



Level Switch

# **NRS 1-50**

For **TWO** Electrodes

**EN**  
English

Original Installation Instructions  
**818953-09**

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## Important Notes

### Usage for the intended purpose

The level switch NRS 1-50 is used in conjunction with level electrodes NRG 1...-.. to limit the water level in steam boilers and (pressurised) hot-water plants.

Water level limiters switch off the heating when the water level falls below the set minimum level (low water).

Depending on the specified directives or standards, the level switch NRS 1-50 is intended to be used in combination with the following level electrodes:

| Level electrode NRG 1...-..                       |                        |                        |                        |                          |           |
|---------------------------------------------------|------------------------|------------------------|------------------------|--------------------------|-----------|
| Functional safety accessory to IEC 61508 SIL 3    | NRG 16-50              | NRG 17-50              | NRG 19-50              | NRG 111-50               |           |
| Functional safety accessory to VdTÜV Bulletin 100 | NRG 16-50<br>NRG 16-11 | NRG 17-50<br>NRG 17-11 | NRG 19-50<br>NRG 19-11 | NRG 111-50<br>NRG 111-11 | NRG 16-36 |
| Marine applications<br>e. g. DNV LR Directives    | NRG 16-50S             | NRG 16-11S             | NRG 16-38S             | NRG 16-39S               |           |

### Function

The level switch NRS 1-50 is designed for different electrical conductivities of the boiler water and for connecting one or two level electrodes.

See section **Schematic representations of arrangements**.

When the water level falls below the low level the level electrodes are exposed and a low level alarm is triggered in the level switch. This switchpoint is determined by the length of the electrode rod (level electrode NRG 1...-50, NRG 1...-11, NRG 16-36).

After the de-energizing delay has elapsed, the two output contacts of the level switch will open the safety circuit for the heating. The switching-off of the heating is interlocked in the external safety circuit and can only be deactivated when the level electrode enters the water again.

In addition, two signal outputs for external signalling devices close instantaneously.

An alarm will also be raised if a malfunction occurs in the level electrode and/or the electrical connection.

If the level electrode is installed in an isolatable level pot outside the boiler, make sure that the connecting lines are rinsed regularly. During the rinsing process the water level cannot be measured in the level pot for 5 minutes. The level switch therefore bypasses the level electrode and monitors the rinsing and bypass time (standby input, controlled by the logic unit SRL 6-50).

If the connecting lines for steam  $\geq 40$  mm and water  $\geq 100$  mm, the installation is considered to be internal. In this case the rinsing processes do not have to be monitored.

An automatic self-testing routine monitors the safety functions in the level switch and the level electrodes. In the event of a malfunction the safety circuit opens instantaneously and switches the heating off.

Alarm and error messages are indicated by LEDs and a signal output for each level electrode is energized without delay.

An alarm can be simulated by pressing the test button.

## Important Notes – continued –

### Safety note

Water level limiters are safety devices and must only be installed, wired 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. Incorrect installation, wiring or commissioning can endanger the safety of your plant.



#### Danger

The terminal strips of the equipment are live during operation.

This presents the danger of electric shock!

Always **cut off power supply** to the equipment before mounting, removing or connecting the terminal strips!



#### 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.

### Scope of supply

#### NRS 1-50

1 Level switch NRS 1-50

1 Installation manual

### Potentially explosive areas

The level switch NRS 1-50 must **not** be used in potentially explosive areas.



#### Note

The level electrodes NRG 1...-50, NRG 1...-11 and NRG 16-36 are simple items of electrical equipment as specified in EN 60079-11 section 5.7. The equipment must be equipped with approved Zener barriers if used in potentially explosive areas. Applicable in Ex-zones 1, 2 (1999/92/EC). The equipment does not bear an Ex marking.

Note that the requirements of the IEC 61508 are not met if the NRG 1...-50, NRG 1...-11 and NRG 16-36 + Zener barriers + NRS 1-50 are interconnected!

## Functional Safety acc. to IEC 61508

### Safety characteristics of the subsystem NRG 1...-50 / NRS 1-50

The level switch NRS 1-50 is certified acc. to IEC 61508 if used in combination with level electrode NRG 1...-50 / NRG 16-36 .

The combination NRG 1...-50 / NRG 16-36 / NRS 1-50 corresponds to a type B subsystem with Safety Integrity Level (SIL) 3. Type B means that the behaviour under fault conditions of the used components cannot be completely determined. The functional safety of the equipment combination refers to the detection and evaluation of the water level and, as a consequence, the contact position of the output relays.

The design of the equipment combination NRG 1...-50 / NRG 16-36 / NRS 1-50 corresponds to the architecture 1oo2.

This architecture consists of two channels that detect and diagnose faults in each other. If a fault is detected, the equipment combination NRG 1...-50 / NRG 16-36 / NRS 1-50 will go to the safe state, which means that the contacts of both output relays will open the safety circuit.

| Safety characteristics                                                  | SIL  | Architecture          | Lifetime (a)          | Proof Test Interval (a)   |
|-------------------------------------------------------------------------|------|-----------------------|-----------------------|---------------------------|
| General                                                                 | 3    | 1oo2                  | 20                    | 20                        |
|                                                                         | SFF  | PFD <sub>av</sub>     | PFH <sub>av</sub>     | λ <sub>DU</sub>           |
| Level switch NRS 1-50 in conjunction with one or two level electrode(s) | >90% | <5 x 10 <sup>-4</sup> | <5 x 10 <sup>-8</sup> | <10 x 10 <sup>-8</sup> /h |

Fig. 1

### Terms and abbreviations

| Terms Abbreviations                                           | Description                                                                                          |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Safety Integrity Level SIL                                    | Classification of the Safety Integrity Level acc. to IEC 61508                                       |
| Lifetime (a)                                                  | Functional safety: Lifetime in years                                                                 |
| Safe Failure Fraction SFF                                     | Percentage of failures without the potential to put the safety-related system into a dangerous state |
| Probability Failure per Demand (Low Demand) PFD <sub>av</sub> | Average probability of failure on demand for low demand mode (once a year)                           |
| Probability Failure per Hour PFH <sub>av</sub>                | Probability of failure per hour                                                                      |
| λ <sub>DU</sub>                                               | Failure rate for all dangerous undetected failures (per hour) of a channel of a subsystem            |

Fig. 2

## Determination of the Safety Integrity Level (SIL) for safety-related systems

Level electrode, level switch and actuators (auxiliary contactor in safety circuit) are subsystems and together constitute a safety-related system that executes a safety function.

