

Level Electrodes

**NRG 16-61**

**NRG 17-61**

**NRG 19-61**

**NRG 111-61**

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## Content of this Manual

### Product:

- NRG 16-61 level electrode
- NRG 17-61 level electrode
- NRG 19-61 level electrode
- NRG 111-61 level electrode

### First edition:

BAN 819682-00/08-2019cm

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## Scope of delivery/Product package

- 1 x NRG 1x-61 level electrode
- 1 x sealing ring
  - ◆ D 27 x 32, form D, DIN 7603-2.4068, bright annealed for NRG 16-61, NRG 17-61, NRG 19-61
  - ◆ D 33 x 39, form D, DIN 7603-2.4068, bright annealed for NRG 111-61
- 1 x electrode extension
- 1 x measuring surface extension, optional
- 1 x Installation & Operating Manual

### Accessories

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

## How to use this Manual

This Installation & Operating Manual describes how to correctly use NRG 16-61, NRG 17-61, NRG 19-61 and NRG 111-61 level electrodes. It applies to 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.
- 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.

### **NRG .. / URS .. / URB .. / SRL .. / etc.**

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

### **SELV**

Safety Extra Low Voltage

## Usage for the intended purpose

NRG 1x-61 level electrodes are used in conjunction with the URS 60 / URS 61 safety control unit as safety high-level limiters for pressurised steam and hot-water plants.

- Safety high-level limiters prevent the defined maximum high water (HW) level from being exceeded, e.g. by switching off the feedwater supply.
- Visualisation and operation take place via the URB 60 operating unit or the SPECTOR*control*.

## Applicable directives and standards

NRG 16-61, NRG 17-61, NRG 19-61 and NRG 111-61 level 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:<br>General requirements |
| ■ EN 61508    | Functional safety of electronic systems                         |

### Standards documents:

- VdTÜV Bulletin BP WASS 0100-RL  
Requirements for water level control and limiting equipment



## Usage for the intended purpose

### Admissible system components, dependent on the required safety integrity level

In accordance with EU Pressure Equipment Directive 2014/68/EU and standards EN 12952, EN 12953 and EN 61508, and the technical rules of VdTÜV Bulletin BP WASS 0100-RL, the level electrodes can be operated with the following system components, as suitable for the required safety integrity level.

	Level electrodes for high water	Safety control unit as level limiter	Operating unit	Monitoring unit
<b>SIL 3</b> to EN 61508	NRG 16-61 NRG 17-61 NRG 19-61 NRG 111-61	URS 60 URS 61	URB 60 SPECTOR <i>control</i>	SRL 6-60

**Fig. 1**

#### Key to Fig. 1:

NRG = level electrode

URS = SPECTOR*connect* safety control unit

URB = visual display and operating unit

SRL = monitoring unit



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



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

- Only remove the level electrode at **0 bar boiler pressure**.



**Risk of severe burns when working on level electrodes that have not been allowed to cool. Level electrodes become very hot during operation.**

- Always allow level electrodes to cool.
- Perform all installation and maintenance work only on level electrodes that have been allowed to cool.



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

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



**Danger to life from faulty NRG 111-61 level electrodes due to the sudden escape of hot steam or hot water.**

Mistakes during transport or installation can cause the ceramic in the NRG 111-61 level electrode to break, so that hot steam or hot water escapes through the vent hole.

- Before and after installation, check that the level electrode is completely undamaged.
- When bringing the level electrode into service, check that it is tight.



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

- NRG 1x-61 level electrodes may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

## 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 brought into service by suitable, trained staff.
Operation	Boiler service technician	Staff trained by the plant operator.
Maintenance work	Specialist staff	Maintenance and setup work may only be performed by authorised staff who have undergone specific training.
Setup work	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.

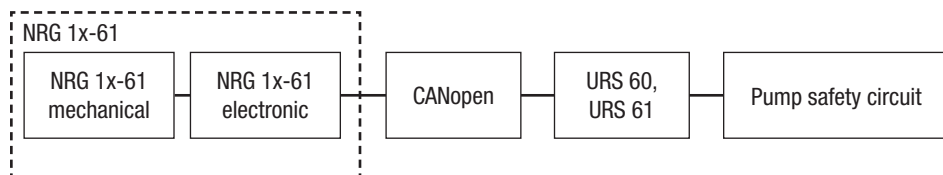
## Functional safety, safety integrity level (SIL)

In combination with the URS 60 / URS 61 safety control unit, NRG 16-61, NRG 17-61, NRG 19-61 and NRG 111-61 level electrodes are suitable for use with safety functions up to SIL 3.

They are each elements of a safety circuit up to a rating of SIL 3 as per EN 61508 in the SPECTOR*connect* system, and can transmit alarm notifications.

Combining them with accessories produces a type B subsystem. The technical and safety characteristics in Fig. 4 are based solely on NRG 1x-61 level electrodes.

### Breakdown of safety function failure rates (HW pump switch-off)



**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

Check level electrode function at least once a year by bringing the system to the maximum water level ( $T_1 = 1$  year), see page 52.

## Reliability data to EN 61508

Description	Characteristic values
Safety integrity level	SIL 3
Architecture	1oo1
Type of equipment	Type B
Hardware error tolerance	HFT = 0
Overall failure rate for dangerous undetected failures	$\lambda_{DU} = < 20 * 10^{-9} 1/h$
Overall failure rate for dangerous detected failures	$\lambda_{DD} = < 5000 * 10^{-9} 1/h$
Safe failure fraction	SFF > 99.0 %
Test interval	T1 = 1 year
Probability of failure on demand	PFD < $20 * 10^{-5}$
Diagnostic coverage. Percentage of dangerous failures detected by a test.	DC > 99.0 %
Mean time to failure	MTTF <sub>D</sub> > 30 a
Diagnostic interval	T2 = 1 hour
Performance level (to ISO 13849)	PL = d
Probability of failure per hour	PFH < $20 * 10^{-9} 1/h$
Ambient temperature as a basis for calculation	Tu = 60 °C
Mean time to repair	MTTR = 0 (no repair)
Fraction of undetected dangerous failures that have a common cause	beta = 2 %
Fraction of detected dangerous failures that have a common cause	beta d = 1 %

**Fig. 4**

## Function

If the water rises above the maximum level, the level electrode is immersed and the URS 60 / URS 61 safety control unit triggers an alarm. This “High Water (HW)” switchpoint is determined by the length of the electrode extension.

The level electrode monitors itself using the principle of conductive measurement. This means that a fault in the electrical connection or electronic measuring equipment also triggers an alarm.

The level electrode is installed inside pressurised steam systems, tanks or feed lines in pressurised hot-water plants. A protective tube provided on site keeps it functioning reliably (see page 33 “Installation examples”).

An NRG 1x-61 level electrode can be installed in a protective tube or level pot together with an NRG 1x-60 level electrode or continuous GESTRA NRG 26-60 level electrode.

If a level electrode is installed in a lockable level pot outside the boiler, the connecting pipes must be flushed regularly. An SRL 6-60 monitoring unit is additionally required to monitor the flushing times and flushing process.

If the steam pipe is  $\geq 40$  mm and the water pipe is  $\geq 100$  mm, installation is regarded as internal. In this case, upstream monitoring of flushing processes is not required.

An automatic self-test cyclically monitors the safety and function of the level 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 via a CAN bus to ISO 11898, and saved there.

### **These data telegrams contain the following information:**

- Alarm signals from the level electrode if water rises above the maximum level
- Fault indications in the event of faults in electronic or mechanical parts
- Excessive temperature in the level electrode terminal box

### **Behaviour in the event of an alarm**

The High Water alarm state is indicated by the NRG 1x-61 level electrode and transmitted to the URS 60 / URS 61 safety control unit via CAN bus. Once the time delay has elapsed, the alarm signal triggers the safety shutoff in the safety control unit. The safety control unit does not lock automatically during this process.

### **The safety circuit is interrupted without a delay if the following malfunctions occur:**

- Sensor malfunction (open circuit, short circuit, faulty component, excessive temperature)
- Communication failure

## Function

### Behaviour in the event of malfunctions

The safety functions of the equipment are monitored in the sensors through periodic self-tests. Fault indications are updated with each self-test. If there are no malfunctions, the display automatically goes blank. Alarm and fault indications are shown by LEDs or an operating unit. They are also saved in the level electrode and transferred to the URS 60 / URS 61 safety control unit using the CANopen protocol.

