GESTRA®

Level Electrode

NRG 21-11
NRG 21-51

EN
English

Original Installation &
Operating Manual

818841-05

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Usage for the intended purpose

The NRG 21-11 / NRG 21-51 level electrode is used to continuously measure the level of electrically conductive or non-conductive fluids in vessels.

The level electrode is designed for use in combination with the following level switches/controllers: NRS 2-50, NRS 2-51, NRR 2-50, NRR 2-51, NRR 2-52 and NRR 2-53 or NRS 2-1, NRR 2-1, NRR 2-2 and NRT 2-1.

Function

The level electrode with NRV 2-31 electronic module works according to the capacitance measurement principle and converts the changes in level into a level-dependent voltage signal, with the length of the electrode rod/electrode wire determining the measuring range.

The level electrode is installed inside the vessel or in an external level pot. If the electrode is installed internally, a protective tube provided on side ensures correct functioning (see **Installation examples** section on page 10).

Safety note

The equipment may only be installed, wired and brought into service by qualified and competent staff.

Maintenance and refits may only be performed by authorised staff who have undergone specific training.

Danger

Steam or hot water can escape when the level electrode is unscrewed!
Risk of severe scalding all over the body!
Only remove the level electrode when the boiler pressure is 0 bar.

The level electrode is hot during operation!
Risk of severe burns to hands and arms.
Make sure that equipment is cold before carrying out installation and maintenance work.

Attention

The name plate indicates the technical features of the equipment. Do not bring into service or operate any equipment that does not bear its own specific rating plate.

Improper use

Use in potentially explosive atmospheres

Do **not** use the equipment in potentially explosive atmospheres.

Technical data

NRG 21-11 / NRG 21-51

Level electrode NRG 21-11
Service pressure
PN 6, 6 bar at 164 °C

Mechanical connection
Thread G ¾ A, ISO 228-1

Materials
Screw-in body 1.4571, X6CrNiMoTi17-12-2
Electrode rod insulation PTFE

Installed length at 164 °C	349	454	559	663	768	873	978	1083
Measuring range	300	400	500	600	700	800	900	1000

Installed length at 164 °C	1196	1293	1395	1498	1607	2130
Measuring range	1100	1200	1300	1400	1500	2000

Weight
approx. 1.8 kg (L=1000 mm)

Level electrode NRG 21-51
Service pressure
PN 6, 6 bar at 164 °C

Mechanical connection
Thread G 1½ A, ISO 228-1

Materials
Screw-in body 1.4571, X6CrNiMoTi17-12-2
Electrode wire insulation PTFE
Earth wire (optional) 1.4401 X5 CrNiMo17-12-2
O-ring system FKM e.g. oil, washing solution and dye baths up to 160 °C, water up to 100 °C.
O-ring system EPDM e.g. water up to 140 °C.

Installed length/measuring range
max. 15000 mm

Weight
approx. 2.1 kg

Technical data continued

NRG 21-11 / NRG 21-51 continued

Electronic module NRV 2-31
Supply voltage
12 V DC

Sensitivity

Range 1:	Water ≥ 0.5 μS/cm
Range 2:	Water ≥ 20 μS/cm
Range 3:	EL fuel oil ε_r 2.3

Output
≥ 0 – ≤ 7 V DC, proportionate to level

Control panel
1 rotary switch with 10 settings for adjustment in line with different electrode lengths
1 DIP switch (2 positions) for sensitivity

Enclosure
Cable box: PA6 GF30, black
Cover: PA6 GF30, black/PSU, transparent grey
Elastomer seal on cover: EPDM
M16 cable gland with integrated strain relief of plastic (PA, NBR)

Electrical connection
1 screw-type 3-pole terminal strip, cable glands with integrated strain relief M16

Protection
IP 65 to EN 60529

Admissible ambient temperature
Max. 70 °C

Product package

NRG 21-11
1 level electrode NRG 21-11
1 sealing ring 27 x 32, form D, DIN 7603, 2.4068, bright annealed
1 Installation & Operating Manual

NRG 21-51
1 level electrode NRG 21-51
1 sealing ring 49 x 55, form D, DIN 7603, 2.4068, bright annealed
1 Installation & Operating Manual

