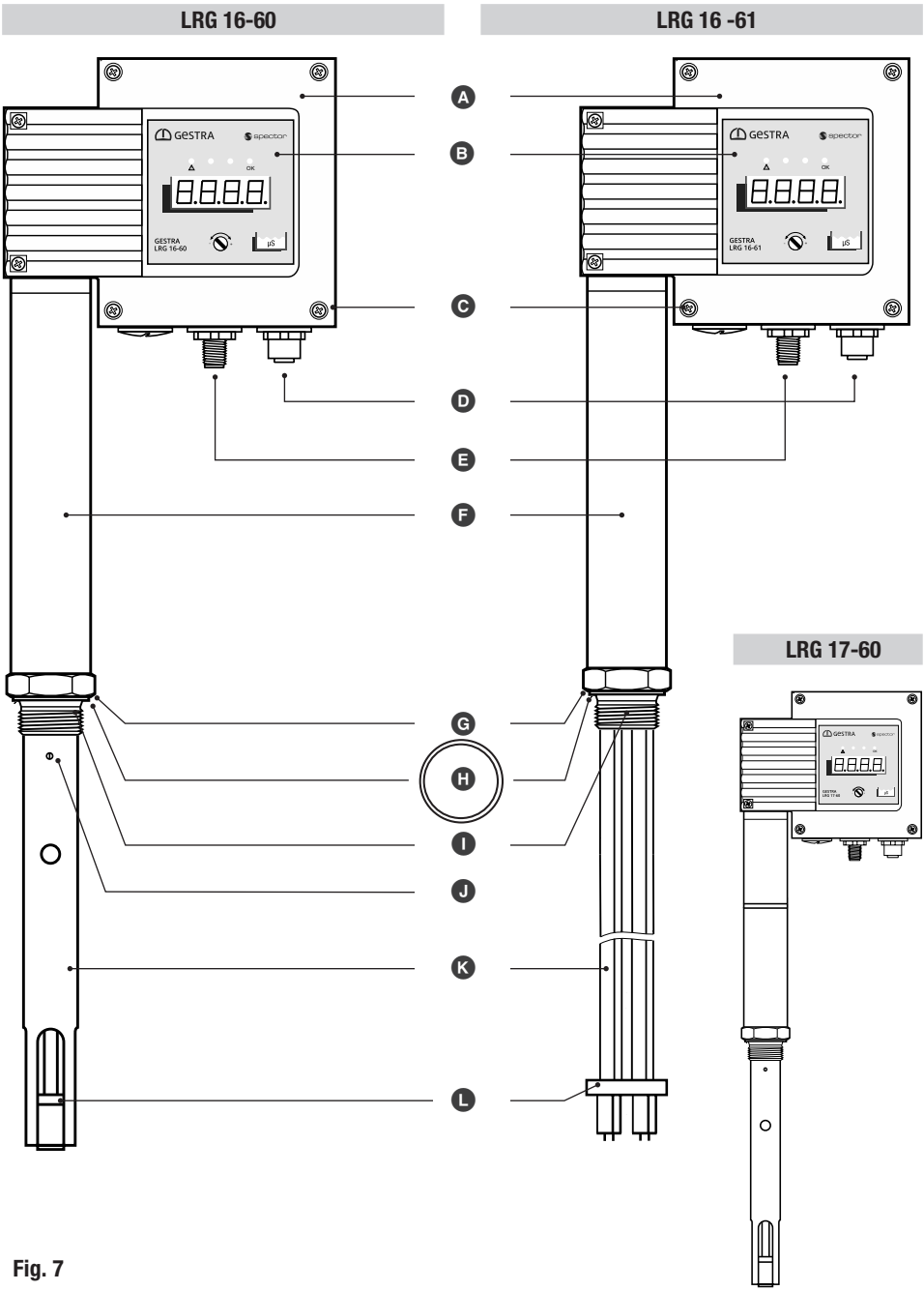


Fig. 7

Overall view

Key to Fig. 7

- Ⓐ Terminal box
- Ⓑ Operating panel with 4-digit LCD, alarm LEDs and rotary knob, see page 55
- Ⓒ 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 disc