### Simulating the alarm state \*

The triggering of an alarm can be simulated by pressing the rotary knob of the NRG 1x-61, 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 pages 45 - 47 clearly show the relationship between the equipment status, the display and the alarm LEDs.

### Limit value settings

The limit value is set by shortening the electrode, see page 27.

## Technical data

### Model and mechanical connection

- |                        |   |
|------------------------|---|
| ■ NRG 16-61, NRG 17-61 | Thread G $\frac{3}{4}$ A, EN ISO 228-1, see Fig. 9  |
| ■ NRG 19-61            | Thread G $\frac{3}{4}$ A, EN ISO 228-1, see Fig. 10 |
| ■ NRG 111-61           | Thread G1 A, EN ISO 228-1, see Fig. 11              |

### Nominal pressure rating, admissible service pressure and temperature

- |              |        |                       |
|--------------|--------|-----------------------|
| ■ NRG 16-61  | PN 40  | 32 bar (g) at 238 °C  |
| ■ NRG 17-61  | PN 63  | 46 bar (g) at 260 °C  |
| ■ NRG 19-61  | PN 160 | 100 bar (g) at 311 °C |
| ■ NRG 111-61 | PN 320 | 183 bar (g) at 357 °C |

### Materials

- |                                   |                                |
|-----------------------------------|--------------------------------|
| ■ Terminal box                    | 3.2581 G AlSi12, powder-coated |
| ■ Sheath                          | 1.4301 X5 CrNi 18-10           |
| ■ Electrode extension             | 1.4401 X5 CrNiMo 17-12-2       |
| ■ Electrode insulation:           |                                |
| ◆ NRG 16-61, NRG 17-61            | PEEK                           |
| ◆ NRG 19-61                       | PEEK and PTFE                  |
| ◆ NRG 111-61                      | Special ceramics               |
| ■ Screw-in body:                  |                                |
| ◆ NRG 16-61, NRG 17-61, NRG 19-61 | 1.4571, X6CrNiMoTi17-12-2      |
| ◆ NRG 111-61                      | 1.4529, X1NiCrMoCuN25-20-7     |

### pH value

- |              |                         |
|--------------|-------------------------|
| ■ NRG 111-61 | Maximum admissible = 10 |
|--------------|-------------------------|

### Electrode lengths supplied

- 500 mm, 1000 mm, 1500 mm
- The electrode extension can be shortened

### Conductivity range at 25 °C

- |                                   |  |
|-----------------------------------|--|
| ■ NRG 16-61, NRG 17-61, NRG 19-61 | 0.5 $\mu$ S/cm to 10,000 $\mu$ S/cm                                |
| ■ NRG 111-61                      | 0.1 $\mu$ S/cm to 100 $\mu$ S/cm, with measuring surface extension |

### Sensitivity

- 0.1  $\mu$ S/cm at an immersion depth of 5 mm, with measuring surface extension

### Supply voltage

- 24 V DC +/-20 %

### Power consumption

- max. 7 VA



## Technical data

### Current input

---

- max. 0.3 A

### Internal fuse

---

- T2A

### Safety cutout at excessive ambient temperature

---

- Shutoff takes place at an excessive ambient temperature of  $\geq 75\text{ }^{\circ}\text{C}$

### Electrode voltage

---

- Approx. 2 V<sub>SS</sub> at no load

### 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 status information
- 1 x red LED for indicating an alarm
- 1 x green LED for indicating OK
- 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

---

- NRG 16-61, NRG 17-61, NRG 19-61 approx. 2.1 kg
- NRG 111-61 approx. 2.7 kg

### Admissible installation positions

---

- Vertical
- Oblique to a maximum inclination of 45°, the electrode rod is limited to a length of 1000 mm maximum.

# Name plate/Identification






Safety note →	 Betriebsanleitung beachten See installation instructions Voir instructions de montage		
Equipment designation →	<b>NRG 16 – 61</b>		
Equipment function →	Niveauelektrode Level electrode Électrode de niveau		
Nominal pressure rating, connection thread Material of screw-in body →	PN40 G3/4 1.4571	IP65	← IP rating
Admissible service pressure, admissible temperature →	 32 bar (464psi) 238°C (460°F)		
Admissible ambient temperature →	770°C (158 °F)		
Power consumption →	7 VA	24 V $\pm$ 20%	← Supply voltage
Data interface →	IN/OUT: CAN-Bus		
Safety integrity level →	IEC 61508 SIL 3		
Current approval →	TÜV. XXX . XX-XXX	 0525	← CE marking ← Appointed authority
Manufacturer →	<b>GESTRA AG</b> Münchener Str. 77 28215 Bremen GERMANY	 	← Protection class ← Disposal information
Serial number →			

Fig. 5



The date of production is stamped on the screw-in body of every level electrode.

## Name plate/Identification













	Betriebsanleitung beachten See installation instructions Voir instructions de montage		Betriebsanleitung beachten See installation instructions Voir instructions de montage		Betriebsanleitung beachten See installation instructions Voir instructions de montage						
<b>NRG 17 – 61</b>		<b>NRG 19 – 61</b>		<b>NRG 111 – 61</b>							
Niveauelektrode Level electrode Électrode de niveau		Niveauelektrode Level electrode Électrode de niveau		Niveauelektrode Level electrode Électrode de niveau							
PN63	G3/4	1.4571	IP65	PN160	G3/4	1.4571	IP65	PN320	G1	1.4529	IP65
		46 bar (667psi) 260°C (500°F)  770°C (158 °F)				100 bar (1450psi) 311°C (592°F)  770°C (158 °F)				183 bar (2654psi) 357°C (675°F)  770°C (158 °F)	
7 VA		24 V $\pm$ 20%		7 VA		24 V $\pm$ 20%		7 VA		24 V $\pm$ 20%	
IN/OUT: CAN–Bus		IN/OUT: CAN–Bus		IN/OUT: CAN–Bus		IN/OUT: CAN–Bus		IN/OUT: CAN–Bus		IN/OUT: CAN–Bus	
IEC 61508 SIL 3		IEC 61508 SIL 3		IEC 61508 SIL 3		IEC 61508 SIL 3		IEC 61508 SIL 3		IEC 61508 SIL 3	
TÜV . XXX . XX–XXX				TÜV . XXX . XX–XXX				TÜV . XXX . XX–XXX			
		0525				0525				0525	
<b>GESTRA AG</b> Münchener Str. 77 28215 Bremen GERMANY											