The specification of the safety-related characteristics **Fig. 1** refers to the level electrode and the level switch including the output contacts. The actuator (e. g. an auxiliary contactor in the safety circuit) is installation specific and, according to IEC 61508, must be considered separately for the whole safety-related system.

Table **Fig. 3** shows the dependence of the Safety Integrity Level (SIL) on the average probability of failure on demand of a safety function for the **whole** safety-related system ( $PFD_{sys}$ ). The “Low demand mode” is here considered for a water level limiter, which means that the frequency of demands for operation of the safety-related system is no greater than one per year.

| Low demand mode $PFD_{sys}$    | Safety Integrity Level (SIL) |
|--------------------------------|------------------------------|
| $\geq 10^{-5} \dots < 10^{-4}$ | 4                            |
| $\geq 10^{-4} \dots < 10^{-3}$ | 3                            |
| $\geq 10^{-3} \dots < 10^{-2}$ | 2                            |
| $\geq 10^{-2} \dots < 10^{-1}$ | 1                            |

**Fig. 3**

The table in **Fig. 4** indicates the attainable Safety Integrity Level (SIL) as a function of the Safe Failure Fraction (SFF) and the Hardware Fault Tolerance (HFT) for safety-related systems.

| Hardware Fault Tolerance (HFT) for type B |       |       | Safe Failure Fraction (SFF) |
|-------------------------------------------|-------|-------|-----------------------------|
| 0                                         | 1     | 2     |                             |
|                                           | SIL 1 | SIL 2 | < 60 %                      |
| SIL 1                                     | SIL 2 | SIL 3 | 60 % - < 90 %               |
| SIL 2                                     | SIL 3 | SIL 4 | 90 % - < 99 %               |
| SIL 3                                     | SIL 4 | SIL 4 | ≥ 99 %                      |

**Fig. 4**

## Technical Data

### NRS 1-50

#### Supply voltage

24 VDC  $\pm$  20 %, 0.3 A

100-240 VAC  $\pm$  10/– 15 %, 47-63 Hz, 0.2 A (optional)

#### External fuse

0.5 A (semi-delay)

#### Power consumption

7 VA

#### Response sensitivity (Electrical conductivity of water at 25 °C)

$> 0.5 \dots < 1000 \mu\text{S/cm}$  or

$> 10 \dots < 10000 \mu\text{S/cm}$

#### Electrical connection of level electrode

2 inputs for level electrode NRG 1...-50, NRG 1...-11, NRG 16-36, 4 poles, with screen,

Sensitivity  $0.5 \mu\text{S/cm}$  or  $10 \mu\text{S/cm}$  (at 25 °C).

#### Stand-by input

2 volt-free inputs, 24 V DC, for monitoring the purging and bypass time.

Max. bypass time: 5 minutes.

#### Safety circuit

2 volt-free make contacts, 6 A 250 V AC / 30 V DC  $\cos \varphi = 1$ .

Delay of response: 3 seconds, 15 sec. for marine applications.

Provide inductive loads with RC combinations according to manufacturer's specification to ensure interference suppression.

#### Signal output

2 volt-free outputs for instantaneous external signalling, 24 VDC, max. 100 mA (semiconductor output).

#### Indicators and adjustors

2 buttons for test and diagnosis,

2 red/green LEDs for indicating the operating mode and alarm.

3 red LEDs for diagnosis,

2 two-pole code switches for setting the number of electrodes.

#### Housing

Housing material: base: polycarbonate, black; front: polycarbonate, grey.

Cross section of connection:  $1 \times 4.0 \text{ mm}^2$  solid per wire or

$1 \times 2.5 \text{ mm}^2$  per stranded wire with sleeve to DIN 46228 or

$2 \times 1.4 \text{ mm}^2$  per stranded wire with sleeve to DIN 46228; terminal strips can be detached

Fixing of housing: Mounting clip on supporting rail TH 35, EN 60715

#### Electrical safety

Degree of contamination: 2, overvoltage category III to EN 61010-01.

#### Protection

Housing: IP 40 to EN 60529

Terminal strip: IP 20 to EN 60529

#### Weight

approx. 0.5 kg

### NRS 1-50 – continued –

#### **Further conditions:**

##### **Ambient temperature**

when system is switched on: 0 ° ... 55 °C

during operation: –10 ... 55 °C

##### **Transport temperature**

–20 ... +80 °C (<100 hours), defrosting time of the de-energized equipment before it can be put into operation: 24 hours.

##### **Storage temperature**

–20 ... +70 °C, defrosting time of the de-energized equipment before it can be put into operation: 24 hours.