Dimensions of the LRG 16-60

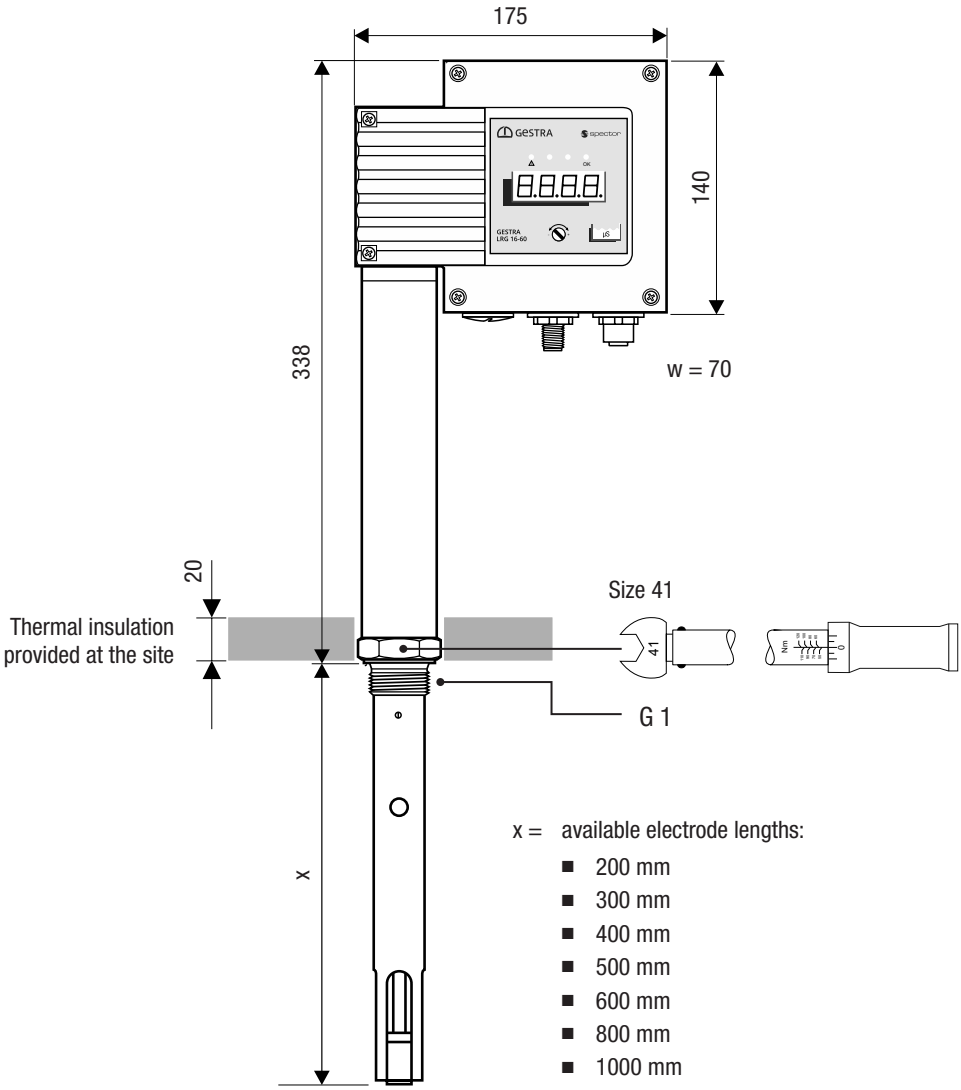


Fig. 8 All lengths and diameters in mm

Dimensions of the LRG 17-60

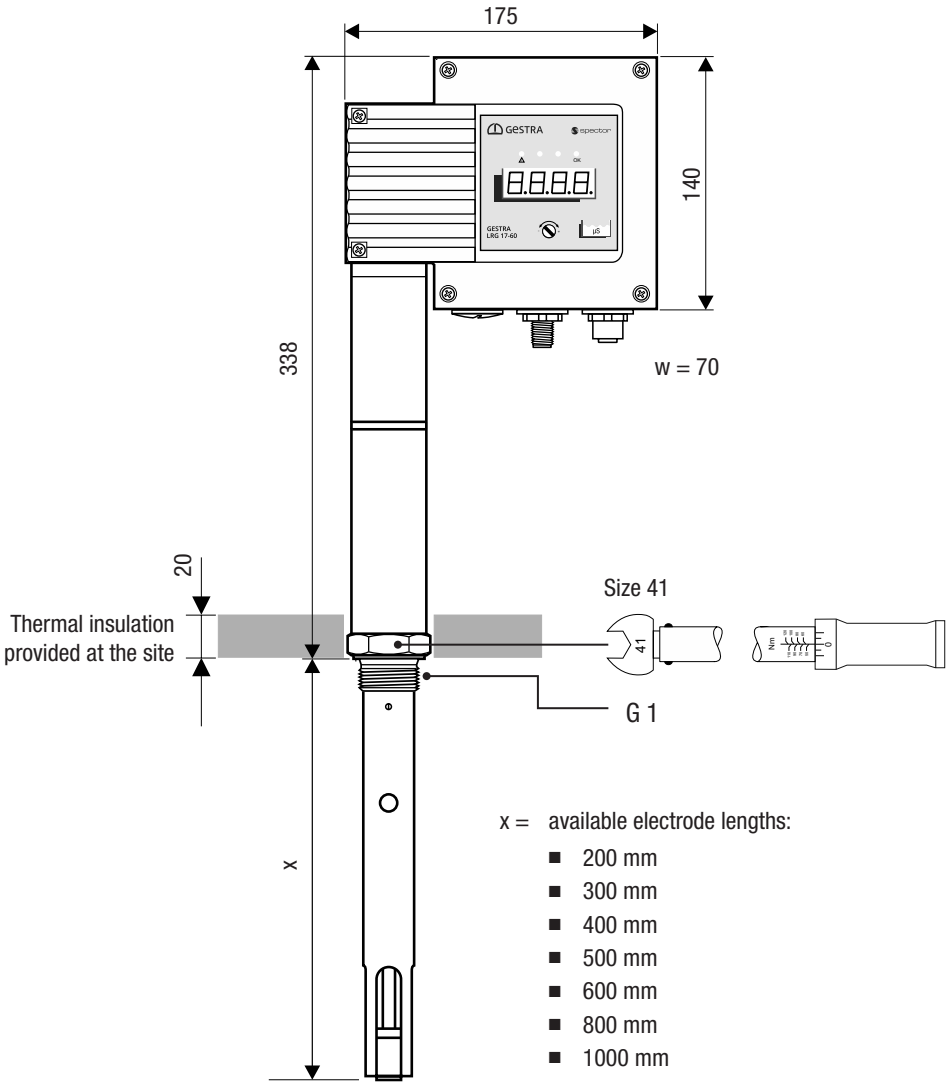


Fig. 9 All lengths and diameters in mm

Dimensions of the LRG 16-61

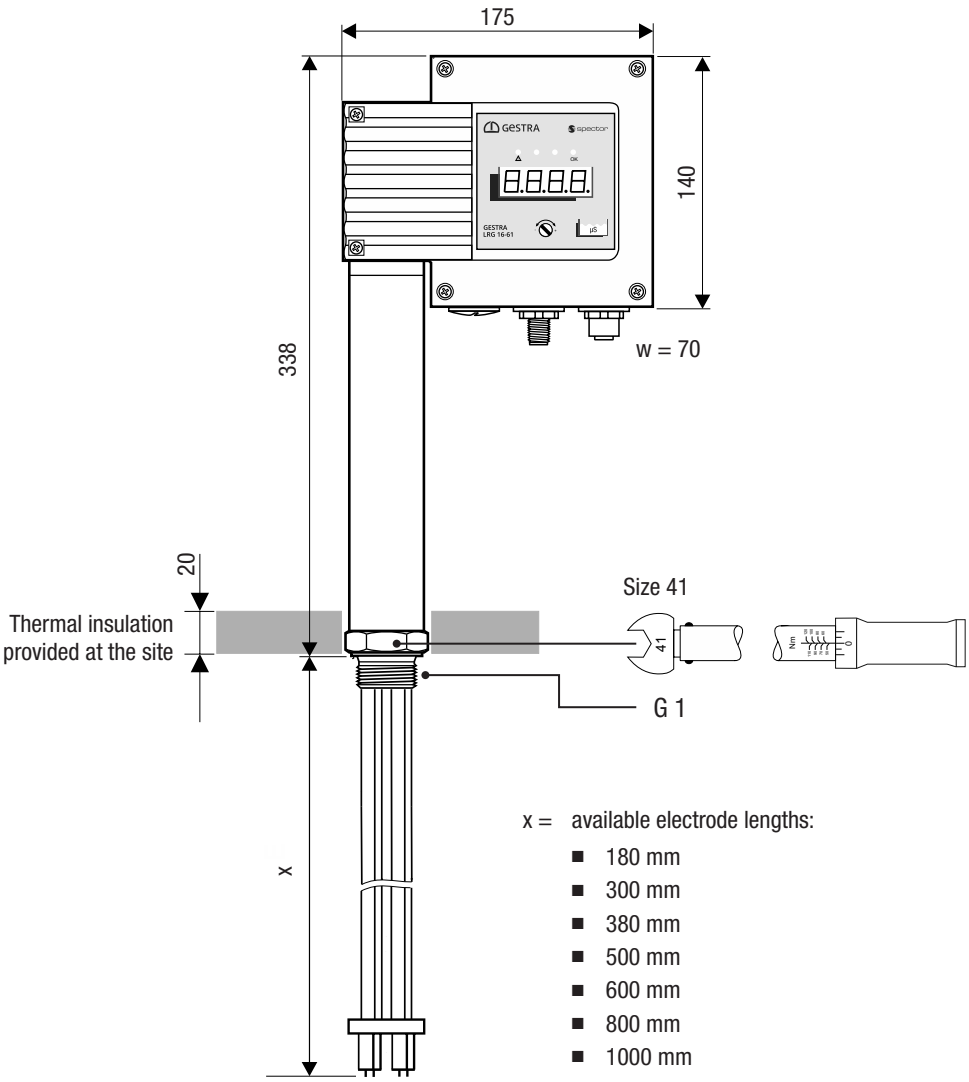


Fig. 10 All lengths and diameters in mm

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 plant parts to a central earthing point to prevent equalisation currents.
- Use a cover to protect the equipment from direct sunlight, condensation and heavy rain.
- Use UV-resistant cable ducts for routing the connecting cable.
- Take further measures to protect the equipment from harmful environmental influences such as lightning, insects and animals, and salty air.

You will need the following tools:

- Torque wrench (with size 41 open-ended spanner attachment), see pages 25 to 27 and page 31.

⚠ 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 under pressure.

- Reduce the boiler pressure to 0 bar and check it before you unscrew the conductivity electrode.
- Only remove the conductivity electrode 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 malfunctions in the plant or the conductivity electrode.

- Inspect the sealing surfaces of the tank standpipe or flange cover to ensure they are perfectly machined, see Fig. 11.
- Take care not to bend conductivity electrodes during installation!
- Do not subject the measuring electrodes to hard knocks during installation.
- Do **not** install the body Ⓐ or sheath Ⓕ of the measuring electrode in the boiler thermal insulation!
- Please note the installation dimensions of the conductivity electrode; see installation examples on pages 34 to 37.
- Check the boiler standpipe and flange during the preliminary boiler inspection.
- Tighten to the specified torques.

Additional notes for installation

⚠ ATTENTION

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

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

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

Therefore, always adhere to the distances stated below.

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 and any other metallic fittings, and the low water (LW) level.
- Do not shorten the measuring electrode or measuring tube.

LRG 16-61