Fig. 6

## Factory settings

**NRG 1x-61 level electrodes are delivered ex works with the following settings:**

- Baud rate: 50 kBit/s
- Limiter ID: 0005

# Overall view

NRG 16-61, NRG 17-61

NRG 19-61

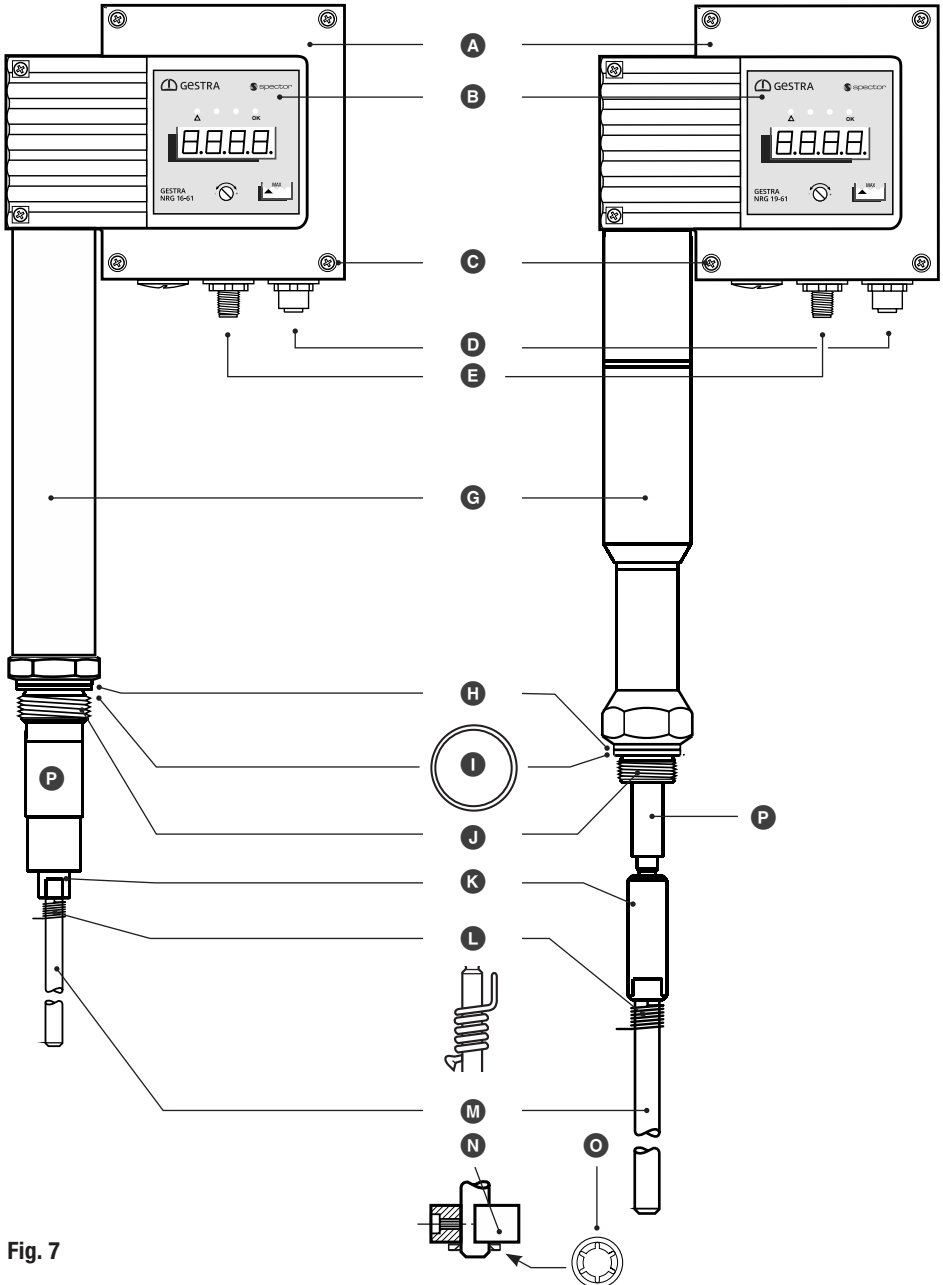


Fig. 7

# Overall view

## NRG 111-61

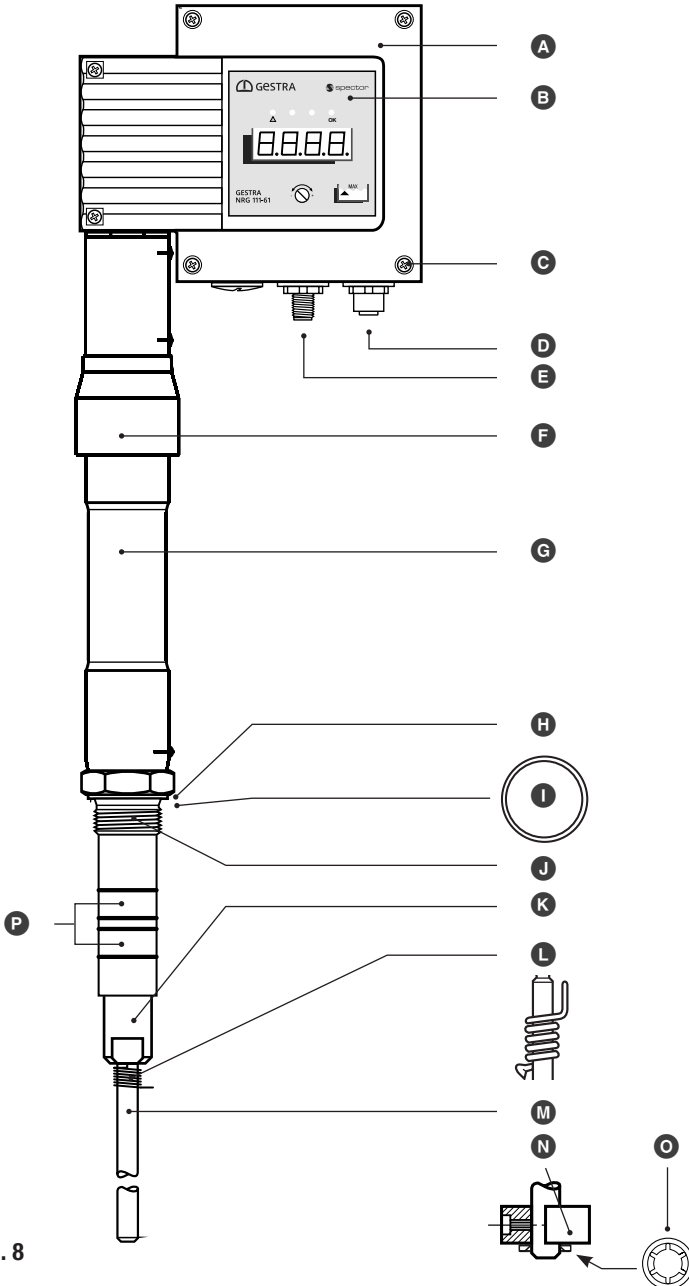


Fig. 8

## Overall view

### Key to Fig. 7

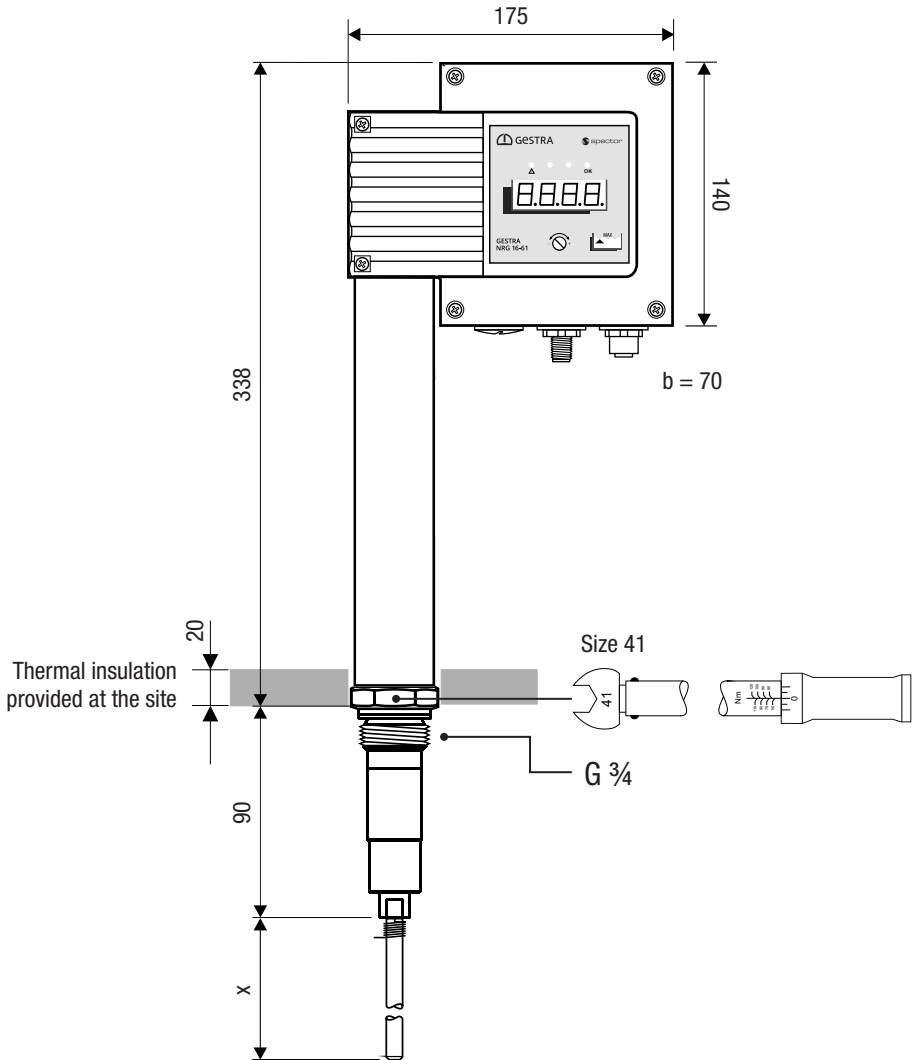
- A** Terminal box
- B** Operating panel with 4-digit LED display/alarm LEDs and rotary knob, see page 45
- C** Cover screws M4 x 16 mm
- D** M12 CAN bus socket, 5-pole, A-coded
- E** M12 CAN bus connector, 5-pole, A-coded
- F** Protective sleeve on NRG 111-61 only\*
- G** Sheath  
For NRG 16-61 and NRG 17-61 with a simplified view of the different designs.
- H** Seal seat for sealing ring
- I** Sealing ring D 27 x 32, form D, DIN 7603-2.4068, bright annealed for NRG 16-61, NRG 17-61, NRG 19-61  
Sealing ring D 33 x 39, form D, DIN 7603-2.4068, bright annealed for NRG 111-61
- J** Electrode thread
- K** Tip of electrode
- L** Retaining spring
- M** Electrode extension
- N** Measuring surface extension
- O** Lock washer
- P** Insulator