##### **Relative humidity**

max. 95 %, no moisture condensation

##### **Site altitude**

max. 2000 m

## Example name plate / marking

|                                                                                                                                                                                                                                  |    |    |                                                                                                        |     |    |                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|--------------------------------------------------------------------------------------------------------|-----|----|-----------------------------------------------------------------------------------|
|  Betriebsanleitung beachten!<br> See installation instruction! | 2  |    | 3                                                                                                      |     |    |                                                                                   |
|                                                                                                                                                                                                                                  | 4  | 5  | 6                                                                                                      |     |    |                                                                                   |
|                                                                                                                                                                                                                                  | 15 | 7  | 17                                                                                                     | 8   |    |                                                                                   |
| 16                                                                                                                                                                                                                               |    |    |                                                                                                        |     |    |                                                                                   |
| 9                                                                                                                                                                                                                                |    |    |                                                                                                        |     |    |                                                                                   |
| 10                                                                                                                                                                                                                               |    | 18 | <br>12345678-12345678 |     |    |                                                                                   |
|                                                                                                                                                                                                                                  |    | 19 |                                                                                                        |     |    |                                                                                   |
|                                                                                                                                                 |    | 20 | UK<br>CA                                                                                               | EAC | CE |  |
|                                                                                                                                                                                                                                  |    | 21 |                                                                                                        |     |    |                                                                                   |

13

Fig. 5

- |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1 Safety note</p> <p>2 Function</p> <p>3 Type designation</p> <p>4 Power consumption</p> <p>5 Protection</p> <p>6 Operating data<br/>(max. ambient temperature)</p> <p>7 Supply voltage</p> <p>8 Protection class</p> <p>9 Wiring diagram</p> <p>10 Type approval no.</p> <p>11 Material number, serial number</p> <p>12 Manufacturer</p> <p>13 Type approval</p> <p>14 Disposal note</p> | <p><b>Optional data</b></p> <p>15 Measuring range in <math>\mu\text{S}/\text{cm}</math></p> <p>16 Measuring range in ppm</p> <p>17 Relay protection</p> <p>18 Note on functional safety</p> <p>19 Marking for limiter or monitor</p> <p>20 Field for adjusted limit</p> <p>21 Operating principle acc. to EN 60730-1</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



The manufacturing date is shown at the side of the equipment.

## Dimensions and Functional Elements

### NRS 1-50

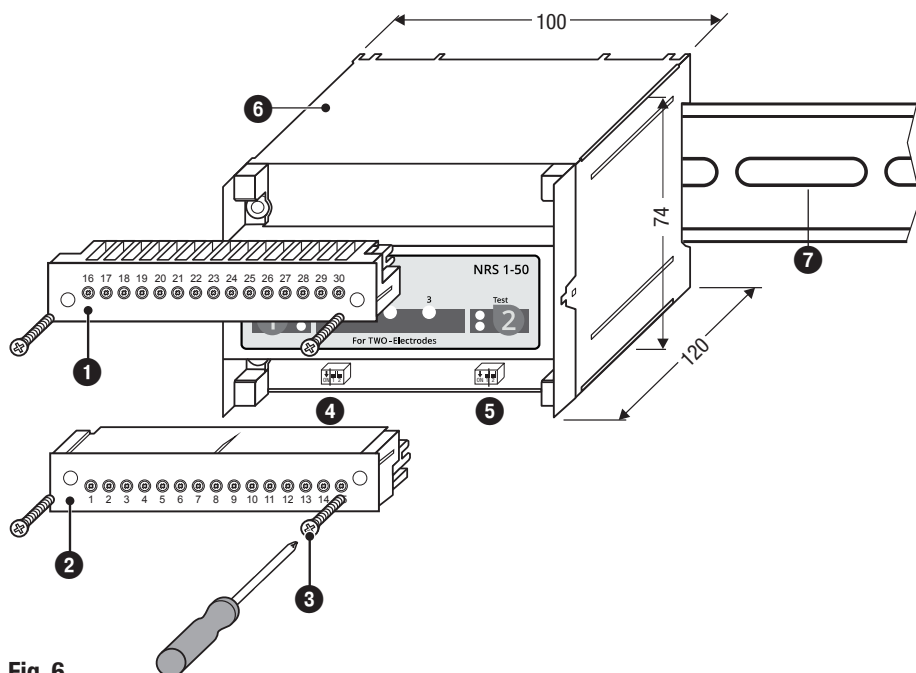


Fig. 6

The code switches are accessible after removing the lower terminal strip. The terminal strips can be unplugged after undoing the right and the left fixing screws.

### Key

- ❶ Upper terminal strip
- ❷ Lower terminal strip
- ❸ Fixing screws (cross recess head screws M3)
- ❹ Code switch for switching on/off level electrode 1 / 2
- ❺ Code switch for switching on/off level electrode 1 / 2
- ❻ Enclosure
- ❼ Supporting rail type TH 35, EN 60715

## Installation

### Mounting level switch NRS 1-50

The level switch NRS 1-50 is clipped onto the support rail ⑦ type TH 35, EN 60715 in the control cabinet. **Fig. 6**

## Electrical Connection

### Supply voltage

Provide the level switch NRS 1-50 with an external semi-delay fuse 0.5 A.

### Connection of level electrode

To connect the level electrodes please use:

- For level switch NRS 1-50 with response sensitivity 10  $\mu$ S:  
Screened multi-core control cable, min. conductor size 0.5 mm<sup>2</sup>, e.g. LiYCY 4 x 0.5 mm<sup>2</sup>,  
max. length 100 m.
- For level switch NRS 1-50 with response sensitivity 0.5  $\mu$ S:  
Double-screened multi-core low-capacitance data cable, min. conductor size 0.5 mm<sup>2</sup>,  
**Li2YCY PiMF 2 x 2 x 0.5 mm<sup>2</sup>, max. length 30 m.**

Wire terminal strip in accordance with the wiring diagram. **Fig. 7.** Connect screens to terminals 5 and 13 and to the central earthing point (**CEP**) in the control cabinet.

### Connection of safety circuit

Connect the safety circuit for the heating to terminals 23, 24 and 26, 27. Wenn used as water level limiter according to EN 12952 / EN 12953 connect the output contacts of the two monitoring channels by adding a wire link between the terminals 24 and 26.

Provide the output contacts with a 2 A or 1 A (for 72 hours operation) slow-blow fuse.