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

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

   Sealing surfaces must be perfectly machined, as shown in Fig. 11.

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

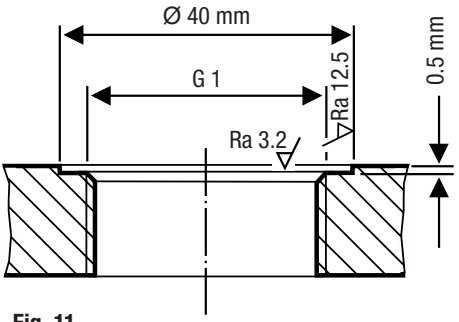


Fig. 11

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

Example LRG 1x-60

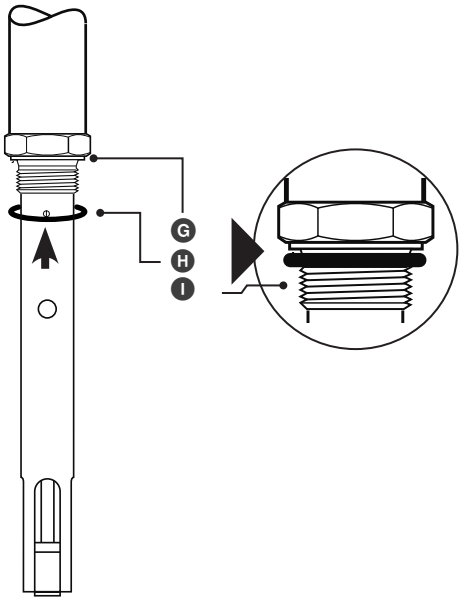


Fig. 12

⚠ 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® P40) to the electrode thread ❶.
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:

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

Installation examples with dimensions, see Fig. 14, Fig. 15, Fig. 16 on page ff. 34

Detaching the terminal box from the electrode

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

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

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

⚠ DANGER

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

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

- Cleaning the measuring electrodes of the conductivity electrode, see page 66.
- Taking out of service/Disassembly, see page 65

⚠ ATTENTION

Avoid open circuits, damage to terminals and subsequent short circuits

- When screwing the conductivity electrode into or out of the standpipe, take care not to twist or trap the connecting cables from the electrode to the terminal box!
- Therefore, detach the terminal block ❻ from the PCB.

Installation

Detaching the terminal box from the electrode

You will need the following tools:

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

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

   Interior view of terminal box:

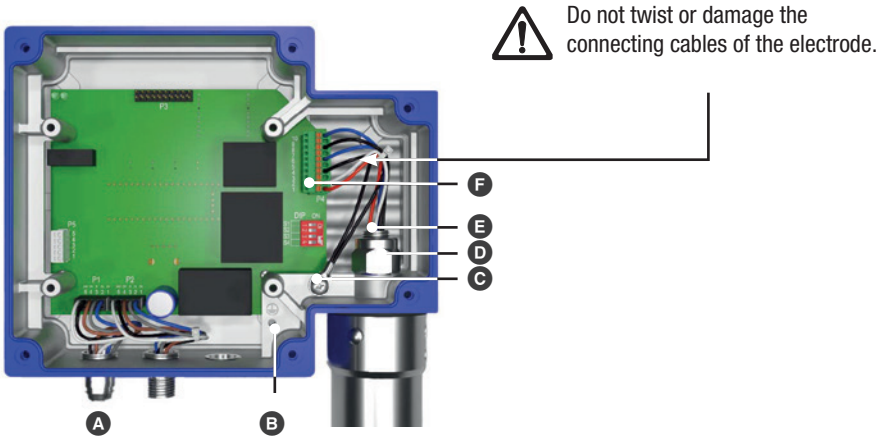


Fig. 13

Key:

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

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

Detaching the terminal box from the electrode

5. **During cleaning/maintenance (see page 66) or taking out of service (see page 65)**
   Unscrew the conductivity electrode from the tank standpipe.
6. **When installing for the first time or after cleaning/maintenance**
   Screw the conductivity electrode into the tank standpipe.

To do so, proceed as described on pages 30 / 31 (points 1. to 4.) above and adhere to the stated tightening torques.

