

Level Electrode

NRG 16-11 NRG 17-11 NRG 19-11 NRG 111-11



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# **Important Notes**

## Usage for the intended purpose

Use level electrodes NRG 16-11, NRG 17-11, NRG 19-11 and NRG 111-11 only in conjunction with level switch NRS 1-7 for low-level limiting (low level alarm). The equipment must not be used in explosion risk areas.

## Safety note

The equipment must only be installed and commissioned by qualified and competent staff. Retrofitting and maintenance work must only be performed by qualified staff – who through adequate training – have achieved a recognised level of competence.



### Danger

When loosening the electrode steam or hot water might escape.

This presents the danger of severe scalds to the whole body.

It is essential not to mount or dismantle the electrode unless the boiler pressure is verified to be 0 bar.

The electrode becomes hot during operation.

Touching the hot equipment presents the risk of severe burns to hands and arms. All installation and maintenance work must only be performed when the equipment is cold.

If the internal ceramic insulation of the level electrode NRG 111-11 breaks hot steam may escape through the lateral relief vent of the electrode stem.

This presents the danger of severe scalding!

Do not stand close to the electrode during operation.



### **Attention**

The name plate specifies the technical features of the equipment. Note that any piece of equipment without its specific name plate must neither be commissioned nor operated.

### **PED (Pressure Equipment Directive)**

The equipment fulfills the requirements of the PED 97/23/EC. The equipment can be used with fluids of group 1 and 2. With CE marking (except for equipment according to section 3.3 of the PED).

#### ATEX (Atmosphère Explosible)

The equipment constitutes a simple item of electrical equipment as defined in DIN EN 50020 section 5.4. According to the European Directive ATEX 94/9/EC the equipment may only be used in potentially explosive atmospheres if it is provided with approved Zener barriers.

Applicable in Ex zones 1, 2 (1999/92/EC). The equipment does not bear an Ex marking. The suitability of the Zener barriers is certified in a separate document.

# **Explanatory Notes**

## Scope of supply

### NRG 16-11

- 1 Level electrode NRG 16-11, PN 40
- 1 Joint ring 27 x 32, form D, DIN 7603, 1.4301, bright-annealed
- 1 Disk with set screw (measuring surface extension) optional
- 1 Retaining ring optional
- 1 Installation manual

### NRG 17-11

- 1 Level electrode NRG 17-11, PN 63
- 1 Joint ring 27 x 32, form D, DIN 7603, 1.4301, bright-annealed
- 1 Disk with set screw (measuring surface extension) optional
- 1 Retaining ring optional
- 1 Installation manual

### NRG 19-11

- 1 Level electrode NRG 19-11, PN 160
- 1 Joint ring 27 x 32, form D, DIN 7603, 1.4301, bright-annealed
- 1 Disk with set screw (measuring surface extension) optional
- 1 Retaining ring optional
- 1 Installation manual

### NRG 111-11

- 1 Level electrode NRG 111-11, PN 320
- 1 Gasket 33 x 39 DIN 7603-1.4301
- 1 Sealing plug for M 20 connection
- 1 Surface extension disk with grub screw
- 1 Retaining ring
- 1 Installation manual

# Description NRG 16-11, NRG 17-11, NRG 19-11, NRG 111-11

The level electrode NRG 1...-11 detects the min. liquid level (low level alarm) in a steam boiler. The operation of the electrode is based on the conductivity measuring principle using the electrical conductivity of water for signaling one liquid level:

### Low level alarm

The NRG 1...-11 is designed for use in conjunction with level switch NRS 1-7 as a self-monitoring low level limiter with periodic self-checking (SMART) feature.

Application in steam and pressurised hot-water plants in accordance with TRD 604, sheet 1 and sheet 2 (24 h/72 h operation) as well as DIN EN 12952 and DIN EN 12953.

The electrical equipment meets the requirements of the Regulations on Protection Circuits EN 50156-1.

# Explanatory Notes - continued -

#### **Function**

The water level limiter comprises a level electrode type NRG 1...-11 and a level switch type NRS 1-7. The level electrode NRG 1...-11 consists of two concentrically arranged electrodes (measuring electrode and compensating electrode) which are isolated from each other by special insulating seals.