#### Note

- In the event of an alarm the level switch NRS 1-50 does not interlock automatically. If a lock function is required by the installation it must be provided in the follow-up circuitry (safety circuit). The circuitry must meet the requirements of the EN 50156.

### Connection of logic unit (standby input)

For connecting the level switch with the logic unit use a control cable, e. g. 2 x 0.5 mm<sup>2</sup>. The control voltage must not exceed 36 V DC.

### Connection for signal output

A signal output for the connection of further external signalling equipment is allocated to each monitoring channel in the level switch, max. load 100 mA. For connecting the level switch with the logic unit use a control cable, 2 x 0.5 mm<sup>2</sup>. In the event of an alarm or error message the signal outputs (terminals 20, 21 and 29, 30) open instantaneously.



#### Danger

- For the supply of the level switch NRS 1-50 with 24 V DC use a safety extra-low voltage (SELV) power supply unit that must be electrically isolated from dangerous contact voltages and must meet at least the requirements on double or reinforced isolation acc. to EN 61010-1, EN 60730-1, EN 60950-1 or EN 62368-1 (safe isolation).
- Any item of equipment that you want to connect to terminals 6, 7, 14, 15 (standby input 1 / 2) must be certified to have at least double or reinforced isolation according to EN 61010-1, EN 60730-1, EN 60950-1 or EN 62368-1 (safe isolation) between the standby inputs and the live parts of the installation that are not supplied with safety extra-low voltage (SELV).



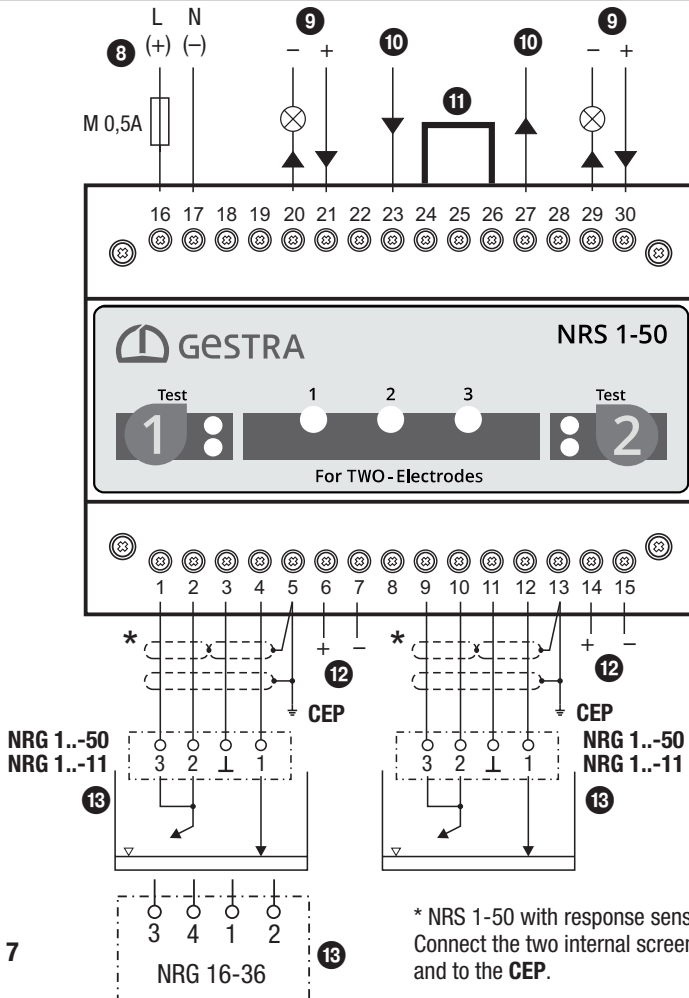
#### Attention

- Provide the level switch NRS 1-50 with an external semi-delay fuse 0.5 A.
- Connect screens to terminals 5 and 13 and to the central earthing point (**CEP**) in the control cabinet.
- To protect the switching contacts provide the safety circuit with a slow-blow fuse 2 A or 1.0 A (for 72 hrs. operation).
- When switching off inductive loads, voltage spikes are produced that may impair the operation of control and measuring systems. Connected inductive loads must be provided with suppressors such as RC combinations as specified by the manufacturer.
- When used as water level limiter according to EN 12952 / EN 12953 connect terminals 24 and 26 by adding a wire link.
- Install connecting lines to level electrodes and logic unit separated from power cables.
- Do not use unused terminals as support point terminals.

### Tools

- Screwdriver for slotted screws, size 3.5 x 100 mm, completely insulated.