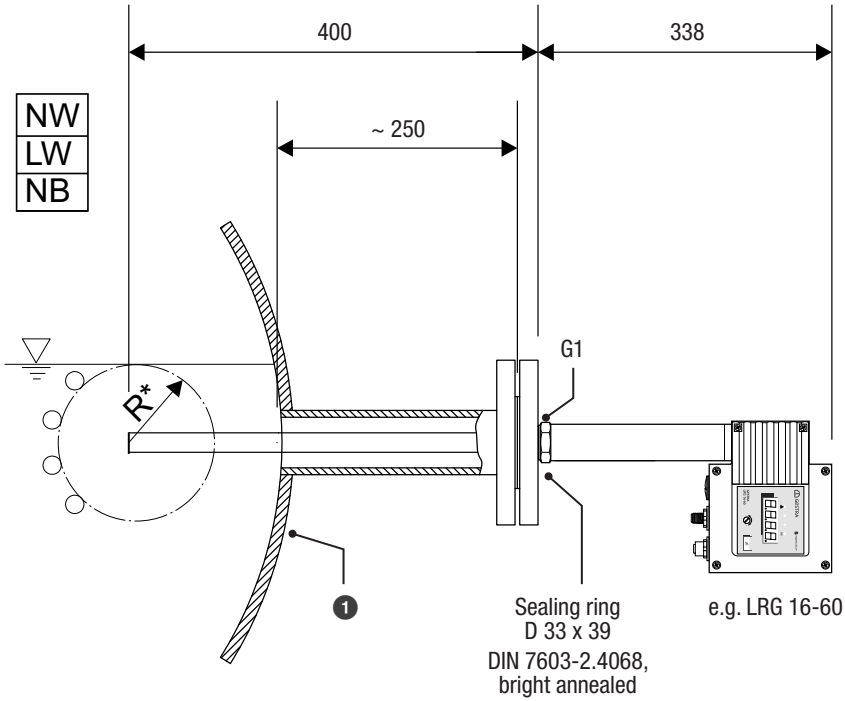
7. Rotate the terminal box so that it is correctly orientated.
8. Tighten the nut in the terminal box to a torque of 25 Nm.
9. Re-insert the connector in the terminal block F until you hear it click into place.
   The connector cannot be inserted the wrong way round. If necessary, use cable ties to tie the connecting cables together in the terminal box.
10. Screw the ring cable lug C firmly onto the terminal box.
11. Finally, check the wiring one more time.
12. Close the rear panel of the electrode terminal box and screw back on.

Installation examples with dimensions

Conductivity measurement

Installing the conductivity electrode via a flange on the side.

Key, see page 37



*** Minimum distances (R)**

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

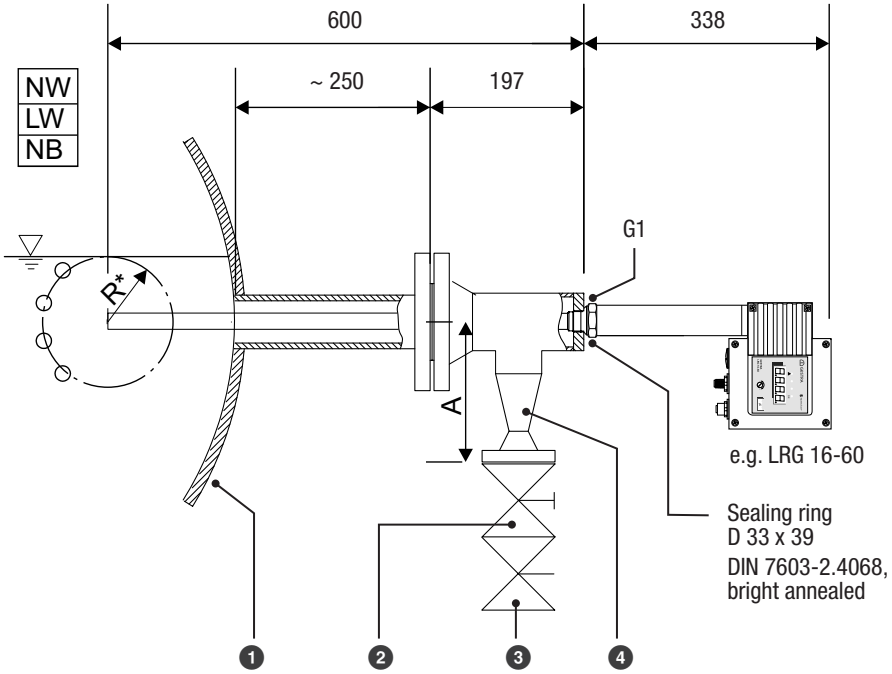
Fig. 14 All lengths and diameters in mm

Installation examples with dimensions

Conductivity measurement and continuous blowdown control

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

Key, see page 37



*** Minimum distances (R):**

- LRG 16-60/LRG 17-60 R = 30 mm
- LRG 16-61 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 level pot

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

Key, see page 37

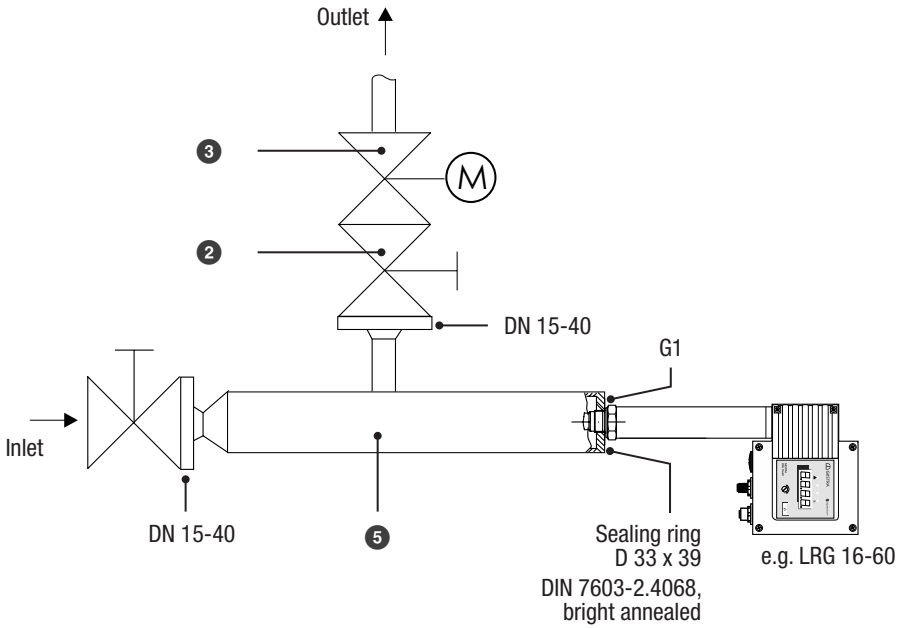


Fig. 16 All lengths and diameters in mm

Installation examples with dimensions

Key Fig. 14 to Fig. 16

1. Boiler drum
2. Stop valve GAV
3. Continuous blowdown valve BAE
4. 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 electrode's internal wiring.