The level limiter operation is based on the conductive measuring principle using the electrical conductivity of water for signaling water level. During normal, trouble-free operation the level electrode tip is immersed in boiler water and no low level alarm is given. A low level alarm will only be raised if the electrode tip is exposed for more than 3 seconds. A low level alarm will also be activated if the insulating seals placed between the electrodes and the body are no longer pressure tight, allowing water to penetrate into the body. However in this instance the alarm is caused by a malfunction of the electrode, and confirmation should always be done by checking if there is water in the gauge glass. The equipment combination NRG 1...-11 and NRG 1-7 provides fail safe protection against a first fault in accordance with TRD 604.

## **System components**

### **NRS 1-7**

Level switch **NRS 1-7**. Two channel level limiter (redundancy) with periodic self-checking routine to EN 50156-1.

## Design

### NRG 16-11, NRG 17-11, NRG 19-11

Screwed 34" BSP. DIN EN ISO 228-1

Electrical connection: Four pole connector, terminal box made from aluminium (optional)

#### NRG 111-11

Screwed 1" BSP, DIN EN ISO 228-1

Electrical connection: Terminal box made from aluminium

# **Technical Data**

### NRG 16-11, NRG 17-11, NRG 19-11

### Type approval

TÜV·WB·05-354

EG 01 202 931-B-01-0077

### Service pressure

NRG 16-11: 32 bar at 238 °C NRG 17-11: 60 bar at 275 °C NRG 19-11: 100 bar at 311 °C

### Connection

Screwed G 3/4 A, to ISO 228

#### **Materials**

Screw-in body: 1.4571, X6CrNiMoTi17-12-2 Measuring electrode: 1.4571, X6CrNiMoTi17-12-2

Electrode rod: 1.4401, X5CrNiMo17-12-2

Electrode insulation: Gylon® Four pole connector: Polyamid (PA)

Terminal box: 3.2161 G AlSi8Cu3 (optional)

### Lengths available

500 mm, 1000 mm, 1500 mm, 2000 mm, 2500 mm, 3000 mm

### **Cell constant C**

0.13 cm<sup>-1</sup> **with** measuring surface extension 0.3 cm<sup>-1</sup> **without** measuring surface extension

### Response sensitivity

10  $\mu S/cm$  at 25 °C, cell constant 0.3 cm  $^{-1}$  0.5  $\mu S/cm$  at 25 °C, cell constant 0.13 cm  $^{-1}$ 

### **Electrical connection**

Four-pole connector, cable gland M 16,

terminal box made from aluminium, cable glands M 16 (optional)

#### **Protection**

IP 65 to EN 60529

## Max. admissible ambient temperature

70°C

### Weight

Approx. 1.1 kg

# Technical Data - continued -

#### NRG 111-11

## Type approval

TÜV·**WB**·05-354

EG 01 202 931-B-01-0077-01

## Service pressure

NRG 111-11: 180 barg (at 357 °C)

### Connection

1" BSP (to DIN EN ISO 228-1)

#### **Materials**

Screw-in body: 1.4529, X1NiCrMoCuN25-20-7 Measuring electrode 1.4122, X39CrMo17-1 Electrode rod: 1.4401, X5CrNiMo17-12-2 Electrode insulations Special Constant material

Terminal box: 3.2161 G AlSi8Cu3

### Lengths available

500 mm, 1000 mm, 1500 mm, 2000 mm, 2500 mm, 3000 mm

#### pH value

Max. admissible: 10

## **Cell constant C**

0.13 cm<sup>-1</sup> with measuring surface extension

## Response sensitivity

0.5 µS/cm up to 400 µS/cm at 25 °C

### **Electrical connection**

Terminal box made from aluminium, cable glands M 20 (2)