### \* Description of protective sleeve **F** for the NRG 111-61 level electrode

Mistakes during transport or installation can cause the ceramic in the NRG 111-61 level electrode to break, so that hot steam or hot water escapes through the pressure relief hole. The protective sleeve

**F** diverts escaping hot steam or hot water downwards.

## Dimensions of NRG 16-61, NRG 17-61

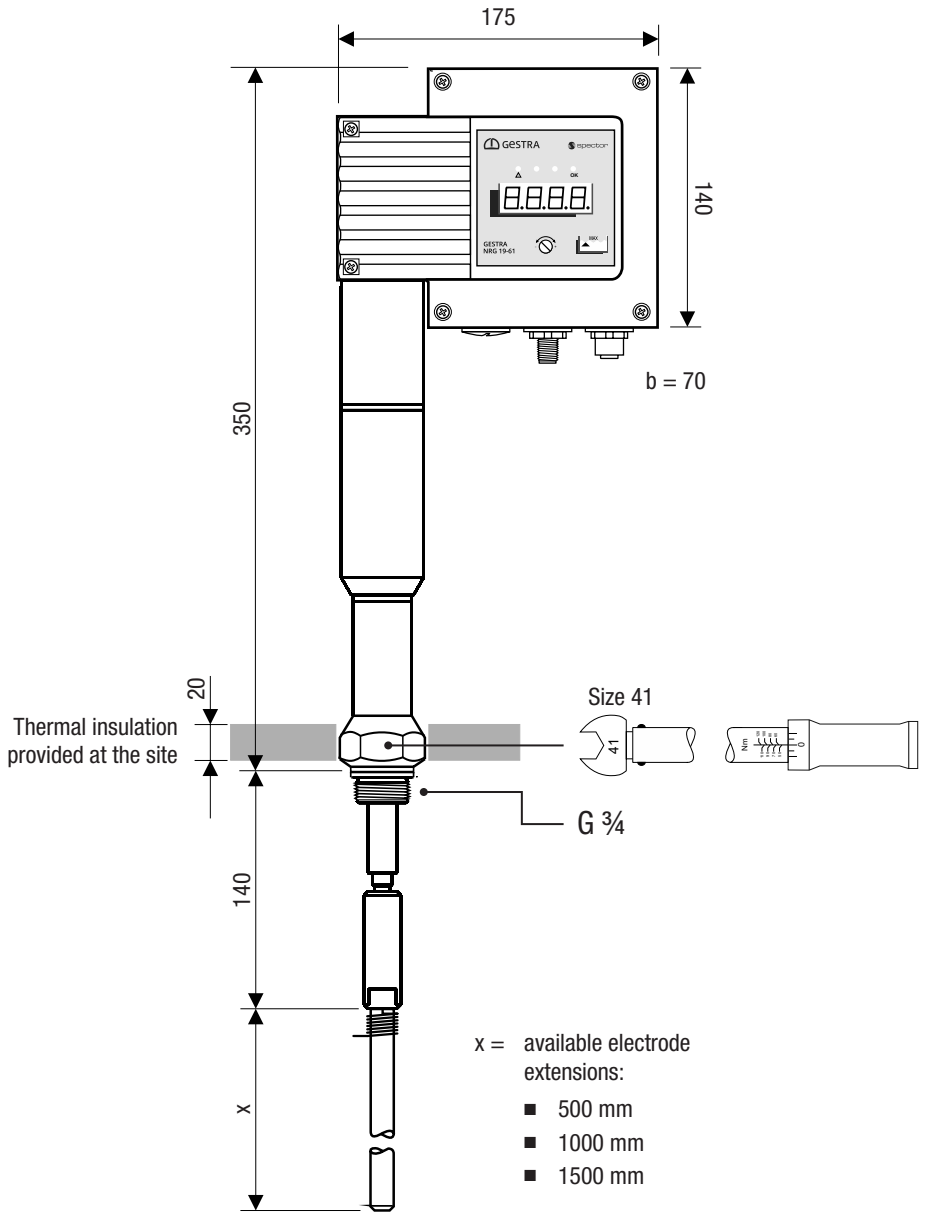


x = available electrode extensions:

- 500 mm
- 1000 mm
- 1500 mm

**Fig. 9** All lengths in mm

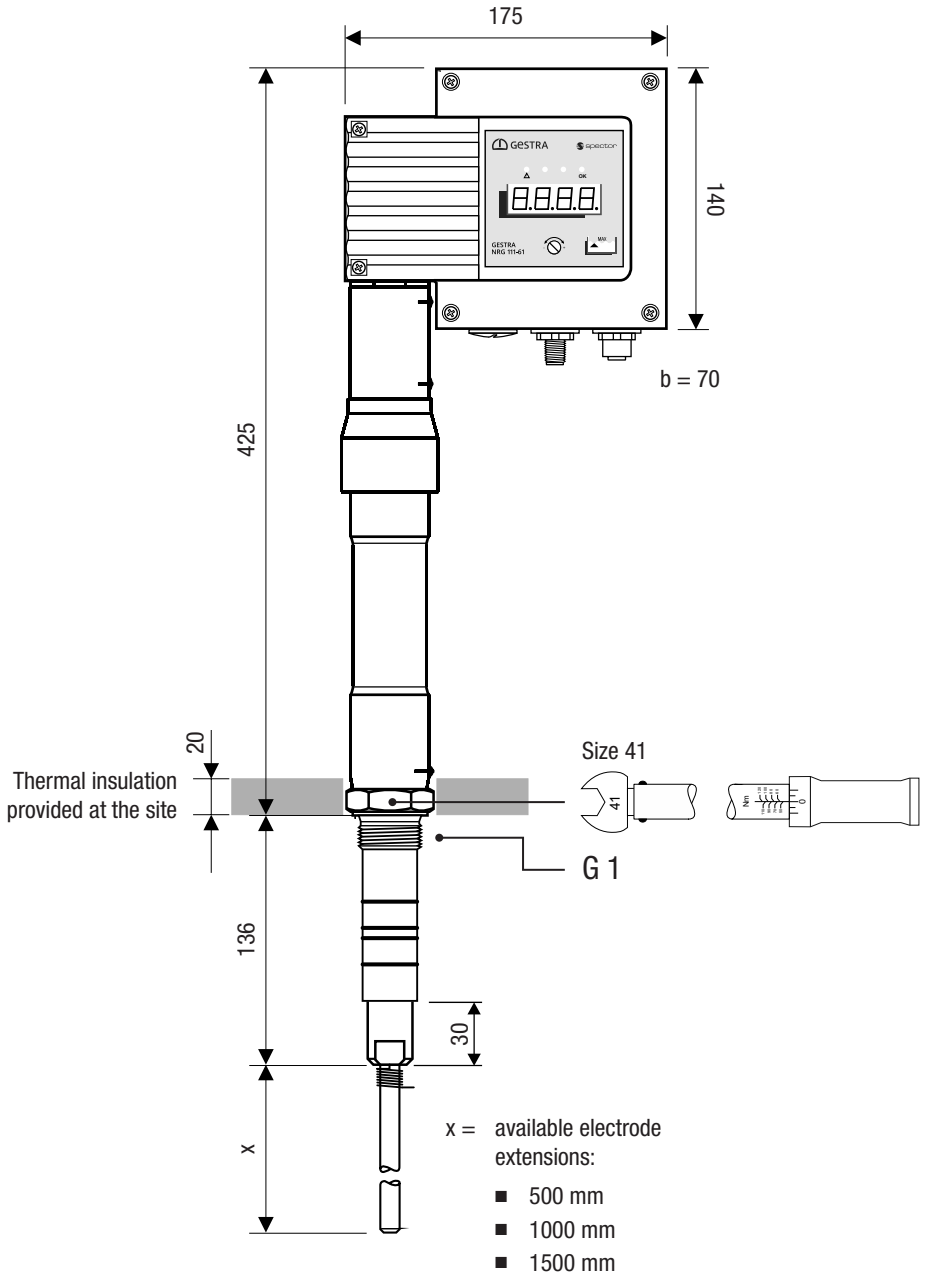
# Dimensions of the NRG 19-61



**Fig. 10** All lengths in mm



# Dimensions of the NRG 111-61



**Fig. 11** All lengths in mm

## Preparing for installation



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

- Pay attention to the admissible ambient conditions in the technical data, see page 17.
- Do not operate the equipment if the temperature is below freezing.
  - ◆ At temperatures below freezing, use a suitable heat source (e.g. control cabinet heater, etc.).
- Connect all 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:**

- Open-ended spanner size 13, 19, 41
- Torque wrench (with size 41 open-ended spanner attachment)
- Scriber or pen
- Hacksaw
- Flat file, medium cut (2)
- Allen key (size 3)

## Preparing for installation

### Establishing the measuring length of the level electrode

#### ATTENTION



**Incorrectly shortened electrodes will not be able to detect high water.**

Electrodes must not be shorter than the permitted high water switchpoint.