## Wiring diagram for level switch NRS 1-50



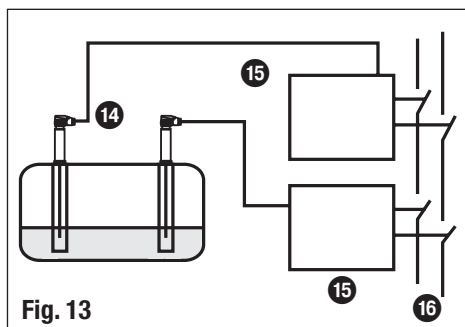
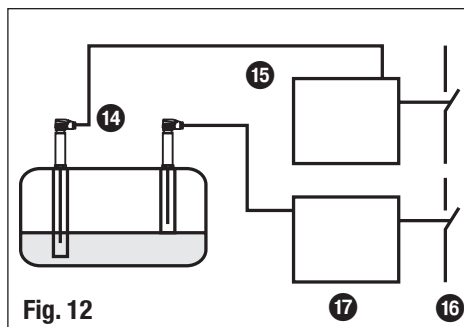
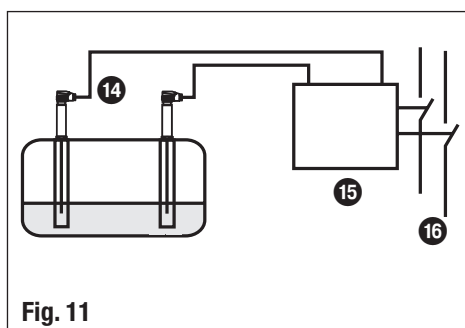
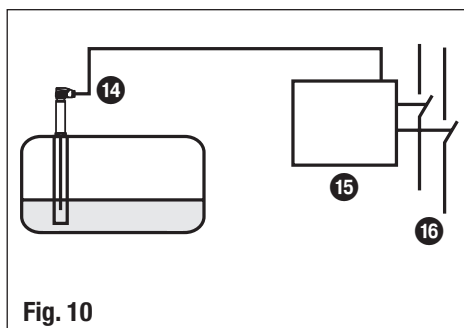
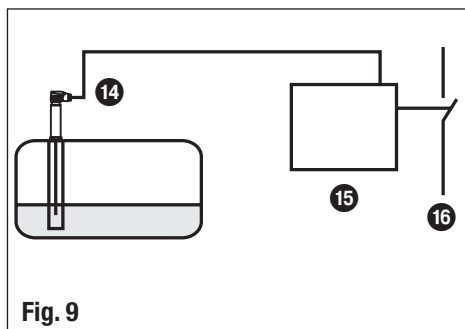
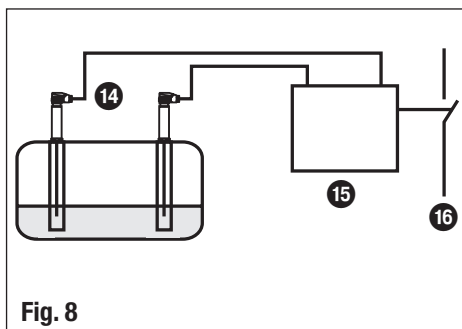
\* NRS 1-50 with response sensitivity 0.5  $\mu$ S:  
Connect the two internal screens to terminal 5/13  
and to the CEP.

### Key

- 8** Supply voltage
- 9** Signal output 1 / 2 for external alarm 24 V DC, 100 mA (semiconductor output)
- 10** Safety circuit, input and output
- 11** Wire link, on site, when used as water level limiter acc. to EN 12952 / EN 12953
- 12** Stand-by input 1 / 2, 24 V DC, for connecting the logic unit SRL 6-50
- 13** Level electrode NRG 1...-50, NRG 1...-11 or NRG 16-36

**CEP** Central earthing point in control cabinet

## Schematic representations of arrangements



### Key

- |                                   |                                                  |
|-----------------------------------|--------------------------------------------------|
| 14 Level electrode(s) NRG 1...-50 | 16 Safety circuit                                |
| 15 Level switch NRS 1-50          | 17 Level switch NRS 1-50 for low-level pre-alarm |

### Explanatory notes to schematic representations

#### Steam boiler plants according to EN 12952-07 / EN 12953-06, 72 h operation

##### Fig. 8

Combination consisting of 2 level electrodes NRG 1...-50 and 1 level switch NRS 1-50 as water level limiter. Functional safety IEC 61508, SIL 3.

The equipment combination meets the demand for two independent water level limiters.

#### (Pressurized) hot-water plants and electrically heated steam boilers according to EN 12953-06 Steam boiler plants with high availability according to EN 12952-07 / EN 12953-06, 72h operation

##### Fig. 9

Combination consisting of 1 level electrode NRG 1...-50 and 1 level switch NRS 1-50 as water level limiter. Functional safety IEC 61508, SIL 3.

Hot water installations require two independent and separate water level limiters. For this purpose one equipment combination NRG 1...-50/NRS 1-50 shall be installed in the hot-water boiler and the second one in the pressure maintaining vessel, the expansion tank or the like (depending on the type of pressurization). For electrically heated steam boilers one water level limiter is sufficient.

To meet the plant operator's demand for a higher level of availability of the steam boiler plant, two (or three) independent equipment combinations NRG 1...-50/NRS 1-50 can be installed in the steam boiler.

#### Further applications in accordance with national sets of regulations

##### Fig. 10

Combination consisting of 1 level electrode NRG 1...-50 and 1 level switch NRS 1-50 as water level limiter.

The level switch opens two separate safety circuits. Functional safety IEC 61508, SIL 3.

##### Fig. 11

Combination consisting of 2 level electrodes NRG 1...-50 and 1 level switch NRS 1-50 as water level limiter.

The level switch opens two separate safety circuits. Functional safety IEC 61508, SIL 3.

##### Fig. 12

Combination consisting of 1 level electrode NRG 1...-50 and 1 level switch NRS 1-50 as water level limiter and 1 level electrode NRG 1...-50 / 1 level switch NRS 1-50 as first low-level alarm. Functional safety IEC 61508, SIL 3.

##### Fig. 13

Combination consisting of 2 level electrodes NRG 1...-50 and 2 level switches NRS 1-50 as water level limiter.

The level switch opens two separate safety circuits. Functional safety IEC 61508, SIL 3.



#### Note

- Please observe the safety-related characteristics on page 7, Fig. 1.

## Basic Settings

### Factory setting

#### Level Switch NRS 1-50

The level switch features the following factory set default values:

- De-energizing delay: 3 sec., 15 sec. for marine applications.
- Configuration: Operation with two level electrodes NRG 1 ...-50. S1/S2 of code switches 4 and 5 set to OFF.

## Commissioning Procedure



### Danger

The terminal strips of the NRS 1-50 are live during operation.

This presents the danger of electric shock!

Always **cut off power supply** to the equipment before mounting, removing or connecting the terminal strips!

### Changing configuration

If only one electrode is used for operation (e. g. in case of emergency operation) change the settings as follows:

- Switch off mains voltage.
- Unscrew the right and left fixing screws 3 and remove the lower terminal strip 2, Fig. 6
- Depending on which electrode shall be deactivated, set S1/S2 of code switches 4 and 5 to ON.
- Attach lower terminal strip and fasten fixing screws.
- Apply mains voltage, equipment is re-started.