### **Protection**

IP 65 to EN 60529

### Max. admissible ambient temperature

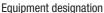
70°C

### Weight

Approx. 1.8 kg

# Technical Data - continued -

## Name plate / marking



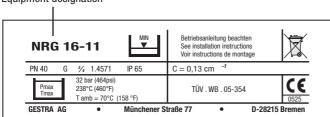


Fig. 1

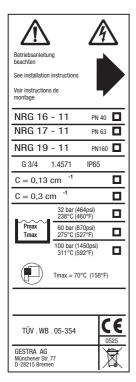


Fig. 2

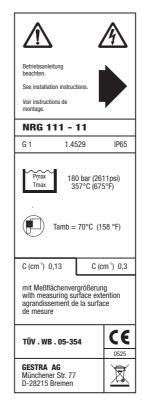


Fig. 3

# Dimensions NRG 16-11, NRG 17-11, NRG 19-11

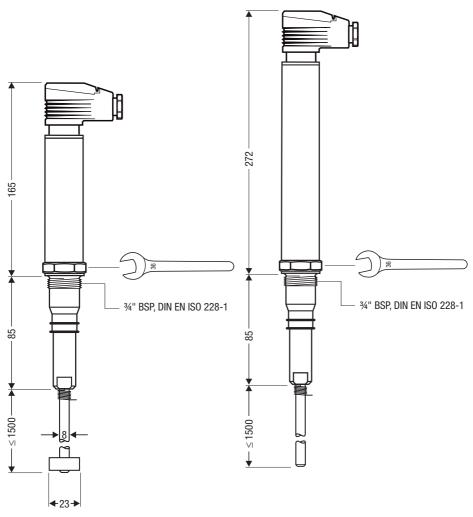


Fig. 4 NRG 16-11 with measuring surface extension

Fig. 5 NRG 17-11, NRG 19-11 without measuring surface extension

# Dimensions NRG 16-11, NRG 17-11, NRG 19-11 - continued -

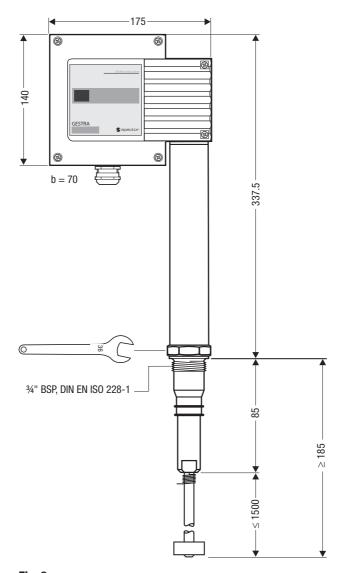


Fig. 6
NRG 17-11, NRG 19-11 with terminal box made from aluminium (optional) and measuring surface extension

# **Dimensions NRG 111-11**

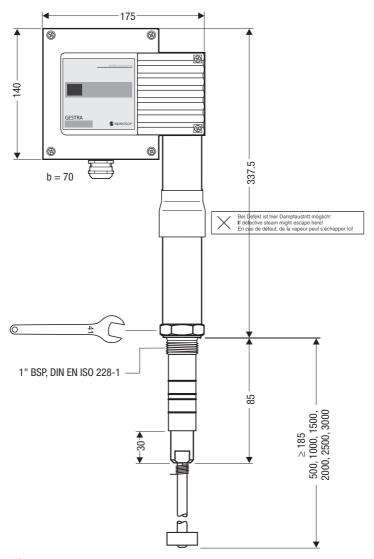
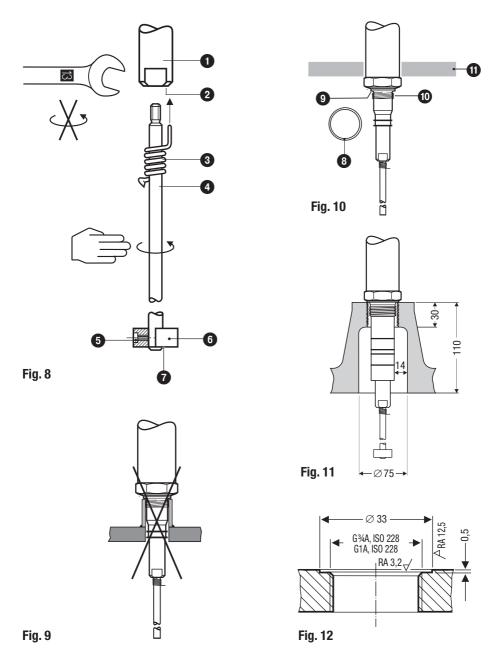


