



Level Electrode

NRG 21-11

NRG 21-51

EN
English

Original Installation Instructions
818841-03

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Important notes

Usage for the intended purpose

The level electrodes NRG 21-11, NRG 21-51 are level sensors for giving a continuous measurement of electrically conductive and non-conductive liquids in vessels.

The level electrode is designed for use in conjunction 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 and the electronic module NRV 2-29 work according to the capacitance measurement principle and translate the level changes into a level-dependent current signal, with the length of the electrode rod determining the measuring range.

The level electrode is installed inside the vessel or in an external level pot. If the electrode is installed inside the boiler or vessel, a protection tube provided on side ensures correct functioning (see section **Examples of installation** (page 10).

Safety note

The equipment 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.



Danger

When loosening the level electrode steam or hot water might escape!
This presents the risk of severe scalding all over the body!
It is therefore essential not to dismantle the electrode unless the boiler pressure is verified to be 0 bar.

The level electrode becomes hot during operation.
Risk of severe burns to hands and arms.
Before carrying out installation and maintenance work make sure that the equipment is cold.



Attention

The name plate specifies the technical features of the equipment. Do not commission or operate any item of equipment that does not bear its specific name plate.

Directives and standards

ATEX (Atmosphère Explosible)

According to the European Directive 2014/34/EU the equipment must **not** be used in explosion-risk areas.

UL/cUL (CSA) Approval

The equipment complies with the requirements of the following standards: UL 508 and CSA C22.2 No. 14-13, Standards for Industrial Control Equipment. File E243189.

Note on the Declaration of Conformity / Manufacturer's Declaration **CE**

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.

Technical data

NRG 21-11, NRG 21-51

Level electrode NRG 21-11

Service pressure

PN 6, 6 bar at 164 °C

Mechanical connection

Screwed G $\frac{3}{4}$ A, DIN ISO 228

Materials

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

Electrode rod insulation: PTFE

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

Length of installation 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

Screwed G 1 $\frac{1}{2}$ A, ISO 228

Materials

Screw-in body 1.4571, X6CrNiMoTi17-12-2

Insulating seal of electrode rope PTFE

Earth wire (optional) 1.4401 X5 CrNiMo17-12-2

O-ring system FKM, e. g. mineral oil, lye, dyebaths up to 160 °C, water up to 100 °C.

O-ring system EPDM, e. g. water up to 140 °C.

Length of installation / measuring range

max. 15000 mm

Weight

approx. 2.1 kg

Technical data - continued -

NRG 21-11, NRG 21-51 - continued -

Electronic module NRV 2-29

Supply voltage

12 V DC

Response sensitivity

Range 1: Water $\geq 0.5 \mu\text{S/cm}$

Range 2: Water $\geq 20 \mu\text{S/cm}$

Range 3: Fuel oil EL ϵ_r 2,3

Output

$\geq 0 - \leq 7$ V DC, level proportional

Adjustor

1 Code switch with 6 poles for setting the measuring range

Enclosure

PPO (Noryl®)

Electrical connection

1 Screw-type terminal strip with 3 poles, cable gland with integrated cable clamp M 16

Protection

IP 65 to EN 60529

Admissible ambient temperature

Max. 70 °C

Scope of supply

NRG 21-11

- 1 Level electrode type NRG 21-11
- 1 Joint ring 27 x 32 form D to DIN 7603, made from 2.4068, bright annealed
- 1 Installation manual

NRG 21-51

- 1 Level electrode type NRG 21-51
- 1 Joint ring 49 x 55 form D to DIN 7603, made from 2.4068, bright annealed
- 1 Installation manual

Name plate/markings

Equipment designation

Safety note

NRG 21-11				Betriebsanleitung beachten See installation instructions Voir instructions de montage	
PN 6	G 3/4	1.4571	IP 65		
P_{max}	6 bar (87 psi)			Meßlänge / Range H= mm	CE
T_{max}	164°C (327°F)				
		T_{amb}	70°C (158 °F)		
GESTRA AG		D-28215 Bremen		Mat-Nr.:	

Disposal note

Pressure rating, thread type, material number, protection

NRG 21-51				Betriebsanleitung beachten See installation instructions Voir instructions de montage	
PN 6	G 1 1/2	1.4571	IP 65	Dichtung: <input type="checkbox"/> FKM <input type="checkbox"/> EPDM	
P_{max}	6 bar (87 psi)			Meßlänge / Range H= mm	CE
T_{max}	164°C (327°F)				
		T_{amb}	70°C (158 °F)		
GESTRA AG		D-28215 Bremen		Mat-Nr.:	