Toggle switch, white



Toggle switch, white

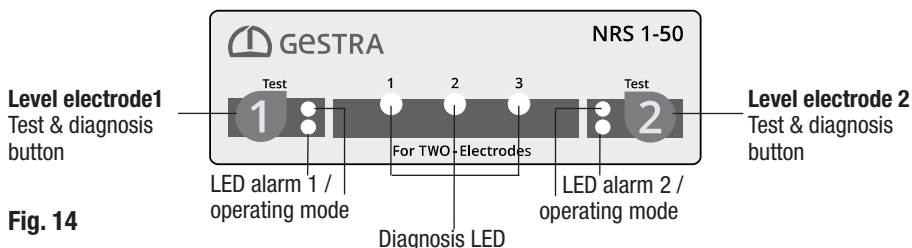
|                               | Code switch 4 |     | Code switch 5 |     |
|-------------------------------|---------------|-----|---------------|-----|
|                               | S 1           | S 2 | S 1           | S 2 |
| Level electrode 1 activated   | OFF           |     | OFF           |     |
| Level electrode 1 deactivated | ON            |     | ON            |     |
| Level electrode 2 activated   |               | OFF |               | OFF |
| Level electrode 2 deactivated |               | ON  |               | ON  |



### Note

- If only one level electrode is switched on, only the LEDs for power and alarm of the corresponding channels will be illuminated.

## Checking switchpoint and function



**Fig. 14**

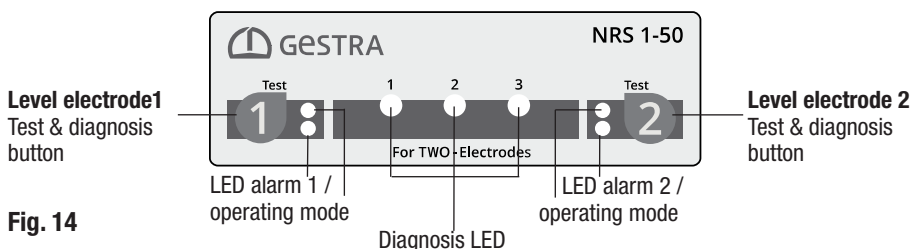
| Start                                                                                                                              |                                                   |                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Activity                                                                                                                           | Indication                                        | Function                                                                                                                    |
| Apply mains voltage.                                                                                                               | All LEDs are illuminated.                         | System is being started and tested, this takes approx. 10 sec. Output contacts are open. Signal outputs 1 and 2 are closed. |
|                                                                                                                                    | All LEDs are illuminated for more than 10 sec.    | System malfunction. Possible causes: Faulty power supply, level switch defective.                                           |
| Raise water in boiler until the switchpoint "low water level (LW)" is exceeded. Level electrode(s) make(s) contact with the water. | Green LEDs for level electrode 1 / 2 illuminated. | Output contacts are closed. Signal outputs 1 and 2 open.                                                                    |

| Checking switchpoint and function                                                                              |                                                  |                                                                                    |
|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------|
| Lower water level until it is below the switchpoint "low water level (LW)". Level electrode(s) is/are exposed. | Red LEDs for level electrode 1 / 2 are flashing. | De-energizing delay is running. Signal outputs 1 and 2 are closed instantaneously. |
|                                                                                                                | Red LEDs for level electrode 1 / 2 illuminated.  | Delay time has elapsed, output contacts open. Signal outputs 1 and 2 are closed.   |

| Possible installation faults                                                                                                             |                                                                                                     |                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Status and indication                                                                                                                    | Fault                                                                                               | Remedy                                                                                                                              |
| Sightglass indicates level below switchpoint "low water (LW)", red LEDs for level electrodes 1/2 not illuminated. Safety circuit closed. | Electrode rod(s) is/are too long.                                                                   | Cut electrode rod(s) to the length dictated by the switchpoint LW.                                                                  |
|                                                                                                                                          | If installed inside the boiler: Upper vent hole in protection tube does not exist or is obstructed. | Check installation of level electrode. Make sure that the level in the protection tube corresponds to the actual water level.       |
| Water level sufficient. Red LEDs for level electrodes 1 / 2 illuminated! Safety circuit open.                                            | Electrode rod(s) is/are too short.                                                                  | Replace electrode rod(s) and cut new rods to the length dictated by the switchpoint LW.                                             |
|                                                                                                                                          | The earth connection to the vessel is interrupted.                                                  | Clean seating surfaces and screw in level electrode with metallic joint ring. Do not insulate the electrode with hemp or PTFE tape! |
|                                                                                                                                          | Electrical conductivity of the boiler water too low.                                                | Set response sensitivity of the level switch to 0.5 µS/cm.                                                                          |
|                                                                                                                                          | Upper vent hole flooded.                                                                            | Check installation of level electrode. Make sure that the level in the protection tube corresponds to the actual water level.       |

## Operation, Alarm and Test

### Indicators and adjustors



| Operation                     |                                                   |                                                           |
|-------------------------------|---------------------------------------------------|-----------------------------------------------------------|
| Activity                      | Indication                                        | Function                                                  |
| Level electrode(s) submerged. | Green LEDs for level electrode 1 / 2 illuminated. | Output contacts are closed.<br>Signal outputs 1 / 2 open. |

| Alarm                                                         |                                                  |                                                                                     |
|---------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|
| Level electrode(s) exposed, level below low water level (LW). | Red LEDs for level electrode 1 / 2 are flashing. | De-energizing delay is running.<br>Signal outputs 1 / 2 are closed instantaneously. |
|                                                               | Red LEDs for level electrode 1 / 2 illuminated.  | Delay time has elapsed, output contacts open.<br>Signal outputs 1 / 2 are closed.   |

| Test channel 1 and 2                                                                                                                       |                                                  |                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>During operation:</b><br>Press key 1 or 2 and hold it down until the end of the test, level switch must react as if there was an alarm. | Red LEDs for level electrode 1 / 2 are flashing. | Alarm simulated in channel 1 or 2.<br>De-energizing delay is running.<br>Signal outputs 1 / 2 are closed instantaneously. |
|                                                                                                                                            | Red LEDs for level electrode 1 / 2 illuminated.  | Delay time has elapsed, output contacts open.<br>Signal outputs 1 / 2 are closed.<br>Test finished.                       |