Fig. 7
NRG 111-11 with measuring surface extension

# Design

# NRG 16-11, NRG 17-11, NRG 19-11, NRG 111-11



# **Functional Elements**

# NRG 16-11, NRG 17-11, NRG 19-11

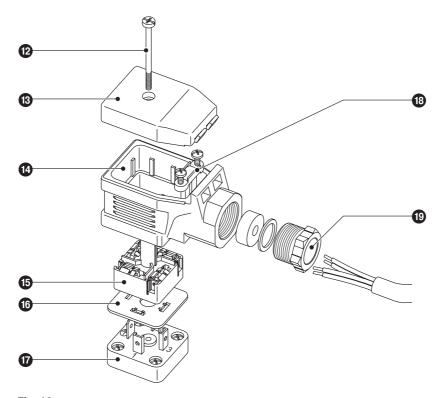
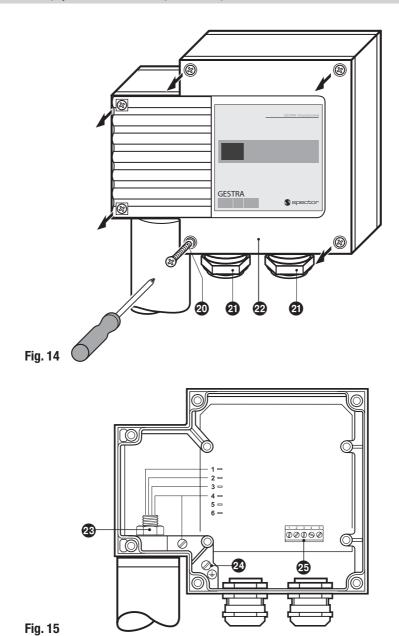


Fig. 13

# Functional Elements - continued -

# NRG 111-11, optional for NRG 16-11, NRG 17-11, NRG 19-11



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# Design / Functional Elements - continued -

## Key

- Measuring electrode
- 2 Bore
- 3 Spring
- 4 Electrode tip
- 6 Grub screw
- 6 Disk (Measuring surface extension)
- Retaining ring
- **8** Gasket 27 x 32, form D, DIN 7603, 1.4301 bright annealed
- 9 Seating surface
- Electrode thread
- Thermal insulation, provided on site, d = 20 mm (outside of thermal insulation of steam generating unit)
- 2 Screw M 4
- 13 Lid
- Upper part of terminal box
- **15** Connecting plate
- Sealing element
- 17 Contact plate for level electrode
- Cable clamp
- 19 Cable gland M 16 (PG 9)
- 4 Housing screws M 4
- 21 Cable entry M 20 x 1.5
- 22 Housing lid
- 23 Nut
- 24 PE connection
- 25 Terminal strip

# Installation

## NRG 16-11, NRG 17-11, NRG 19-11, NRG 111-11, step 1

- 1. Screw electrode tip 4 into measuring electrode 1, Fig. 8
- 2. Carefully determine required measuring length, taking minimum length into account.
- 3. Mark length of electrode tip 4.
- 4. Unscrew electrode tip 4 from measuring electrode 1 and cut tip.
- 5. Screw electrode tip 4 into measuring electrode 1 and tighten. Slide spring 3 along electrode tip 4, so that its bent end completely enters into small bore 2.
- 6. If a measuring surface extension is required slip disk onto electrode tip 4 ensuring that the electrode tip protrudes 2 mm from disk. Fasten disk with grub screw 5. Push retaining ring vover electrode tip against disk o.

## NRG 16-11, NRG 17-11, NRG 19-11, NRG 111-11, step 2

- 1. Check seating surfaces, Fig. 12
- 2. Place supplied gasket 3 onto seating surface of the threaded standpipe or flange. Fig. 10
- 3. Apply a light smear of silicone grease (e. g. WINIX® 2150) to electrode thread **10**.
- Screw level electrode into threads of flange provided on vessel and tighten with a 36/41 mm ring spanner. The torque required is 160 Nm when cold (NRG 16-11, NRG 17-11, NRG 19-11) or 475 Nm (NRG 111-11).