#### NRG 16-61, NRG 17-61, NRG 19-61, NRG 111-61

1. Manually screw the electrode extension **M** into the tip of the electrode **K**.
2. Determine the required measuring length of the level electrode and mark this on the electrode extension **M**.
3. Unscrew the electrode extension **M** from the electrode tip **K**.
4. Shorten the electrode extension **M** as far as the mark and deburr the cut edge.

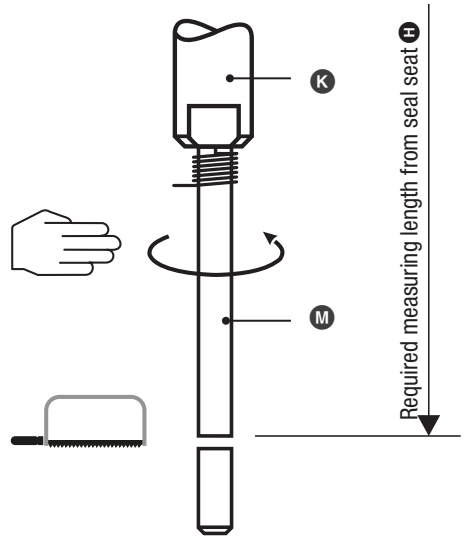


Fig. 12

## Preparing for installation

### Screw the level electrode and electrode extension together

NRG 16-61, NRG 17-61, NRG 19-61, NRG 111-61

- Following a visual inspection, firmly screw the electrode extension into the electrode tip **K**.
- While doing this, push the retaining spring **L** onto the electrode extension **M** until it is securely held in the hole provided.  
Use an open-ended spanner (size 13) to firmly hold the electrode during this work.

**If necessary (e.g. for low conductivity of around 0.5  $\mu\text{S}/\text{cm}$ ), you can fit the optional measuring surface extension **N**.**

- Push the measuring surface extension **N** onto the electrode extension **M**.



Make sure the electrode extension **M** protrudes from the underside by at least 2 mm.

- Using an Allen key, secure the measuring surface extension.
- Push the supplied lock washer **O** over the electrode extension **M** from below and press it against the measuring surface extension.

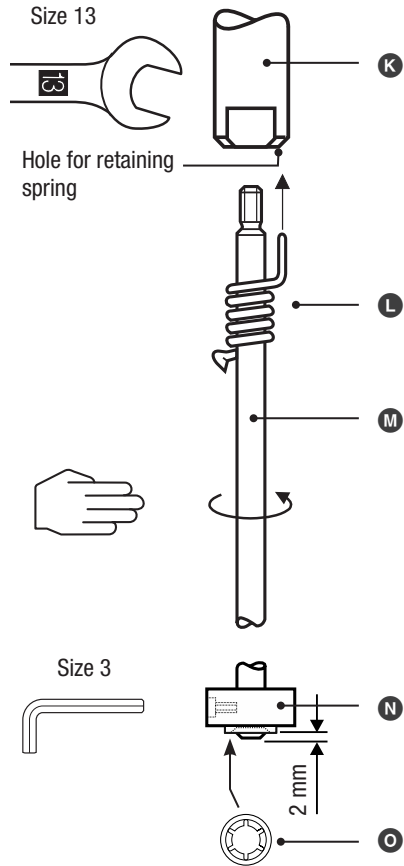


Fig. 13

## Installation

### DANGER



#### **Danger to life from scalding caused by escaping hot steam.**

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

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

### WARNING



#### **Hot level electrodes can cause severe burns.**

Level electrodes are extremely hot during operation.

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

### ATTENTION



#### **Incorrect installation can lead to malfunctions in the system or the level electrode.**

- Inspect the sealing surfaces of tank threaded standpipe or flange covers to ensure they are perfectly machined, see Fig. 14 and Fig. 15.
- Take care not to bend level electrodes during installation!
- The level electrode must not be at an incline of more than 45° maximum, and the length of the electrode rod is limited to 1000 mm maximum.
- Do **not** install the terminal box **A** or upper part of the sheath **G** of the level electrode in the boiler thermal insulation!
- Do not install in the screwed socket.
- Pay attention to the minimum clearances when installing the level electrode, see installation examples Fig. 17 to Fig. 19.
- To prevent current leaks, maintain a minimum distance of 14 mm between the electrode and earth (flange or tank wall).
- Check the boiler connection and flange during the preliminary boiler inspection.

## Installation

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

Sealing surfaces must be perfectly machined as shown in Fig. 14 and Fig. 15.

### Sealing surface dimensions for NRG 16-61, NRG 17-61, NRG 19-61

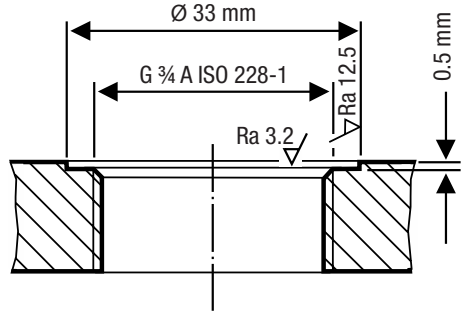


Fig. 14

### Sealing surface dimensions for NRG 111-61

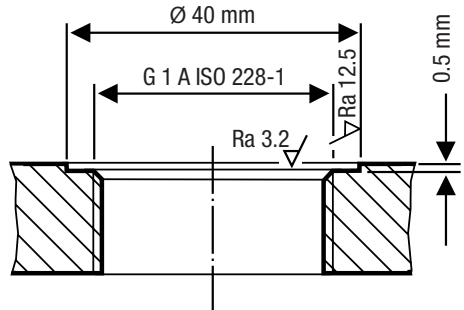


Fig. 15

## Installation

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

### **!** DANGER

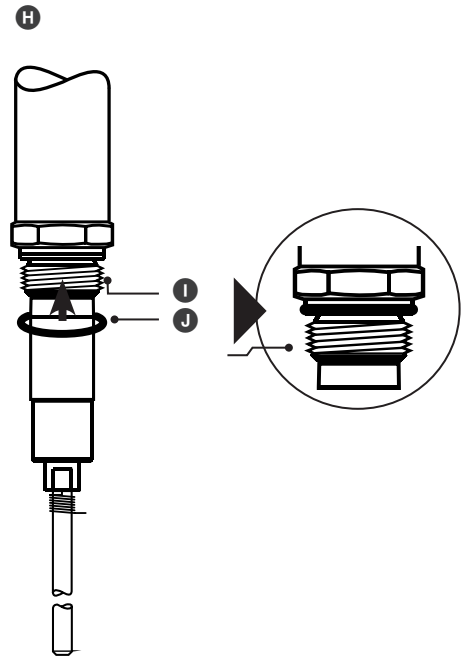


**Danger to life from escaping hot steam if incorrect or defective seals are used.**

- Only use the supplied sealing ring for sealing the electrode thread **J**.
- ◆ **Sealing ring D 27 x 32**  
DIN 7603-2.4068, bright annealed for NRG 16-61, NRG 17-61, NRG 19-61
- ◆ **Sealing ring D 33 x 39**  
DIN 7603-2.4068, bright annealed for NRG 111-61

#### **Prohibited seal materials:**

- Hemp, PTFE tape
- Conductive paste or grease



**Fig. 16**

### Example

3. If necessary, apply a small quantity of silicone grease (e.g. Molykote® III) to the electrode thread **J**.
4. Screw the level 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).  
Tighten to the torques stated below.