## Troubleshooting

### Indication, diagnosis and remedy



#### Attention

Before carrying out the fault diagnosis please check:

#### Supply voltage:

Is the level switch supplied with the voltage specified on the name plate?

#### Wiring:

Is the wiring in accordance with the wiring diagram and the relevant schematic representation of arrangement?

**Configuration:** Are the code switch settings ④ and ⑤ correct for the number of level electrodes used?

## Fault Indication and Troubleshooting – continued –

### Indication, diagnosis and remedy – continued –

| Fault indication                                  |                                                    |                                                                                                   |                                        |
|---------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|
| Status                                            | Diagnosis                                          | Function                                                                                          | Next activity                          |
| Faulty evaluation of level electrode 1, channel 1 | Diagnosis LED 1 and LED alarm 1 illuminated.       | Output contacts are opened instantaneously.<br>Signal output 1 closes instantaneously.            | next:<br>Press <b>key 1</b> .          |
| Faulty evaluation of level electrode 2, channel 2 | Diagnosis LED 2 and LED alarm 2 illuminated.       | Output contacts are opened instantaneously.<br>Signal output 2 closes instantaneously.            | next:<br>Press <b>key 2</b> .          |
| Malfunction in level switch detected.             | Diagnosis LED 3 and LED alarm 1 and 2 illuminated. | Output contacts are opened instantaneously.<br>Signal outputs 1 and 2 are closed instantaneously. | next:<br>Press <b>key 1 or key 2</b> . |

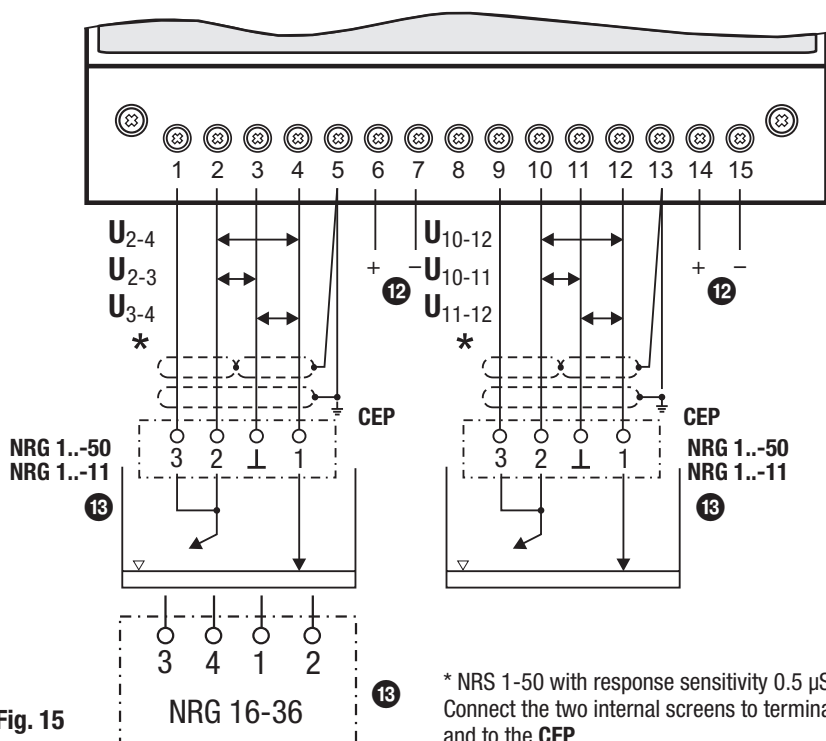
| Diagnosis                                                                                               |                           |                                                                                                         |                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Display 1 and activity                                                                                  | Display 2                 | Fault                                                                                                   | Remedy                                                                                                                               |
| LED alarm 1 and diagnosis LED 1 illuminated. Press and hold down <b>key 1</b> .                         | Diagnosis LED 1 flashing. | Malfunction in level electrode 1, malfunction in level switch, faulty wiring, faulty measuring voltage. | – check wiring,<br>– measure electrode voltages,<br>– clean and, if necessary, exchange level electrode,<br>– exchange level switch. |
|                                                                                                         | Diagnosis LED 2 flashing. | Malfunction in level electrode 1, malfunction in level switch, faulty wiring.                           |                                                                                                                                      |
|                                                                                                         | Diagnosis LED 3 flashing. | Interference voltage causing malfunction, boiler earth without PE                                       | Provide screen and earthing, connect boiler with PE.                                                                                 |
| LED alarm 2 and Diagnosis LED 2 illuminated. Press and hold down <b>key 2</b>                           | Diagnosis LED 1 flashing. | Malfunction in level electrode 2, malfunction in level switch, faulty wiring, faulty measuring voltage. | – check wiring,<br>– measure electrode voltages,<br>– clean and, if necessary, exchange level electrode,<br>– exchange level switch. |
|                                                                                                         | Diagnosis LED 2 flashing. | Malfunction in level electrode 2, malfunction in level switch, faulty wiring.                           |                                                                                                                                      |
|                                                                                                         | Diagnosis LED 3 flashing. | Interference voltage causing malfunction, boiler earth without PE.                                      | Provide screen and earthing, connect boiler with PE.                                                                                 |
| LED alarm 1 and 2 and Diagnosis LED 3 illuminated. Press and hold down <b>key 1 or 2</b> .              | Diagnosis LED 1 flashing. | Malfunction in processor, stand-by fault.                                                               | Observe operating instructions for the logic unit SRL. Replace level switch.<br><br>Replace level switch.                            |
|                                                                                                         | Diagnosis LED 2 flashing. | Internal voltage fault.                                                                                 |                                                                                                                                      |
|                                                                                                         | Diagnosis LED 3 flashing. | Malfunction in relay.                                                                                   |                                                                                                                                      |
| Once the fault is eliminated, the level switch returns to normal operation.                             |                           |                                                                                                         |                                                                                                                                      |
| After elimination of the fault switch off the mains voltage and switch it on again after approx. 5 sec. |                           |                                                                                                         |                                                                                                                                      |