Example name plate/Identification

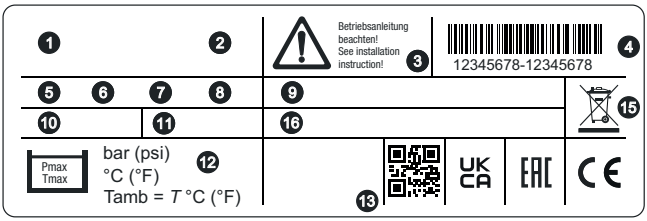

Fig. 1

❶ Equipment designation
❷ Function symbol
❸ Safety note
❹ Material number-serial number
❺ Nominal pressure rating
❻ Connection thread
❼ Material of screw-in thread
❽ IP rating
❾ Component type approval
❿ Nominal size of connecting flange
⓫ Electrode length on delivery
⓬ Maximum pressure and temperature ratings
⓭ Manufacturer
⓮ Mark of conformity
⓯ Disposal information

Optional information

⓰ Seal, cell constant, additional data

Installation

Dimensions of the NRG 21-11 / NRG 21-51

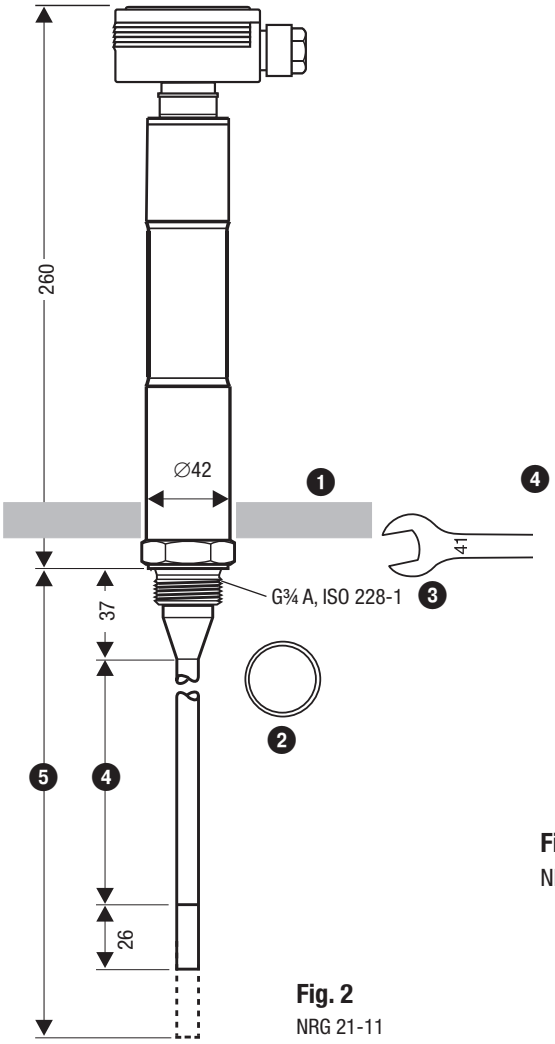

Fig. 2
NRG 21-11

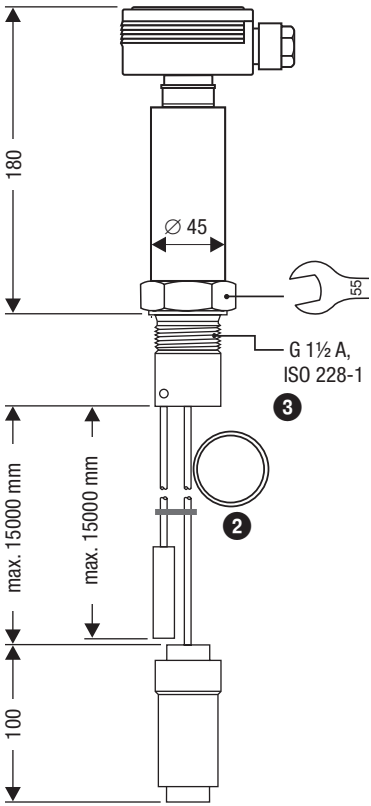

Fig. 3
NRG 21-51 with earth wire (optional)

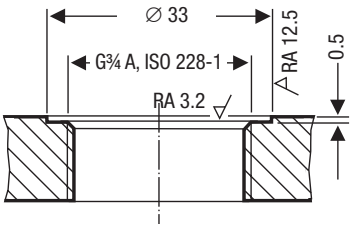

Fig. 4

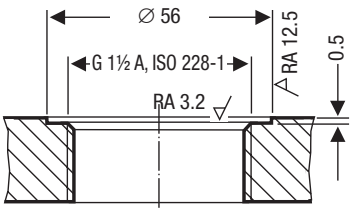

Fig. 5

Note

- See page 10 for installation examples.
- When installing outdoors, the level electrode **must** be equipped with a GESTRA weather protection cover.