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

If the terminal box needs to be rotated by **>180°**, proceed as described on pages 31 to 33.

Functional elements

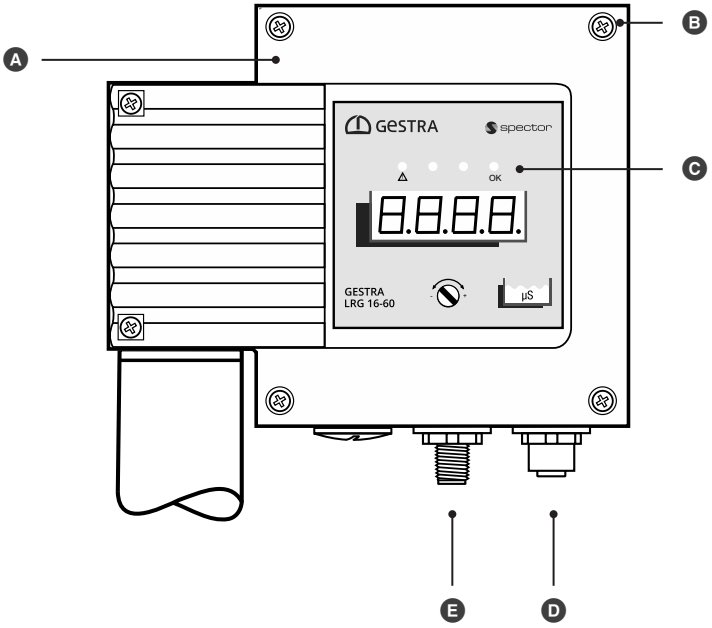


Fig. 17

- **A** Terminal box
- **B** Cover screws M4 x 16 mm
- **C** Operating panel with 4-digit LCD, alarm and status LEDs and rotary knob, see page 55
- **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

- Use 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 as the bus line.
- Pre-wired control cables (with connector and coupling) are available as accessories in various lengths.
- The baud rate (transmission speed) is determined by the line length between the bus terminal devices, and the conductor size is determined by the overall current 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.
- If using 5 sensors or more and a cable length of ≥ 100 m, the conductor size needs to be doubled to 1.0 mm².
- At larger distances of > 100m, the 24 V DC supply can also be connected on site.

Example

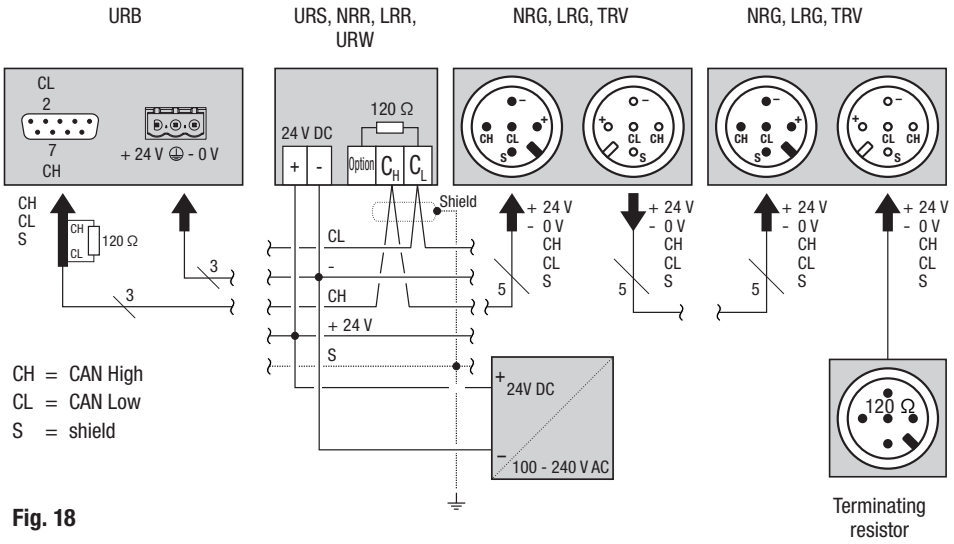


Fig. 18

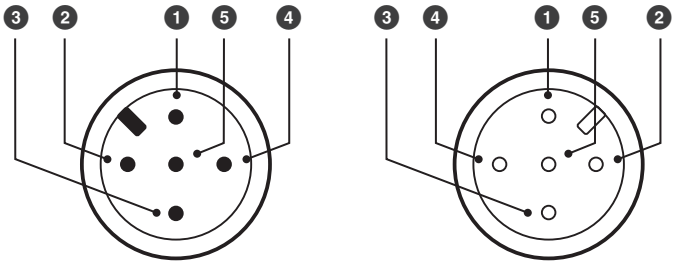
Connecting the CAN bus system

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!
- Use a central earth to prevent differences in potential between plant parts.
  - ◆ 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 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
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 each 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

Changing parameters with password protection enabled

When password protection is enabled, you must enter the password before changing parameters, see page 42. Password protection applies only to the menu items with parameters that the user can actually change.

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

Password protection after restarting the equipment

Parameters are also password-protected when the equipment has been restarted, if password protection was previously enabled, see page 52.

Default ex-works password

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

Bringing into service

Selecting and setting a parameter:

1. 

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

The display alternates between the set parameter and its actual value, e.g. Filt. → "value" → Filt.

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

1234 → Id.Hi → GrP → bd.rt → °C.in → °C.Pt → AL.Hi → CF → tC → CAL → FiLt → Sout → Unit → diSP → SGnL (*) → InFo → PW

*** SGnL (LRG 16-61 only)**

Key to parameters, see page 43.

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

2. 

Once you have selected a parameter, press and hold the rotary knob until:

- "**PASS**" appears on the display, prompting you to enter a password; move on to step **3**.

  or (password protection disabled)

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

With password entry:

3. Release the rotary knob.

4. 

Next, press and hold the rotary knob until "**0000**" appears on the display and the right-hand digit flashes.

5. 

Enter the password "**1902**". You can skip to the next flashing digit by briefly pressing the rotary knob.

– / + reduce/increase the value.

6. 

After the final digit, press and hold the rotary knob until "**donE**" is displayed.

The display then alternates between the selected parameter and its current value.

7. 

Press and hold the rotary knob until the current parameter value flashes on the display. Move on to step **8**.

Bringing into service

Without password entry:

8. 

Set the desired value.

- / + reduce/increase the value

Each parameter has an individual, admissible value range.

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

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

9. 

Save your settings by pressing the rotary knob for approx. 1 second.

The message "**donE**" is shown and the parameter appears on the display once more.