#### Attention

- The seating surfaces and threads on the vessel and mounting flange must be accurately machined, Fig. 12
- Do not bend the electrode tip when cutting.
- Use only the supplied gasket: NRG 16-11, NRG 17-11, NRG 19-11: 27 x 32, form D, DIN 7603, 1.4301 NRG 111-11: D 33 x 39. DIN 7603-1.4301
- Do not lag the electrode body.
- Do not insulate the threads with hemp or PTFE tape.
- Do not apply conductive paste or grease to the electrode thread.
- Provide a min. spacing of 14 mm between electrode and earth (flange, boiler wall), Fig. 11, Fig. 17
- Observe the minimum distances for the installation of the electrode.
- If the level electrode NRG 111-11 is to be installed in a flanged standpipe DN 50 use only the GESTRA hat flange! Fig. 11
- When using the level electrode **NRG 111-11** take the pH limit value (10) and the max. admissible electrical conductivity (100 µS/cm at 25 °C) into consideration.

# Installation - continued -



# Important notes

- One level electrode NRG 1...-11 can be installed together with one GESTRA level electrode, one level switch or transmitter for water level control and high level alarm in one single protection tube or level pot (inside diameter 100 mm). Fig. 16. If the NRG 1...-11 is installed inside the vessel, it must be at least 40 mm away from the upper vent hole.
- The installation of two level-limiting electrodes NRG 1...-11 in one standpipe is not allowed!
- For the approval of the boiler standpipe observe the relevant regulations.
- For typical installation examples refer to pages 19 20.
- When mounting the electrode laterally make sure that the inclination angle does not exceed 45° and that the length of the electrode rod is limited to 1000 mm. Fig. 17
- If the electrode is installed outdoor, it must be provided with a weather-proof cover supplied by GESTRA. As an alternative the level electrode can be equipped with a terminal box made from aluminium.

### **Tools**

- Open-end spanner A. F. 13, DIN 3110, ISO 3318
- Open-end spanner A. F. 36, DIN 3110, ISO 3318
- Open-end spanner A. F. 41, DIN 3110, ISO 3318
- Scriber
- Hacksaw
- Flat file, cut 2, DIN 7261, form A

# **Examples of Installation**

# NRG 16-11, NRG 17-11, NRG 19-11

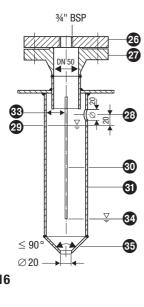


Fig. 16

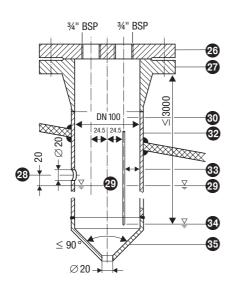


Fig. 18

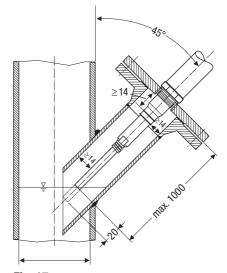
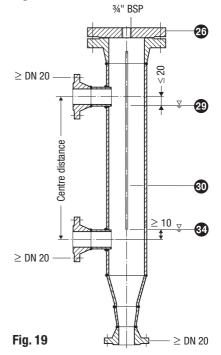


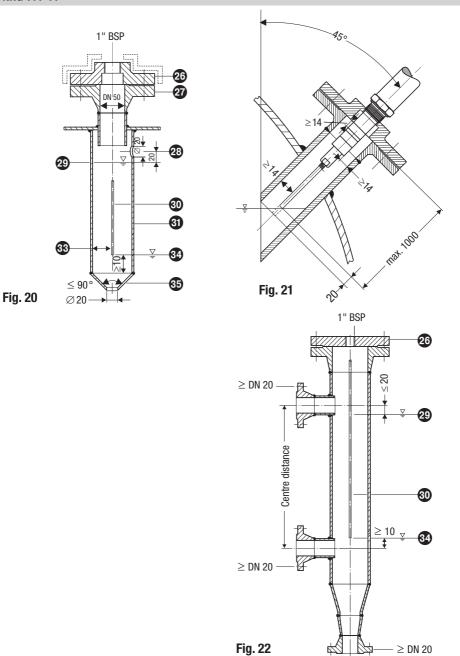
Fig. 17



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# Examples of Installation - continued -