Attention

- Install the level electrode in a vertical position only. If the electrode is installed in non-conductive vessels such as plastic tanks, or in horizontal round tanks, spherical tanks or other asymmetrical vessels without a protective tube installed on site, a counter electrode must be provided. In this case, use an earth tube (NRG 21-11) or an NRG 21-51 level electrode with earth wire.
- The sealing surfaces of the standpipe or flange cover must be accurately machined as shown in **Fig. 4, 5**.
- Do not bend the electrode rod during installation!
- Do not subject the electrode rod to hard impacts.
- Only use the supplied sealing ring.
  Sealing ring 27 x 32 (NRG 21-11) or 49 x 55 (NRG 21-51), form D, DIN 7603, 2.4068, bright annealed
- Do not insulate the electrode body along with the vessel.
- Do not insulate the electrode thread with hemp or PTFE tape.
- Do not apply conductive paste or grease to the electrode thread.
- Comply with the minimum distances when installing the electrode.
- Compliance with the specified tightening torque is essential.
- Do not shorten the electrode rod/electrode wire.

NRG 21-11 / NRG 21-51

1. Check the sealing surfaces. **Fig. 4, 5**
2. Place the supplied sealing ring ❷ on the sealing surface of the standpipe or flange cover. **Fig. 4, 5**
3. Coat the electrode thread ❸ with a small amount of temperature-resistant silicone grease (e.g. WINIX® 2150).
4. Screw the level electrode into the standpipe or flange and secure with a size 41 (NRG 21-11) or size 55 (NRG 21-51) open-ended spanner. The required tightening torque **when cold is 160 Nm.**

Key

❶ Thermal insulation, provided on site, d = 20 mm (outside thermal insulation of steam boiler)

❷ Sealing ring

❸ Electrode thread

❹ Measuring range (mm) = xxx %

❺ Maximum installed length at 164 °C

Installation examples

NRG 21-11

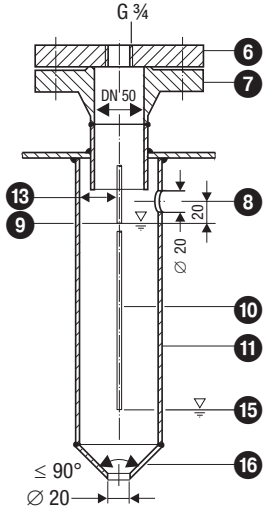

Fig. 6 Protective tube (provided on site) for internal installation

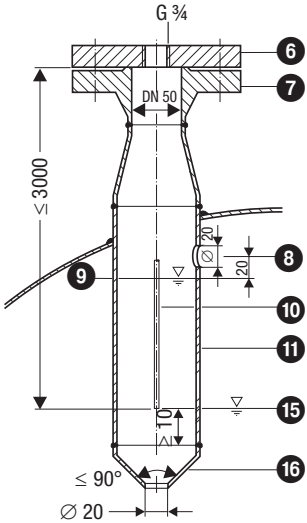

Fig. 7 Protective tube (provided on site) for internal installation

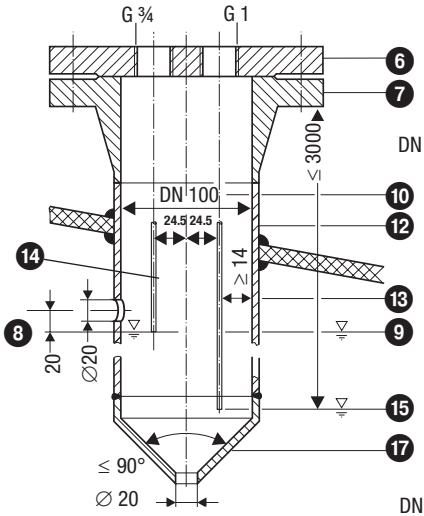

Fig. 8
Protective tube (provided on side) for internal installation in combination with other GESTRA equipment