Pay attention to the time limit for password entry

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

Key to parameters:

- 11234 = reading display (normal operating state, example)
- Id.Hi = identifier for the limiter function (affects the URS 6x safety control unit)
- GrP = controller group, identifier of the control function (affects the URB 60/SPECTOR*control*)
- bd.rt = baud rate
- °C.in = display ambient temperature of terminal box
- °C.Pt = display temperature of monitored fluid
- AL.Hi = set alarm limit of limiter function
- CF = cell constant of electrode
- tC = temperature coefficient of monitored fluid
- CAL = calibration function for calibrating the display based on a reference value (sample)
- FiLt = filter constant
- Sout = scale of 4-20 mA actual output on the LRR 1-60 controller
- Unit = display unit (µS or ppm)
- diSP = initiate a display test
- SGnL = view signal reserve (**LRG 16-61 only**)
- InFo = view software version and equipment type
- PW = enable/disable password protection

Bringing into service

Display test for safety-relevant parameters

An initial display test takes place for some safety-relevant parameters (e.g. AL.Hi). Its aim is to prevent the entry of an incorrect value due to undetected faulty display segments.

Setting example, see page 46

Using the alarm limit for the limiter function (AL.Hi) as an example, here we show you the procedure for setting the parameters, including the display test, which is the same for all safety parameters.

A one-off display test opens a 10-minute time window, during which several safety-relevant parameters can be changed without the display test being repeated.

Manually initiating a display test.

Alternatively, you can initiate the display test by pressing "**diSP**", see page 51.

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

All CAN bus equipment from GESTRA AG has default ex-works parameter settings, 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 nodes.
- To apply changed communication parameters, perform the steps below on the URB 60 visual display and operating unit or the SPECTOR*control*:
  - **Reimport the list of equipment**

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

Pay attention to the setting instructions on page 42 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 setting by pressing the rotary knob for approx. 1 second.

Bringing into service

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.

Pay attention to the setting instructions on page 42 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).

   Relationship between ID and URS 60/URS 61 control unit

   ID 0001 to 0004 = limiter function 1-4 on the URS 60

   ID 0005 to 0008 = limiter function 1-4 on the URS 61
4. Save your setting by pressing the rotary knob for approx. 1 second.

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.

Pay attention to the setting instructions on page 42 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 setting by pressing the rotary knob for approx. 1 second.

Changing the alarm limit of the limiter function

Notes on setting the “AL.Hi” alarm limit

This setting only applies to the limit for safety shutdown by the URS 60/URS 61 safety control unit.

It does not affect the limit signal contacts of the LRR 1-60 conductivity controller.

Please also see the information in the relevant Installation & Operating Manual.

Pay attention to the setting instructions on page 42 and proceed as follows:

1. Select the parameter “**AL.Hi**”.
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**”.
6. When the display test is complete, the last digit of the limit value flashes.
7. Set the required limit:
   - LRG 1x-60: 0000–6000
   - LRG 16-61: 0000–9999
8. Save your setting by pressing the rotary knob for approx. 1 second.

A one-off display test opens a 10-minute time window, during which several safety-relevant parameters can be changed without the display test being repeated.

Replacing faulty equipment

Faulty equipment jeopardises plant safety.

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

Bringing into service

Changing the cell constant

Notes on calibrating the cell constant

The cell constant of each LRG 1x-6x conductivity electrode is precisely set at the factory. If recalibration is necessary at the installation site due to the conditions there, (see page 53, 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 indicated value in line with a reference reading from a reliable sample at the site.

Alternatively, you can perform recalibration using the convenient "**CAL**" function, see page 48.

Pay attention to the setting instructions on page 42 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 indicated value.
The indicated value will have decreased due to the build-up of deposits. You can compensate for this by increasing the "CF" value, as described in items 1 to 4 above

.

Changing the temperature coefficient

You can adjust the temperature coefficient of the monitored fluid manually, as long as an appropriate value has been established.
The factory setting of "2.1" is normally used for steam generating units with a constant pressure. For newly installed electrodes, this figure may need to be adapted in line with the temperature coefficient of the boiler water.

Pay attention to the setting instructions on page 42 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 value of "tC" lowers the indicated value.

Using the “CAL” function

The CAL function enables convenient readjustment of the cell constant “CF” when deposits build up on the electrode during operation. To do this, the reference reading of a reliable sample is converted into the indicated value at the operating point. The internal processor then automatically recalculates and corrects the cell constant “CF”.

⚠ ATTENTION

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

- The electrode urgently needs cleaning, see see page 66.
- Continued operation is possible.

Pay attention to the setting instructions on page 42 and proceed as follows:

1. Using a reliable sample, establish a reference reading of the current conductivity at the plant’s operating point.
2. Select the parameter “**CAL**”.

   First of all, the current cell constant “CF” is displayed.
3. Press and hold the rotary knob until the current conductivity value flashes on the display.
4. Set the reference value you previously established (conductivity from the reference sample) as the new indicated value.
5. Save your setting by pressing the rotary knob for approx. 1 second.

Attempts to change the “CF” to values over 005.0 will be aborted. “Quit” then appears on the display and the display reverts to the menu item “cal”.
The electrode now urgently needs cleaning, as described on pages 65 and 66.

Bringing into service

Using the “FiLt” feature

The aim of this feature is to “smooth” the reading for the controller function and the 4-20 mA actual output on the LRR1-60.

- If the limiter is deactivated (Id.Hi = 0), the adjustable time constant (1-30 seconds) also has an effect on the conductivity electrode display.
- If the limiter is activated (Id.Hi = 1–8), the filter does **not** have an effect on the limiter or on the display. The time constant for the limiter is safety-relevant and fixed.

Pay attention to the setting instructions on page 42 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 output on the LRR 1-60

Pay attention to the setting instructions on page 42 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:

   - LRG 1x-60: see Fig. 20 on page 50
   - LRG 16-61: see Fig. 21 on page 50
4. Save your setting by pressing the rotary knob for approx. 1 second.

Measuring ranges of the LRG 1x-60 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)	
Adjustable via the rotary knob on the operating panel.		4 mA equals	20 mA equals
This setting may only be made by the boiler manufacturer service or by specialist personnel authorised by the boiler manufacturer.	0.5-20	0.5	20
	1.0-100	0.5	100
	2.0-200	0.5	200
Maximum output load for actual value output = 500 ohm.	5.0-500	0.5	500
	10.0-1000	0.5	1000
	20.0-2000	0.5	2000
	60.0-6000	0.5	6000

Fig. 20

With the LRG 1x-60, 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 as necessary.

Measuring ranges of the LRG 16-61 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)	
Adjustable via the rotary knob on the operating panel.		4 mA equals	20 mA equals
This setting may only be made by the boiler manufacturer service or by specialist personnel authorised by the boiler manufacturer.	50-3000	50	3000
	50-5000	50	5000
	50-7000	50	7000
Maximum output load for actual value output = 500 ohm.	50-9999	50	9999

Fig. 21

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

5.