#### **Tightening torque when cold:**

- NRG 16-61, NRG 17-61, NRG 19-61 = 120 Nm
- NRG 111-61 = 165 Nm

**Installation example with dimensions, see Fig. 17, page 33**

## Installation

### Installing two level electrodes in a flange

1. Fit the first electrode as described above.
2. Slacken and remove the rear body panel of the second electrode opposite the operating unit.
3. Unfasten the electrode wiring from the PCB.
4. Slacken the nut in the body of the second electrode using a size 19 open-ended spanner.
5. Screw in the second electrode and tighten the nut in the body to a torque of 25 Nm.
6. Reconnect the electrode wiring to the PCB.
7. Close the rear body panel of the second electrode and screw back on.

**Installation example with dimensions, see Fig. 18, page 34**





## Installation examples with dimensions

Use as an internal safety high-level limiter with protective tube provided on site, combined with water level control or water level limiter.

Illustration not to scale.

Key, see page 36

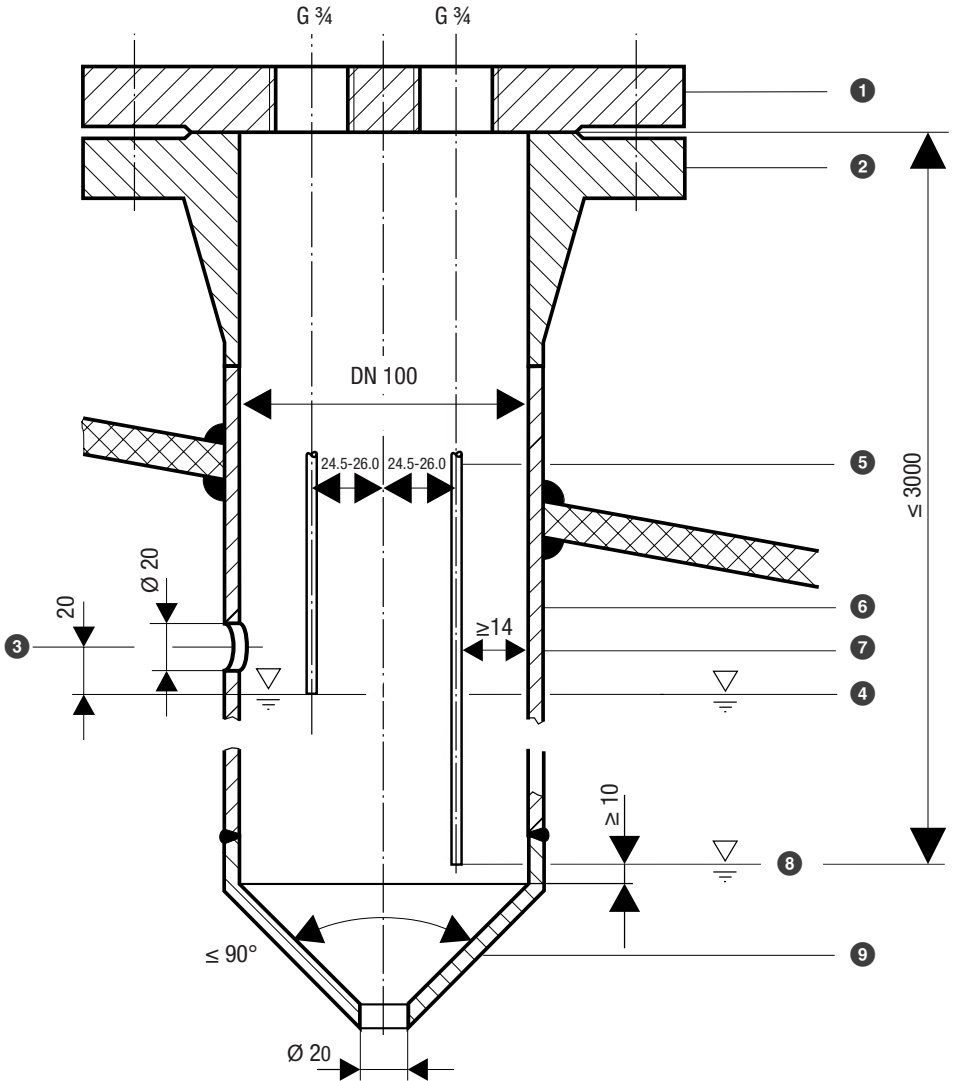


Fig. 18

All lengths and diameters in mm

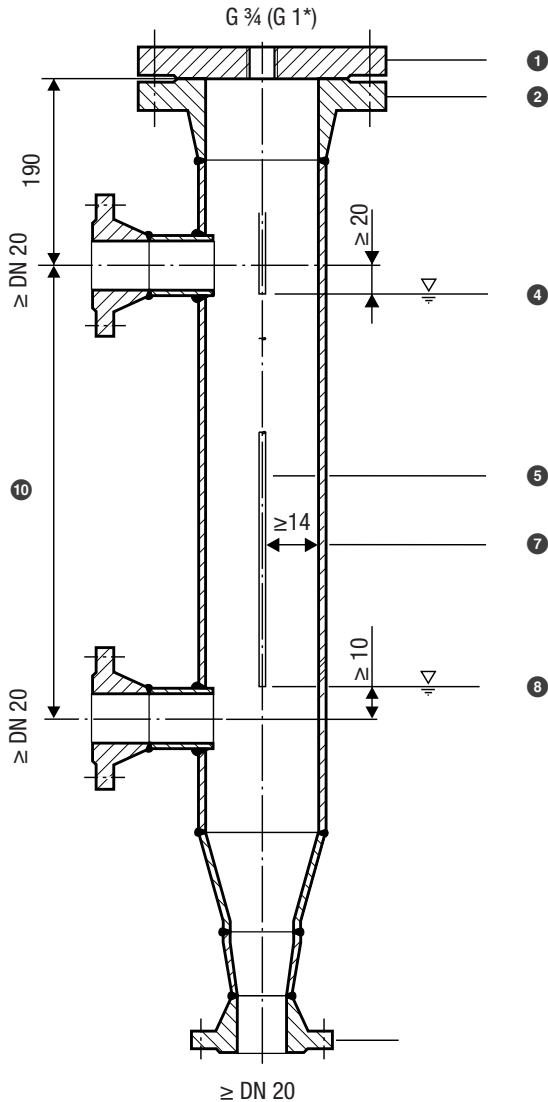
## Installation examples with dimensions

### Level pot $\geq$ DN 80 as an external safety high-level limiter

Illustration not to scale.

Dimensions marked \* apply to the NRG 111-61

Key, see page 36



**Fig. 19**

All lengths and diameters in mm

## Installation examples with dimensions

### Key Fig. 17 to Fig. 19

- ① Fig. 17: Flange (PN 40, 63, 160, 320) DIN EN 1029-01  
Fig. 18: Flange (PN 40, 63, 160) DIN EN 1029-01  
Fig. 19: Flange (PN 40, 63, 60, 320) DIN EN 1029-01
- ② Connection
- ③ Vent hole (locate as close to boiler wall as possible!)
- ④ High water (HW)
- ⑤ Electrode rod,  $d = 8$  mm
- ⑥ Fig. 17 (single electrode): Protective tube DN 80  
Fig. 18 (two electrodes): Protective tube DN 100
- ⑦ Electrode spacing  $\geq 14$  mm (air gaps and creepage paths)
- ⑧ Low water (LW)
- ⑨ Fig. 17 (single electrode): Reducer DIN 2616-2  
Fig. 18 (two electrodes): Reducer DIN 2616-2
- ⑩ Fig. 19: Centre distance of connection

## Positioning the terminal box

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

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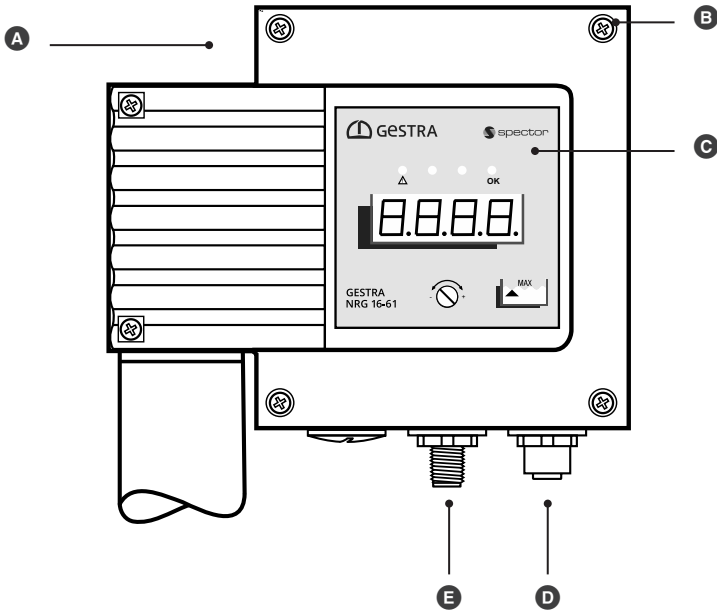
### ATTENTION