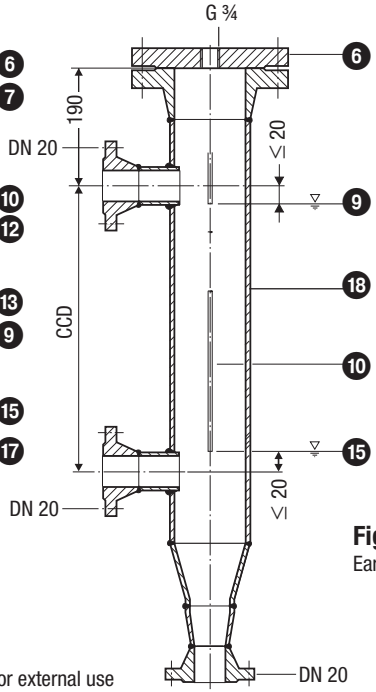

Fig. 9
Level pot for external use

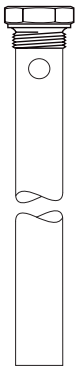

Fig. 10
Earth tube G¾ on G 1½

Installation examples continued

Key

❻ Flange PN 40, DN 50, EN 1092-1 (single electrode)
Flange PN 40, DN 100, EN 1092-1 (electrode combination)

❼ Carry out a preliminary inspection of the standpipe and connection thread during the boiler inspection.

❽ Pressure relief hole Locate the hole as close to the boiler wall as possible.

❾ High water HW

❿ Electrode rod

⓫ Protective foam tube DN 80 (as per AFAQ in France ≥ DN 100)

⓬ Protective foam tube DN 100

⓭ Distance between electrode rod and protective foam tube ≥ 14 mm

⓮ Distance between electrode extension (NRG 1..-50 or NRG 1...-51) ≥ 14 mm
(air gaps and creepage paths)

⓯ Low water LW

⓰ Reducer DIN 2616-2, K-88.9 x 3.2-42.4 x 2.6 W

⓱ Reducer DIN 2616-2, K-114.3 x 3.6-48.3 x 2.9 W

⓲ Level pot ≥ DN 80

CCD Centre-to-centre distance of connections

Tools

- Size 41 open-ended spanner, DIN 3110, ISO 3318
- Size 55 open-ended spanner, DIN 3110, ISO 3318