Bringing into service

Changing the display unit (µS/cm or ppm)

You can choose between µS/cm and ppm (parts per million) as the unit of the reading 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 42 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:

   - **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 42 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 jeopardises plant 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

Viewing the signal reserve "SGnL" (for LRG 16-61 only)

Pay attention to the setting instructions on page 42 and proceed as follows:

1. Select the parameter "**SGnL**".
2. The signal quality is shown in 0-100%. This continually declines as the build-up of deposits on the electrode tips increases.

When the signal quality is < 10% (factory setting), the LCD shows the "Actual value" alternating with "SG.Lo", see "System malfunctions" section on page 64.

Viewing the software version and equipment type "InFo"

Pay attention to the setting instructions on page 42 and proceed as follows:

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

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

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

Enabling/disabling password protection

The default ex-works password cannot be changed

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

Pay attention to the setting instructions on page 42 and proceed as follows:

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

The following may appear on the display:

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

7. Release the rotary knob.

   "**PW**" alternates with the current status, e.g. "**oFF or on**", on the display.
8. Press the rotary knob again until "**oFF** or **on**" flash on the display.
9. Turn the rotary knob and set the desired status.
   - **on** = password protection is enabled
   - **oFF** = password protection is disabled
10. Press and hold the rotary knob until "**donE**" is displayed.
11. Release the rotary knob.

    "**PW**" alternates with the set status, e.g. "**oFF** or **on**".
12. You can quit the menu by waiting (message "**quit**") or by turning the rotary knob to the actual value.

Note for bringing into service:

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

Comparing the reading with the reference reading from a reliable sample

⚠ ATTENTION

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

Whenever the LRG 1x-6x conductivity electrode is brought into service or replaced, proceed as follows:

- Establish the current conductivity of the boiler water using a reference measurement of a controlled sample at the desired plant operating point.
- Compare the reading with the actual reference reading.
- Never start up any plant that has not passed the above conductivity check.
- If electrodes are new or have been cleaned and discrepancies are found, change parameter "**tC**" until the indicated reading matches the reference measurement. Also see the description of parameter "**tC**" on page 47.
- LRG 1x-6x conductivity electrodes may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

Bringing into service

Checking the Al.Hi alarm limit by initiating a test function

Check the **Al.Hi** alarm limit of the limiter function by initiating the test function with the rotary knob; see page 58.

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.

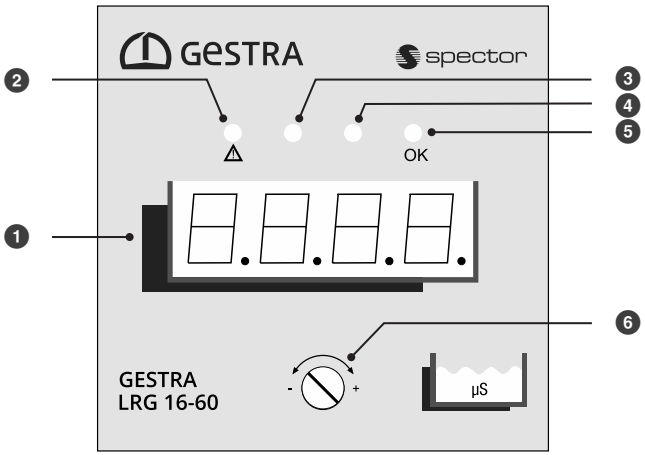


Fig. 22

The operating panel:

1. Actual value display/error code/limit value, green, 4 digits
2. LED 1, alarm/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 and alarms 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 1 = fault indications as per error code table, see page 60 ff.

Priority 2 = conductivity MAX alarm

Priority of error code display

Higher priority error codes overwrite lower priority ones on the display!

Starting, operation, alarm and testing

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

Starting		
Switch on supply voltage	All LEDs light up - Test **Indication:** 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	**Indication:** 1234 **LED 1:** is Off **LED 3 or 4**: lights up green	The momentary temperature-compensated conductivity is displayed The set unit is displayed
	LED 2: flashes green	The equipment performs a self-test *
	LED 2: lights up green	The self-test is complete - the equipment is OK

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

Behaviour in the event of alarms		
The conductivity electrode is immersed The conductivity limit is exceeded = AL.Hi alarm limit	**Indication:** Hi.C alternating with 1234 **LED 1**: Alarm LED lights up red	The alarm notification and current reading alternate on the display The MAX alarm is active
	LED 3 or 4: lights up green	The set unit is displayed
	LED 2: flashes green	The equipment performs a self-test
	LED 2: is OFF	MAX alarm

- The alarm state is transferred to the URS 60/URS 61 safety control unit via CAN data telegram.
- There, once the time delay has elapsed, the alarm notification triggers a safety shutdown.
- The signal outputs are activated.
- The URS 60/URS 61 safety control unit does not automatically lock the safety contacts.

See the following pages for more information and tables.

Behaviour in the event of a malfunction (error code display)		
The conductivity electrode is immersed or not immersed. There is a malfunction.	**Indication:** e.g. E005 **LED 1**: Alarm LED lights up red	An error code is continuously displayed, error code display see page 60 A fault indication is active
	LED 3 or 4: lights up green	The set unit is displayed
	LED 2: flashes green	The equipment performs a self-test
	LED 2: is OFF	Fault or internal error

- The fault or error state is transferred to the URS 60/URS 61 safety control unit via CAN data telegram.
- The fault triggers an immediate safety shutdown there.
- The URS 60/URS 61 safety control unit does not automatically lock the safety contacts.

Electrode alarms and fault indications cannot be acknowledged.

When the alarm or fault indication is cancelled the display also goes blank, and the URS 60/ URS 61 safety control unit closes the safety contacts once more.

Starting, operation, alarm and testing

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

<table>
<tr><th colspan="3">Testing</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 button 1, 2, 3 or 4 of the URS 60/URS 61 safety control unit and hold until the end of the test
or
initiate the limiter test for the LRG 1x-6x conductivity electrode on the URB 60
or
initiate the test function on the SPECTORcontrol.</td><td>Indication:
Hi.C alternating with 1234
LED 1:
Alarm LED lights up red</td><td>The alarm notification and current reading alternate on the display

The MAX alarm is active</td></tr>
<tr><td>LED 3 or 4: lights up green</td><td>The set unit is displayed</td></tr>
<tr><td>LED 2: flashes green</td><td>The equipment performs a self-test</td></tr>
<tr><td>LED 2: is OFF</td><td>MAX alarm</td></tr>
<tr><td colspan="2">■ The URS 60/URS 61 safety control unit or equipment behaves as if there were a real alarm; see page 56.
■ When you cancel the test simulation by releasing the test button, the test is finished and the equipment returns to normal operation.</td></tr>
</table>

Faulty equipment jeopardises plant 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 malfunctions

Causes

System malfunctions 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 connected to 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 cannot be assigned more than once.