**Rotating the terminal box  $\geq 180^\circ$  will damage the level electrode's internal wiring.**

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

## Functional elements



**Fig. 20**

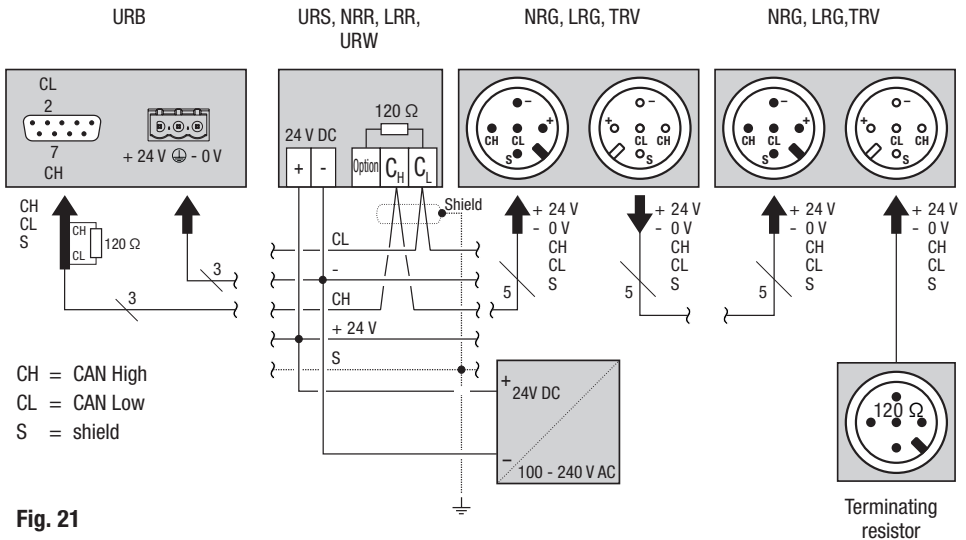
- A** Terminal box
- B** Cover screws M4 x 16 mm
- C** Operating panel with 4-digit LED display/alarm LEDs and rotary knob, see page 45
- D** M12 CAN bus socket, 5-pole, A-coded
- E** M12 CAN bus connector, 5-pole, A-coded

# 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 .. mm<sup>2</sup> or RE-2YCYV-fl 2 x 2 x .. mm<sup>2</sup> 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 mm<sup>2</sup>. In this case, the system is operating at its limits.
- With 5 sensors and a cable length of ≥ 100 m, the wire cross-section needs to be doubled to 1.0 mm<sup>2</sup>.
- At larger distances of > 100 m, the 24 V DC supply can also be connected on site.

## Example



## 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 SPECTORconnect 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** units between terminals C<sub>L</sub> / C<sub>H</sub>.
- Use the CAN bus connector with terminating resistor if you are using the level electrode as the first or last unit.
- 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. 22.

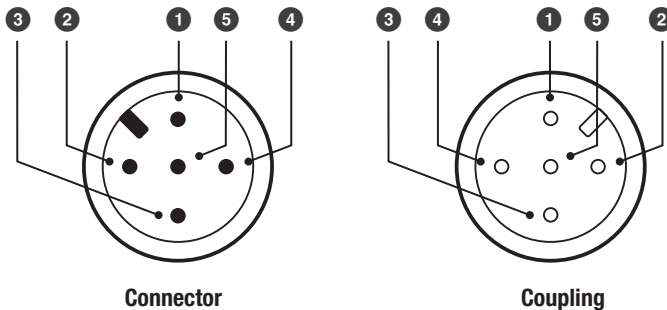


Fig. 22

- |   |        |                    |
|---|--------|--------------------|
| 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  $\Omega$  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



## Bringing into service

### Selecting and setting a parameter:

-  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. bd.rt → "value" → bd.rt.


### The following parameters are shown one after the other when you turn the knob clockwise:


o.P.E.r. → ld → bd.rt → °C.in → r1.r2 → diSP → o.P.E.r.

### Key to parameters, see page 42.



If you do not enter anything for 30 seconds, the display automatically returns to "o.P.E.r."

-  Once you have selected a parameter, press and hold the rotary knob until the current value of this parameter flashes on the display.


-  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.

-  Save your set value by pressing the rotary knob for approx. 1 second.  
The message "donE" is shown and the parameter again appears on the display.

## Bringing into service

### Key to parameters:

- o.P.E.r. = operational (normal operating state)
- Id = limiter ID
- bd.rt = baud rate
- °C.in = ambient temperature of body
- r1.r2 = ratio of RM:RK (measuring electrode : compensation electrode)  
>1 means ALARM = immersed.
- diSP = initiate a display test

### Notes on changing communication parameters “bd.rt, Id”



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 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*.

## Bringing into service

### Changing the baud rate



Set the same baud rate for all bus participants.

**Pay attention to the setting instructions on page 41 ff. 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 or 250 kBit/s).
4. Save your set value by pressing the rotary knob for approx. 1 second.
5. After you have successfully changed the baud rate, restart the entire system.

### 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 41 ff. and proceed as follows:**

1. Select the parameter “**ld**”.
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.
5. After you have successfully changed the limiter ID, restart the entire system.

### Manually initiating a display test

**Pay attention to the setting instructions on page 41 ff. 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 run across the display from right to left:  
“...., 1, 2, 3, 4, 5, 6, 7, 8, 9, ....”
4. Check that all numbers are displayed correctly.  
The display test runs automatically until it has finished, and cannot be interrupted.
5. The display test ends automatically 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 level electrode with an identical one from GESTRA AG.

## Bringing into service

### Checking the high water switchpoint by increasing the level



**Incorrectly installed, shortened or bent level electrodes result in a loss of function that can jeopardise system safety.**

- Check the high water switchpoint when bringing into service and every time the NRG 1x-61 level electrode is replaced.
- Never start up any system without first checking that high water switchpoints are correct.
- NRG 1x-61 level electrodes may only be repaired by the manufacturer, GESTRA AG.
- Only replace faulty equipment with identical equipment from GESTRA AG.

### Checking the limiter switchpoints by initiating a test function

Check the high water (HW) switchpoint by letting the water rise above the defined limit. In this case, the equipment must behave as if there were an alarm, see page 47, “Test” table.

### 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.

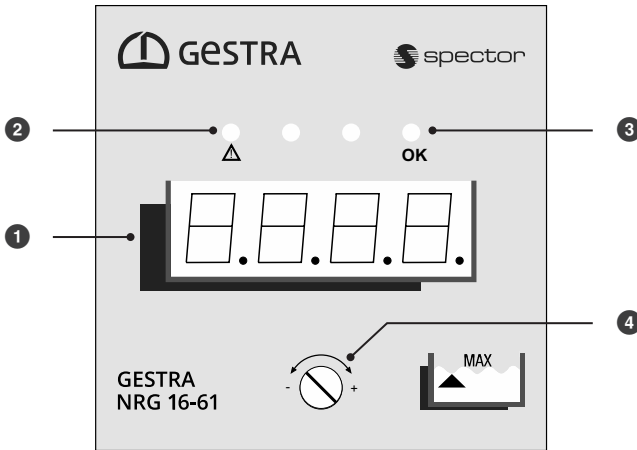


Fig. 23

### The operating panel:

- ① Display of actual value/fault code/limit value, green, 4 digits
- ② LED 1, alarm/fault, red
- ③ LED 2, function OK, green/flashing during self-test
- ④ Rotary knob/push-button 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 fault code table, see page 49 ff.

Priority 2 = high-level alarm

### Priority of fault code display

Higher priority fault codes overwrite lower ones on the display!

## Starting, operation and testing

### Relationship between equipment status, display and alarm LEDs:

Start		
Switch on supply voltage	LED test, all LEDs light up <b>Display:</b> S-xx = software version t-02 = equipment type NRG 1x-61	The system is started and tested. The LEDs and display are tested.