Electrical connection

NRV 2-31

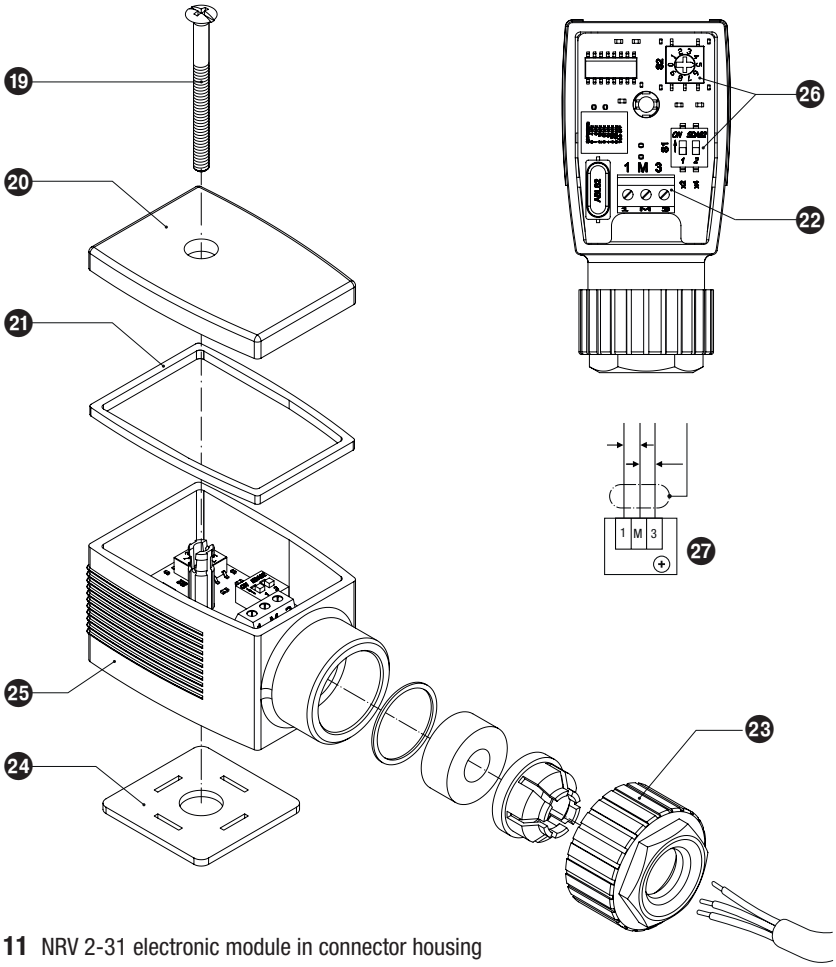

Fig. 11 NRV 2-31 electronic module in connector housing

Key

19 Screw M4

20 Cover

21 Seal

22 Terminals

23 Cable gland M16 (PG 9)

24 Sealing washer

25 Connector housing (NRV 2-31 electronic module)

26 Code switch

27 Wiring of terminals

Electrical connection continued

Connecting the level electrode

To connect the equipment, please use a shielded, multi-core control cable with a minimum conductor size of 0.5 mm², e.g. LiYCY 4 x 0.5 mm², maximum length 100 m.

A maximum of three NRS/NRR 2-5.. switches/controllers can be connected to one level electrode.

Connect the shield just once to the central earthing point **(CEP)** in the control cabinet. Wire the terminal strip as shown in the wiring diagram. **Fig. 12**

NRV 2-31, wiring the terminal strip

1. Undo the screw ⑲ . **Fig. 11**
2. Detach the connector housing (NRV 2-31 electronic module) ㉕ from the level electrode, leaving the sealing washer ㉔ on the contact plate.
3. Remove the cover ⑳ and seal ㉑.
4. Unfasten the cable gland ㉓.
5. Pull the cable through the cable gland ㉓ of the connector housing ㉕ and wire the terminals ㉒ as shown in the wiring diagram in **Fig. 12**.
6. Put on the cover ⑳ and insert the screw ⑲.
7. Put the connector housing ㉕ on the level electrode and secure with the screw ⑲.

Wiring diagram

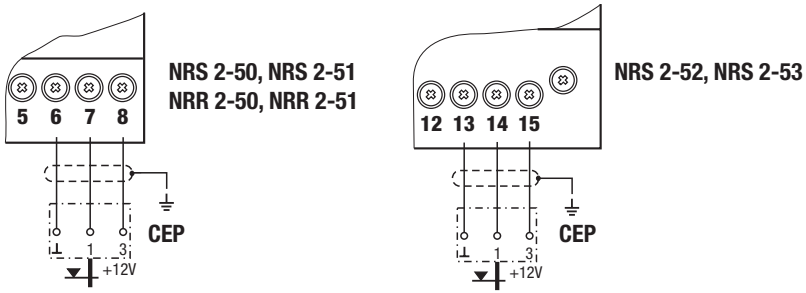

Fig. 13

NRG 21-11 / NRG 21-51 **NRG 21-11 / NRG 21-51**

Attention

- Please refer to the Installation & Operating Manuals of the level switches/level controllers NRS 2-50, NRS 2-51, NRR 2-50, NRR 2-51, NRR 2-52 and NRR 2-53 or NRS 2-1, NRR 2-1, NRR 2-2 and NRT 2-1.
- Route the connecting cable to the level electrode separately from power lines.

Tools

- Size 1 screwdriver
- Size 2.5 screwdriver, fully insulated to VDE 0680-1

Basic settings

Factory setting

The code switches ㉘ are factory-set in such a way that the maximum measuring range is active for water (conductivity ≥ 20 µS/cm). The maximum measuring range extends from the lower end plus 26 mm to the upper measuring point of the electrode rod. **Fig. 14, Fig. 15**

The NRG 21-11 level electrode is delivered with the following factory settings:

NRG 21-11	Measuring ranges	Factory settings of switches		
		S1.1	S1.2	S2 setting
Use in conductive fluids, conductivity > 20 µS/cm	up to 350 mm	ON	OFF	6
	350 mm to 750 mm	OFF	OFF	6
	750 mm to 1500 mm	OFF	OFF	5
	1500 mm to 2500 mm	OFF	OFF	4

The NRG 21-51 level electrode is delivered with the following factory settings:

NRG 21-51	Measuring ranges	Factory settings of switches		
		S1.1	S1.2	S2 setting
Use in conductive fluids, conductivity > 20 µS/cm	500 mm to 1000 mm	ON	OFF	6
	1000 mm to 2000 mm	OFF	OFF	6
	2000 mm to 3800 mm	OFF	OFF	5
	3800 mm to 7500 mm	OFF	OFF	3
	7500 mm to 15000 mm	OFF	OFF	2

The factory settings do not cover the special case where the level electrode is used in non-conductive fluids. In this case, adjust the basic settings of the switches as follows.