# NRG 111-11



# **Examples of Installation** - continued -

## Key

- Flange PN 40, PN 63, PN 160, DN 50, DIN EN 1092-01 (single electrode)
  Flange PN 40, PN 63, PN 160, DN 100, DIN EN 1092-01 (electrode combination)
  GESTRA hat flange PN 320, DN 50, DIN EN 1092-01 (NRG 111-11)
- For the approval of the boiler standpipe the relevant regulations must be considered.
- Vent hole Provide bore as close as possible to the boiler wall!
- 29 High water HW
- 30 Electrode rod d = 8 mm
- 31 Protection tube DN 80 (in France according to AFAQ ≥ DN 100)
- 32 Protection tube DN 100
- 33 Electrode distance ≥ 14 mm (creepage distances and clearances)
- 34 Low water LW
- 35 Reducer DIN 2616-2, K-88.9 x 3.2 42.4 x 2.6 W

# **Electrical Connection**

## NRG 16-11, NRG 17-11, NRG 19-11

Electrical connection via four pole connector.

Note that screened four-core cable, e. g. I-Y(St)Y 2 x 2 x 0.8 or LIYCY 4 x 0.5 mm<sup>2</sup> is required for wiring the electrode.

Max. length 100 m with conductivites from 10  $\mu$ S/cm.

Max. length 30 m with conductivites from 0.5 µS/cm.

Max. length 15 m with conductivites from 0.5  $\mu$ S/cm and application of the ancillary unit URN 1 (24 V DC).

- 1. Unscrew screw @, Fig. 13
- 2. Take the terminal box off the level electrode, leaving the sealing element **10** on the contact plate **17**.
- 3. Remove lid 13.
- 4. Press connecting plate **6** out of the upper part of the terminal box **6**.

## The upper part of the terminal box can be turned in steps of 90°.

- 5. Detach cable gland 19 and cable clamp 18 from the upper part of the terminal box 14.
- 6. Run cable through cable gland **19** and upper terminal box **19** and connect the terminals of the connecting plate **19** according to the wiring diagram.
- 7. Press connecting plate **1** into the upper part of the terminal box and align the cable.
- 8. Hold cable with cable clamp 18 and cable gland 19 in position.
- 9. Mount lid 3 and insert screw 2.
- 10. Put upper part of the terminal box onto the level electrode and fix it firmly with screw 22.

# NRG 111-11, optional for NRG 16-11, NRG 17-11, NRG 19-11

Electrical connection via terminal box made from aluminium

Note that screened four-core cable, e. g.  $I-Y(St)Y \ge x \ge x \le 0.8$  or  $LIYCY \le x \le 0.5$  mm<sup>2</sup> is required for wiring to the electrode.

Max. cable length 100 m with water conductivity from 10 µS/cm.

Max. cable length 30 m with water conductivity from 0.5 µS/cm.

Max. cable length 15 m with water conductivity from 0.5  $\mu$ S/cm when used in conjunction with inverter URN 1 (24 d. c.).

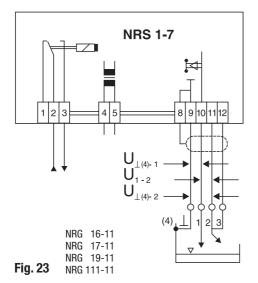
- 1. Undo screws 20 and remove housing cover 22. Fig. 14
- 2. Unscrew union nuts of cable entry 2.
- 3. Slacken nut 3 with 18 mm open-end spanner but do not remove, Fig. 15

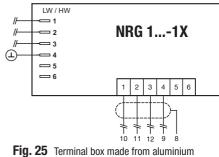
### The electrode terminal box can now be turned through +/- 180°.

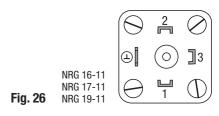
- 4. Turn electrode terminal box into desired position (+/- 180°).
- 5. Tighten nut 23 slightly.
- 6. Remove terminal strip @ from board.
- 7. Connect terminal strip according to wiring diagram.
- 8. Affix terminal strip.
- 9. Re-attach housing cover 22 and fix it with screws 20.