Operation		
Level electrode not immersed	<b>Display:</b> o.P.E.r. <b>LED 2:</b> Operating LED lights up green	Abbreviation of "operational"
Level electrode immersed	<b>Display:</b> HI.LE <b>LED 1:</b> Alarm LED lights up red	Display HI.LE (HIGH LEVEL) and triggering of alarm. After the time delay has elapsed, the URS 60 / URS 61 safety control unit opens the output contacts.
	<b>LED 2:</b> Operating LED is OFF	Alarm

Behaviour in the event of a malfunction (fault code display)		
On the occurrence of a fault	<b>Display:</b> e.g. E.008	A fault code is permanently displayed, fault codes see page 49
	<b>LED 1:</b> Alarm LED lights up red	There is an active malfunction
	<b>LED 2:</b> Operating LED is OFF	A fault is present
<ul style="list-style-type: none"> <li>■ The malfunction or error state is transferred to the URS 60 / URS 61 safety control unit via CAN data telegram.</li> <li>■ The malfunction causes this unit to execute an undelayed safety shutoff.</li> <li>■ The affected signal output is activated.</li> <li>■ The URS 60 / URS 61 safety control unit does not automatically lock the safety contacts.</li> </ul>		



#### Electrode alarms and faults cannot be acknowledged.

When the alarm or malfunction is cancelled the display also goes blank, and the URS 60 / URS 61 safety control unit closes the safety contacts and deactivates the relevant signal outputs once more.

See the following page for more information and tables.

## Starting, operation and testing

Test		
Checking the safety function by simulating the alarm state		
<p><b>In operating mode:</b> Press the rotary knob on the NRG 1x-61 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 open the relevant menu on the URB 60 and initiate the test function.</p>	<p><b>Display:</b> HI.LE</p>	The system simulates immersion of the level electrode.
	<p><b>LED 1:</b> Alarm LED lights up red</p>	High-level alarm
	<p><b>LED 2:</b> Operating LED is OFF</p>	Alarm
	<ul style="list-style-type: none"> <li>■ The switch-off delay is running, the signal output closes with/without a delay.</li> <li>■ The time delay has elapsed, the output contacts open, the signal outputs close.</li> <li>■ The test ends.</li> </ul>	



### Faulty equipment jeopardises system safety.

- If the level electrode does not behave as described above, it may be faulty.
- Perform failure analysis.
- NRG 1x-61 level 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, etc.

### Wiring:

- Does the wiring conform to the wiring diagrams?
- Is the bus line polarity correct throughout?
- Is a 120  $\Omega$  terminating resistor connected to the terminal devices of the CAN bus line?

### Configuration of level electrodes:

- Are the level electrodes 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



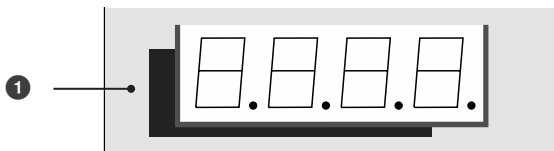
### Interrupting the CAN bus causes a system shutdown and triggers an alarm.

- 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 malfunctions

### Indication of system malfunctions using fault codes



**Fig. 24** ❶ Display of actual value/fault code/limit value, green, 4 digits

Fault code display			
Fault code	Internal designation	Possible faults	Remedy
E.008	Ch1Ch2DiffErr	EMC or internal error	Check the installation location Replace the level electrode
E.009	CH2RM:RKErr	Contamination or loss of insulation	Remove, check and clean the level electrode
E.010	CH2RM+RKErr	EMC or measuring voltage error	In pressurised hot-water plants, reduce the conductivity
E.011	CH2RangeErr	Ch2 Out of Range	Check the wiring Replace the level electrode
E.012	CH1RM:RKErr	Contamination or loss of insulation	Remove, check and clean the level electrode
E.013	CH1RM+RKErr	EMC or measuring voltage error	In pressurised hot-water plants, reduce the conductivity
E.014	Ch1RangeErr	Ch1 Out of Range	Check the wiring Replace the level electrode
E.015	DutyErr	EMC error or measuring frequency faulty	Check the installation location Replace the level electrode
E.016	FreqErr	EMC error or measuring frequency faulty	Check the installation location Replace the level electrode
E.017	MWChErr	Measured value test function fails	Check the wiring Replace the level electrode
E.018	PWMErr	EMC error or external voltages	Check the installation location Replace the level electrode

## System malfunctions

Fault code display			
Fault code	Internal designation	Possible faults	Remedy
<b>E.019</b>	V6Err	EMC or voltage error 6.0 V	Check the installation location Replace the level electrode
<b>E.020</b>	V5Err	EMC or voltage error 5.0 V	Check the installation location Replace the level electrode
<b>E.021</b>	V3Err	EMC or voltage error 3.3 V	Check the installation location Replace the level electrode
<b>E.022</b>	V1Err	EMC or voltage error 1.2 V	Check the installation location Replace the level electrode
<b>E.023</b>	V12Err	EMC or voltage error 12 V	Check the installation location Replace the level electrode
<b>E.024</b>	CANErr	Wrong baud rate or wiring error	Check the baud rate, wiring and terminating resistors
<b>E.025</b>	ESMG1Err	EMC error or internal process error	Check the installation location Replace the level electrode
<b>E.026</b>	BISTErr	EMC or internal error	Check the installation location Replace the level electrode
<b>E.027</b>	OvertempErr	Ambient temperature > 75 °C	Check the installation location Lower the ambient temperature of the terminal box

All fault codes from E.001 to E.007 not listed here are available as reserves



Generally speaking, electromagnetic interference can be the cause of virtually all of the fault codes mentioned above. It is more likely to be the cause of permanent faults; however, it should also be considered in the case of sporadic fault indications.

## System malfunctions

### Common faults during use

<b>Non-immersion of the level electrode is not detected ("o.P.E.r." is not displayed)</b>	
<b>Possible causes if no fault indications are present</b>	<b>Remedy</b>
There may be no supply voltage.	<ul style="list-style-type: none"> <li>■ Switch on the supply voltage.</li> <li>■ Check that the wiring conforms to the wiring diagrams.</li> </ul>
The electrode extension has a short circuit to earth due to a contaminated insulator.	<ul style="list-style-type: none"> <li>■ Check and clean the insulator.</li> <li>■ Always use the supplied metal sealing ring, see page 4.</li> <li>■ Do not use conductive paste or grease for screwing in the thread of the measuring electrode.</li> </ul>
The inner seal of electrode rod is damaged.	Replace the level electrode.
The ambient temperature may be too high, > 75 °C.	<ul style="list-style-type: none"> <li>■ Check installation location</li> <li>■ Lower the ambient temperature of the terminal box</li> </ul>

<b>Immersion of the level electrode is not detected ("H.I.L.E." is not displayed)</b>	
<b>Possible causes if no fault indications are present</b>	<b>Remedy</b>
The vent hole in the protective tube is missing, clogged or flooded.	<ul style="list-style-type: none"> <li>■ Check the protective tube.</li> <li>■ Drill a vent hole in the protective tube.</li> </ul>
The shut-off valves of the external measuring cylinder (optional) may be closed.	Open the shut-off valves.
There are insulating deposits on the electrode extension.	Clean the electrode extension.
The electrode body has no earth connection to the tank.	<ul style="list-style-type: none"> <li>■ Check and clean the sealing surfaces.</li> <li>■ Always use the supplied metal sealing ring, see page 4.</li> <li>■ Make sure the thread of the measuring electrode does not have insulating material wound around it, e.g. hemp or PTFE tape.</li> </ul>

## System malfunctions

### Checking installation and function

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

- Check the high water (HW) switchpoint by letting the water rise above the defined limit. In this case, the equipment must behave as if there were an alarm.
- Check the switchpoint when bringing into service and every time the NRG 1x-61 level electrode is replaced.



System malfunctions in the NRG 1x-61 level electrode also trigger a system malfunction 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 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

### DANGER



#### **Danger to life from scalding caused by escaping hot steam.**

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

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

### WARNING



#### **Hot level electrodes can cause severe burns.**

Level electrodes are extremely hot during operation.

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

#### **Proceed as follows:**

1. Reduce the boiler pressure to 0 bar.
2. Allow the level 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 level electrode.



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

## Disposal

Dispose of level electrodes in accordance with statutory waste disposal provisions.

## 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 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. Return the goods to GESTRA AG together with the completed return confirmation (and declaration of decontamination).

## EU Declaration of Conformity

We hereby declare that the NRG 1x-61 level 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 II 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 online at [www.gestra.com](http://www.gestra.com) or can be requested from us.



You can find our authorised agents around the world at:

**[www.gestra.com](http://www.gestra.com)**

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