NRG 21-51	Measuring ranges	Factory settings of switches		
		S1.1	S1.2	S2 setting
Use in non-conductive fluids	500 mm to 1000 mm	ON	ON	6
	1000 mm to 2000 mm	ON	OFF	6
	2000 mm to 3800 mm	OFF	OFF	6
	3800 mm to 7500 mm	OFF	OFF	4
	7500 mm to 15000 mm	OFF	OFF	3

Establishing the active measuring range

An active measuring range can be established within the electrode's measuring range. Use the code switches ㉙ **Fig.11** to preselect the length of the active measuring range, using the factory setting tables on page 14 for guidance.

Ⓧ Selected (active) measuring range [mm]
❹ Measuring range (mm) = xxx % **see Fig. 2, 3**
㉙ Lower end of measuring range
㉚ Upper end of measuring range
㉛ Diagram for water, conductivity ≥ 20 µS/cm
㉜ Diagram for water, conductivity ≥ 0.5 µS/cm
㉝ Diagram for EL fuel oil, dielectric constant ε_r 2.3

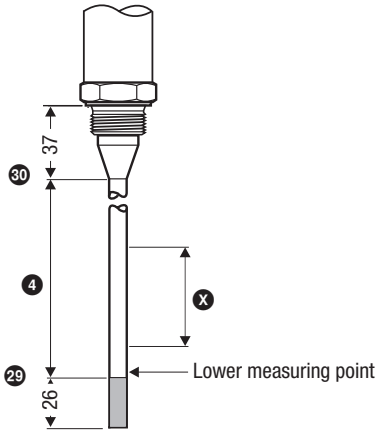

Fig. 14
NRG 21-11

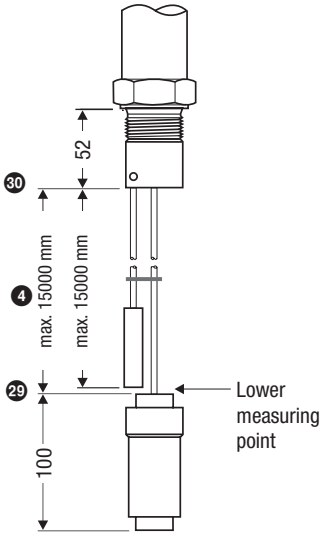

Fig. 15
NRG 21-51 with earth wire (customised version)

Attention

- If Ⓧ is clearly below ❹, change the code switch settings in accordance with the diagrams ㉛, ㉜ and ㉝ for the fluid to be measured.

Establishing the active measuring range continued

Ascertain the type of fluid that is to be measured. Establish how large the active measuring range must be [in mm] for your intended use. Refer to diagram ㉛, ㉜ or ㉝ to determine the required code switch settings for water and EL fuel oil.

Example: Maximum measuring range at 25 °C: 1500 mm, selected active measuring range: 1000 mm, turn rotary switch S2 to position 5 and switches S1.1 and S1.2 to OFF.

If the fluid to be measured is neither water nor EL fuel oil, you must perform a voltage measurement to determine the switch position. To do this, switch on the supply voltage of the connected level switches/ controllers.

1. Undo the screw ⑲ and take off the cover ⑳.
2. Fill the vessel to maximum and connect a voltmeter between terminals “1” (+) and “M” (–). As measurement starts, set DIP switches S1.1 and S1.2 to OFF and turn rotary switch S2 to 0.
3. Now turn rotary switch S2 one position further, from 0 to position 1, then 2, then 3, etc. all the way to 6, then 6 + DIP switch S1.1 = ON.

   As soon as a reading of 7 V is exceeded with one of these switch positions, select the switch position before this one.
4. When your settings are complete, put the cover ⑳ on the connector housing ㉕ and secure with the screw ⑲.