## Checking Level Electrodes

### Measuring voltage across level electrode

Measure the electrode voltage in order to check whether the level electrode is immersed or if there is a malfunction. Please observe **Fig. 15**.

| U <sub>2-4/10-12</sub> | U <sub>3-4/11-12</sub>      |                                | U <sub>2-3/10-11</sub>       |
|------------------------|-----------------------------|--------------------------------|------------------------------|
|                        | immersed                    | exposed                        | Malfunction (immersed/alarm) |
| ≈ 0.7 V<br>85 Hz!      | $< \frac{U_{2-4/10-12}}{2}$ | $\geq \frac{U_{2-4/10-12}}{2}$ | ≤ U <sub>3-4/11-12</sub>     |



**Fig. 15**

## Key

- 12** Stand-by input 1 / 2, 24 V DC, for connecting the logic unit SRL  
**13** Level electrode NRG 1...-50, NRG 1...-11, NRG 16-36  
**CEP** Central earthing point in control cabinet



### Note

- The self-checking routine of the level switch NRS 1-50 reduces  $U_{2-4/10-12}$  to 0 Volt, if executed cyclically.

## Emergency operation

### Emergency operation for water level limiter

If the level switch NRS 1-50 works with two level electrodes NRG 1...-50 (water level limiter to TRD 604, EN 12952-07, EN 12953-06), the installation can continue operating in emergency operation mode according to TRD 401 and EN 12952 and EN 12953 under constant supervision with **only 1** level electrode, in case that one of the two installed level electrodes fails.

If only one electrode is used for operation change the settings as follows:

- Switch off mains voltage.
- Unscrew the right and left fixing screws **③** and remove the lower terminal strip **②**, Fig. 6
- Depending on which electrode shall be deactivated, set S1 or S2 of code switches **④** and **⑤** to ON.
- Attach lower terminal strip and fasten fixing screws.
- Apply mains voltage, equipment is re-started.



Toggle switch, white



Toggle switch, white

|                               | Code switch <b>④</b> |     | Code switch <b>⑤</b> |     |
|-------------------------------|----------------------|-----|----------------------|-----|
|                               | S 1                  | S 2 | S 1                  | S 2 |
| Level electrode 1 activated   | OFF                  |     | OFF                  |     |
| Level electrode 1 deactivated | ON                   |     | ON                   |     |
| Level electrode 2 activated   |                      | OFF |                      | OFF |
| Level electrode 2 deactivated |                      | ON  |                      | ON  |



#### Attention

- Record the beginning of emergency operation in the boiler log.
- An installation operating in emergency mode has to be constantly supervised.
- Immediately replace faulty level electrode.
- Record the end of emergency operation in the boiler log.
- When the emergency operation is over, restore original settings.

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

## Further Notes

### Action against high frequency interference

Should sporadic failures occur in installations susceptible to faults (e. g. malfunctions due to out-of-phase switching operations) we recommend the following actions in order to suppress interferences:

- Provide inductive loads with RC combinations according to manufacturer's specification to ensure interference suppression.
- Make sure that connecting cables leading to the level electrodes are segregated and run separately from power cables.
- Increase the distance to sources of interference.
- Check the connection of the screen to the central earthing point (**CEP**) in the control cabinet.
- HF interference suppression by means of hinged-shell ferrite rings.

### Interlock and interlock deactivation

In the event of an alarm the level switch NRS 1-50 does not interlock automatically.

If a lock function is required by the installation it must be provided in the follow-up circuitry (safety circuit). The circuitry must meet the requirements of the EN 50156.

### Checking the switchpoints

To check the switchpoint "Low water (LW)" you have to lower the water level. When the water level falls below the electrode tip, the level switch must activate an alarm and the safety circuit must open as soon as the de-energizing time delay has elapsed. The switching-off of the heating is interlocked in the safety circuit and can only be deactivated when the level electrode enters the water again. In this case the LEDs for alarm 1 and 2 must be illuminated and no malfunction must be indicated (diagnosis LEDs are not illuminated). Always check the switchpoint when commissioning the equipment, after replacing the level electrode and at regular intervals, e.g. every year.

### Decommissioning / replacing level switch

- Switch off mains voltage and **cut off power supply** to the equipment.
- Unscrew the right and left fixing screws **3** and remove the upper and lower terminal strips **1** **2**, Fig. 6
- Release the white fixing slide at the bottom of the equipment and take the equipment off the supporting rail.

### Disposal

For the disposal of the level switch observe the pertinent legal regulations concerning waste disposal.

## **Declaration of Conformity Directives and Standards**

For more information on the conformity of the equipment as well as applied Directives and Standards please refer to our Declaration of Conformity and associated certificates and/or approvals.

The Declaration of Conformity can be found online at [www.gestra.com](http://www.gestra.com) and associated certificates can be requested from:

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Note that Declarations of Conformity and associated certificates lose their validity if equipment is modified without prior consultation with us.









Agencies all over the world: **[www.gestra.com](http://www.gestra.com)**

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