Baud rate:

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

⚠ ATTENTION

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

- Bring the plant into a safe operating state before commencing work on the installation.
- Switch off the voltage to the plant and secure so that it cannot be switched back on.
- Check that the plant is not carrying live voltage before commencing work.

System malfunctions

Indication of system malfunctions using error codes

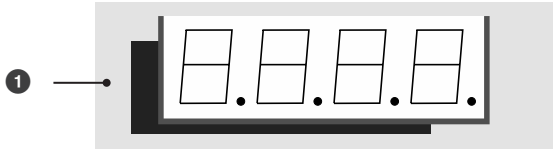


Fig. 23 ❶ Actual value display/error code/limit value, green, 4 digits

Error code table			
Error code	**Internal designation**	**Possible errors**	**Remedy**
E.001	LFKurzschlussErr	Short circuit in conductivity measurement (electrode wires)	Check the installation location. Have the minimum distances been adhered to? Is the electrode immersed? Are the electrode tips soiled? (LRG 16-61 in particular) > clean the electrode tips Replace the conductivity electrode
E.002	LFKabelbruchErr	Open circuit in conductivity measurement (electrode wires)	Check the installation location. Is the electrode immersed? Are the electrode tips soiled? (LRG 16-61 in particular) > clean the electrode tips Is the "**Sout**" parameter correctly set? Replace the conductivity electrode
E.003	Ch1Ch2LFDiffErr	Excessive difference between redundant conductivity measurement channels	Replace the conductivity electrode
E.004	PtMinTempErr	Pt1000 below minimum temperature or short circuit	Check the installation location. Compare the measured temperature reading with the plant temperature via the menu item "**°C.Pt**". Replace the conductivity electrode
E.005	PtMaxtempErr	Pt1000 above maximum temperature or open circuit	Check the installation location. Compare the measured temperature reading with the plant temperature via the menu item "**°C.Pt**". Replace the conductivity electrode
E.006	Ch1Ch2PtDiffErr	Excessive difference from redundant Pt1000 measurement	Replace the conductivity electrode

System malfunctions

Error code table			
Error code	**Internal designation**	**Possible errors**	**Remedy**
E.007	USIGTSTErr	Test signal measuring voltage outside tolerance	Replace the conductivity electrode
E.008	ISIGTSTErr	Test signal measuring current outside tolerance	Replace the conductivity electrode
E.009	ADCTSTErr	Pt1000 test measuring voltage outside tolerance	Replace the conductivity electrode
E.010	ICONErr	Pt1000 test measuring current outside tolerance	Replace the conductivity electrode
E.011	ADVTSTErr	12-bit/16-bit AD converter comparison outside tolerance	Check the installation location. Is the electrode immersed? Are the electrode tips soiled? (LRG 16-61 in particular) > clean the electrode tips
E.012	FREQTSTErr	Test signal frequency outside tolerance	Replace the conductivity electrode
E.013	VMessErr	Control voltage of 4-20 mA output (LRGT models only)	Is the current loop open or does it have reversed polarity? Check the pin assignment of the M12 connector. Check the current signal with a multimeter.
E.014	ADSReadErr	16-bit AD converter does not respond	Replace the conductivity electrode
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 current output faulty	Contact the Service department.
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

System malfunctions

Error code table			
Error code	**Internal designation**	**Possible errors**	**Remedy**
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 error	Replace the conductivity electrode
E.026	BISTErr	µC periphery self-test error	Replace the conductivity electrode
E.027	OvertempErr	PCB/ambient temperature > 75 °C	Check the installation location. Lower the ambient temperature of the terminal box (cool if necessary)

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

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

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

System malfunctions

Errors that do not provoke a shutdown

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

Rarely, the indicated conductivity shows extreme values that are sporadically repeated.	
Possible causes if no error codes are shown	**Remedy**
Electrode rods are not continuously immersed.	■ Check that the installation conforms to this Manual. ■ Pay attention to the installation examples and stated minimum distances.

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

The code CF.Hi flashes on the display	
Possible causes	**Remedy**
The cell constant is excessively high after the "CAL" calibration process or manual readjustment LRG 1x-6x CF > 3.0	■ Remove the conductivity electrode, see page 65. ■ Check and clean the electrode, see page 66

System malfunctions

The code “SG.Lo” flashes on the display	
Possible causes if no error codes are shown	**Remedy**
The measurement signal is too low and below the defined limit (factory setting: 10%).	■ Remove the conductivity electrode, see page 65 ■ Check and clean the electrode, see page 66 ■ **LRG 16-61 only** Check the signal quality using the menu item “**SGnL**” after cleaning and re-installing the electrode.

Checking installation and function

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

- Check installation and function.
- Perform an equipment test, see page 58. In this case, the equipment must behave as if there were an alarm.
- Check the indicated reading and set alarm limit and perform an equipment test when bringing into service and whenever the LRG 1x-6x conductivity electrode has been replaced.

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 error code.

In the event of malfunctions or faults that cannot be remedied with the aid of this Installation & Operating Manual, please contact our service centre or authorised agent in your country.

Taking out of service/Disassembly

⚠ DANGER

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

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

- Reduce the boiler pressure to 0 bar and check the pressure before unscrewing the conductivity electrodes.
- Only remove the conductivity electrode 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 line is interrupted.

If the terminal box needs to be rotated by **>180°** in relation to the electrode, proceed as described on pages 31 to 33 and detach the terminal box from the electrode.

Cleaning the conductivity electrode

Monthly comparison of readings

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

In the event of discrepancies, the conductivity electrode must be compared using the "**CAL**" function; see page 48.

Cleaning interval

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

Before cleaning the measuring electrode(s), take the conductivity electrode out of service and remove it, see page 65.

LRG 16-60, LRG 17-60

1. Undo the threaded pin Ⓙ and manually unscrew the measuring tube Ⓚ.
2. Clean the electrode rod and measuring surface.
3. Next, screw the measuring tube Ⓚ back on and secure it with the threaded pin Ⓙ *.

LRG 16-61

1. Clean the measuring electrodes Ⓚ*.

   Move on to the points below:

   *Ⓙ / Ⓚ *= key to overall view, see page 24*

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

1. Wipe off loose deposits with a grease-free cloth.

   Scrub off stubborn deposits using sandpaper (medium grain).
2. Fit the clean conductivity electrode as described on page 28.
3. Switch on the supply voltage.
4. Bring the equipment or plant into service, see page 41.
5. Compare the reading with the conductivity directly established from a reference measurement, see page 53.
6. Check the safety function by simulating the alarm state; see page 54 / 58.

Disposal

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

Returning decontaminated equipment

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

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

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

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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 certificates.

You can find our authorised agents around the world at:
www.gestra.com

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819878-01/10-2022cm (808950-01) · GESTRA AG · Bremen · Printed in Germany