㉛ Diagram for water, conductivity ≥ 20 µS/cm

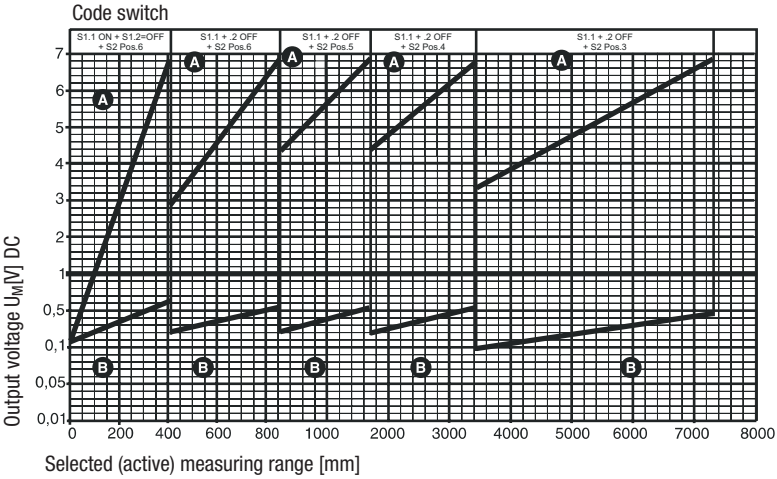

Fig. 16

Establishing the active measuring range continued

32 Diagram for water, conductivity ≥ 0.5 µS/cm

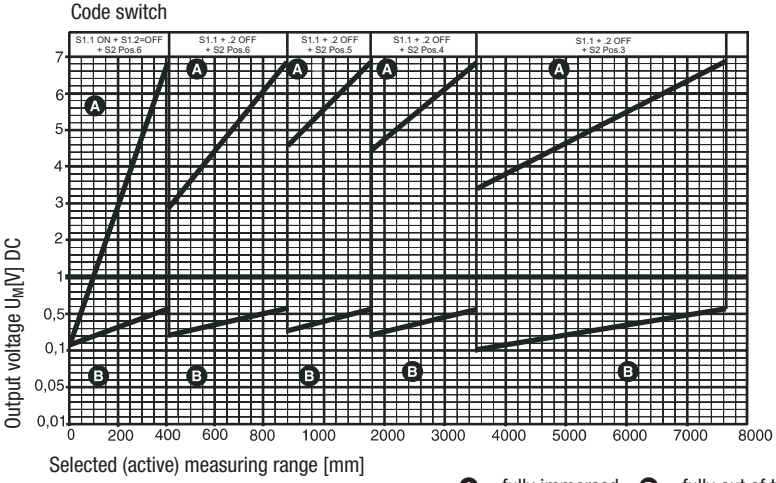

Fig. 17

33 Diagram for EL fuel oil, dielectric constant εr 2.3

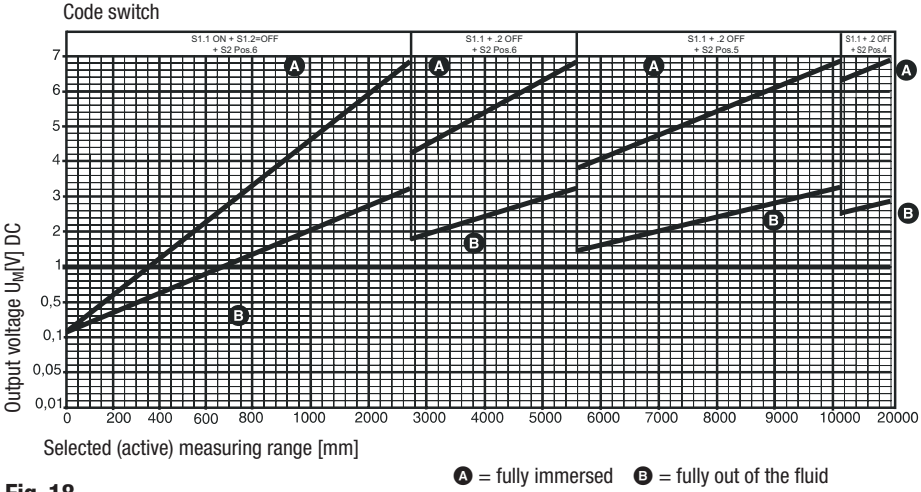

Fig. 18

Bringing into service

Switching on the supply voltage

Please check that the level electrode is connected as shown in the wiring diagram (**Fig. 13)** and switch on the supply voltage of the connected level switches/level controllers.