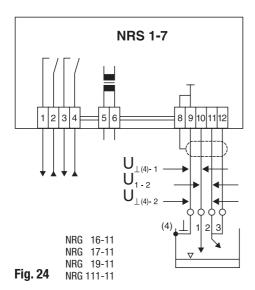
# **Electrical Connection** - continued -

# Wiring diagram









This wiring diagram is only valid for France.

# **Electrical Connection** -continued -

## Voltage table

Use this voltage table as a reference when checking whether the level electrode is submerged or if there is a malfunction. Please take the wiring diagram of the electrode NRS 1-7 into account.

Fig. 23, Fig. 24

п	<b>U</b> <sub>1-⊥(4)</sub>		<b>U</b> <sub>2-⊥(4)</sub>
<b>U</b> <sub>1-2</sub>	submerged	exposed	malfunction (submerged/alarm)
10 $V_{eff}$ 0.5 $\mu$ S/cm, $C = 0.13 \text{ cm}^{-1}$ 2 $V_{eff}$ 10 $\mu$ S/cm, $C = 0.3 \text{ cm}^{-1}$	< <mark>U</mark> 1-2 <b>2</b>	≥ <del>U</del> <sub>1-2</sub> 2	≤ <b>U</b> <sub>1-⊥(4)</sub>



### Note

■ The self-checking routine of the amplifier NRS 1-7 reduces U<sub>1-2</sub> every 40 seconds to 0 volt!

## **Tools**

- Screwdriver for cross-recess head screws, size 1
- Screwdriver for slotted screws, size 2.5, completely insulated according to DIN VDE 0680-1
- Open-end spanner A. F. 18 (19)

# **Commissioning**

## **Check wiring**

Check whether the NRG 1...-11 and the associated controller NRS 1-7 are wired in accordance with the wiring diagram. Fig. 23-26

## **Apply mains voltage**

Apply mains voltage to level switch NRS 1-7.

# **Operation**

### Low-level limiter

Operation in combination with controller NRS 1-7 in steam and pressurised hot water plants to TRD 401, TRD 602, TRD 604, EN 12952, EN 12953 or other national regulations.



#### Note

Should malfunctions occur during the commissioning procedure refer to chapter "Operational Malfunctions" on page 25 in order to analyse and correct them.

# **Operational Malfunctions**

## Fault-finding list for troubleshooting

### Level electrode submerged - low-level alarm

**Fault:** The electrode housing does not have earth connection to the boiler.

*Remedy:* Clean seating surfaces and insert metal joint ring D27 x 32 (D33 x 39) to DIN 7603, 1.4301.

Do **not** insulate level electrode with hemp or PTFE tape.

**Fault:** The internal insulation of the electrode rod is damaged.

**Remedy:** Replace level electrode.

**Fault:** Mains voltage is not applied to level switch.

**Remedy:** Apply mains voltage. Wire electrode according to wiring diagram.

### Water level below low level limit - no function

**Fault:** The vent hole in the protection tube does not exist, is obstructed or flooded.

**Remedy:** Check protection tube and, if necessary, provide vent hole.

**Fault:** The isolating valves of the external measuring pot are closed.

**Remedy:** Open isolating valves.

**Fault:** The electrode rods have earth contact. **Remedy:** Check and change position of installation.

If faults occur that are not listed above or cannot be corrected, please contact our Technical Service or authorized agency in your country.

# **Decommissioning**



### **Danger**

Risk of severe burns and scalds to the whole body! Before removing the level electrode make sure that the vessel or measuring pot are depressurised (0 bar) and cooled down to room temperature (20 °C).

# **Disposal**

Remove the level electrode and separate the waste materials in accordance with the material specification. Electronic components (boards) must be disposed of separately. For the disposal of the level electrode observe the pertinent legal regulations concerning waste disposal.

## **Annex**

## Note on the Declaration of Conformity / Declaration by the Manufacturer C€

For details on the conformity of our equipment according to the European Directives see our Declaration of Conformity or our Declaration of Manufacturer.

The current Declaration of Conformity / Declaration of Manufacturer are available in the Internet under www.gestra./de/documents or can be requested from us.

# For your notes



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