Checking the measuring range

Before you bring the level electrode into service, please check that the active measuring range you established is suitable for the operating conditions of the plant.

Checking the measuring voltages

The supply voltage can be measured in the connector housing ㉕ between terminals “3” and “M”. The voltage must be 12 V DC. If this voltage is not present, please check the connected level switch/level controller.

The measuring voltage UM, which is proportionate to the level, can be measured between terminals “1” (+) and “M” (–). Increase the level to the maximum (fully immersed) of the selected (active) measuring range (e.g. 1000 mm) and measure the voltage.

Compare this value with the value on the corresponding diagram (in diagram ㉛, UM is 4.6 V at 1000 mm). The following values must be measured in all cases:
Level electrode fully out of the fluid: UM ≥ 0 V, level electrode fully immersed: UM ≤ 7 V DC

If UM = 0 V or UM > 7 V DC is measured with the level electrode immersed, please replace the level electrode.

Note

- If you set the measuring range while the fluid is **cold**, the settings will change when the electrode rod extends as a reaction to heat. You will then need to correct your settings.

Troubleshooting

Indications, diagnosis and remedies

Attention

Please check the following before diagnosis:

Supply voltage:
Is the level electrode supplied with the voltage specified on the name plate?

Wiring:
Does the wiring conform to the wiring diagram?

Error indications	
The equipment is not working accurately	
Error	**Remedy**
The level electrode was installed without a protective tube. The protective tube is required as a counter electrode.	Install a protective tube.
The pressure relief hole in the protective tube is missing, clogged or flooded.	Check the protective tube and provide a pressure relief hole if none is present.
Stop valves of the external level pot (optional) are closed.	Open the stop valves.
The desired lower end of the measuring range is outside the level electrode's measuring range. The level electrode is too short.	Install a level electrode of sufficient length.
The measuring range is incorrectly set.	Correct the settings of the code switch ㉖. See **Basic settings**
The electrode rod/electrode wire is heavily soiled due to the build-up of deposits.	Remove the level electrode and clean the electrode rod/ electrode wire with a damp cloth.
UM = 0 V or > 7 V DC is measured with the level electrode immersed.	Replace the level electrode.

The equipment fails to work	
Error	**Remedy**
No supply voltage	Switch on the supply voltage. Check all electrical connections.
The earth connection to the vessel is interrupted.	Clean sealing surfaces and screw in the level electrode with a metal sealing ring 27 x 32 (NRG 21-11), form D, DIN 7603, 2.4068, bright annealed, or 49 x 55 (NRG 21-51), form D, DIN 7603, 2.4068, bright annealed. Do **not** insulate the electrode thread with hemp or PTFE tape

Maintenance

Safety note

The equipment may only be installed, wired and brought into service by qualified and competent staff.

Maintenance and refits may only be performed by authorised staff who have undergone specific training.

Danger

Steam or hot water can escape when the level electrode is unscrewed!
Risk of severe scalding all over the body!
Only remove the level electrode when the boiler pressure is 0 bar.

The level electrode is hot during operation!
Risk of severe burns to hands and arms.
Make sure that equipment is cold before carrying out installation and maintenance work.

Cleaning the electrode rod

The equipment may only be installed and removed by qualified specialist staff. Pay attention to the instructions in the “Installation” section on page 9.

To clean the electrode rod, take the level electrode out of service and remove it.

Clean the electrode rod/electrode wire with a damp cloth.

Removing and disposing of the level electrode

Removing and disposing of the NRG 21-11 / NRG 21-51 level electrode

1. Switch off the supply voltage.
2. Undo the screw ⑲ and take off the cover ⑳.
3. Detach the connecting cables from the terminals ㉒ and pull the cables out through the cable gland.
4. Make sure the equipment is not hot or under pressure before dismantling it.

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

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.

Declaration of Conformity; Standards and Directives

You can find details on the conformity of the equipment and the applicable standards and directives in the Declaration of Conformity and associated certificates.

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

GESTRA GmbH
Münchener Straße 77
28215 Bremen
Germany
Tel. +49 421 3503-0
Fax +49 421 3503-393
e-mail info@de.gestra.com
Website www.gestra.com

Modifications to the equipment not approved by us will invalidate the Declarations of Conformity and certificates.

For your notes

For your notes

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

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