CE Marking

Manufacturer

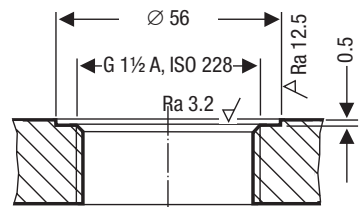
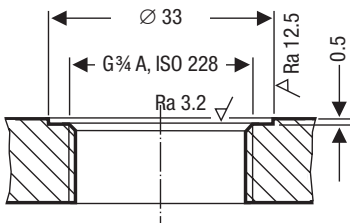
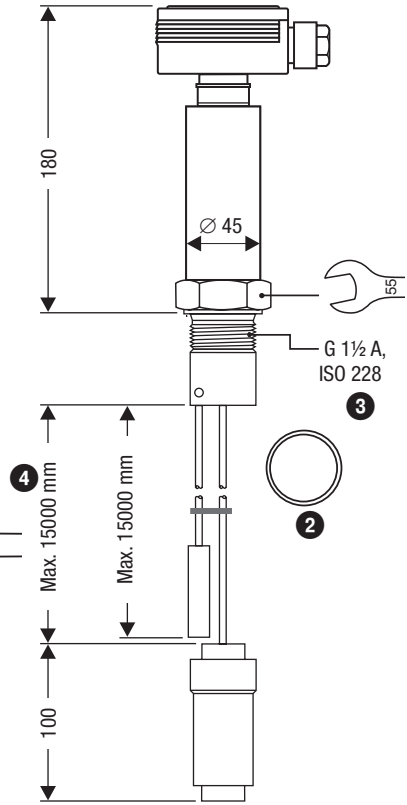
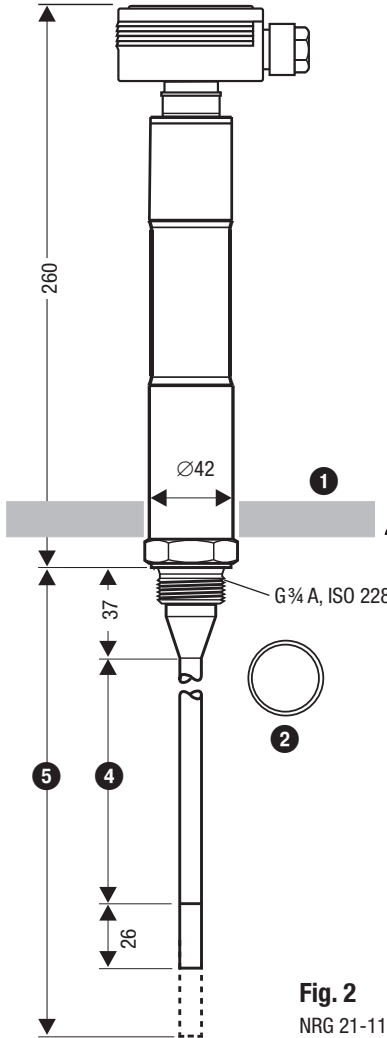
Application range

Material number

Fig. 1

Installation

Dimensions NRG 21-11, NRG 21-51





Note

- Refer to pages 10 for typical installation examples.
- If installed outdoors the level electrode **must** be equipped with a GESTRA weather protection cover.



Attention

- Install level electrode only in a vertical position. A counter-electrode must be provided if the electrode is installed in non-conductive vessels such as plastic tanks, or in horizontal round tanks, spherical tanks or other asymmetrical tank shapes without on-site protection tube. In this case use an earth tube (NRG 21-11) or install the level electrode NRG 21-51 with earth wire.
- The seating surfaces of the standpipe or the flange provided on the vessel must be accurately machined **Fig. 4, 5!**
- Do not bend electrode rod when mounting.!
- Do not subject electrode rod to physical shocks.
- Use only the supplied joint ring!
Joint seal 27 x 32 (NRG 21-11) or 49 x 55 (NRG 21-51), form D, DIN 7603, 2.4068, bright annealed
- Do not lag electrode body above the hexagonal section!
- Do not insulate electrode thread with hemp or PTFE tape!
- Do not apply conductive paste or grease to the electrode thread!
- Observe the minimum distances for the installation of the electrode!
- Observe the specified tightening torque.
- Do not cut the electrode rod / electrode rope.

NRG 21-11, NRG 21-51

1. Check seating surfaces. **Fig. 4, 5**
2. Place supplied joint ring **2** onto seating surface of the threaded standpipe or flange. **Fig. 4, 5**
3. Apply a light smear of silicone grease (e. g. WINIX® 2150) to electrode thread **3**.
4. Screw level electrode into threaded standpipe or flange and tighten with an open-end spanner A. F. 41 (NRG 21-11) or A. F. 55 (NRG 21-51) mm. The torque required **when cold is 160 Nm**.

Key

- | | |
|--|--|
| 1 Thermal insulation, provided on site, d = 20 mm (outside of thermal insulation of steam boiler) | 3 Electrode thread |
| 2 Gasket | 4 Measuring range (mm) = xxx % |
| | 5 Max. length of installation at 164 °C |

Examples of installation

NRG 21-11

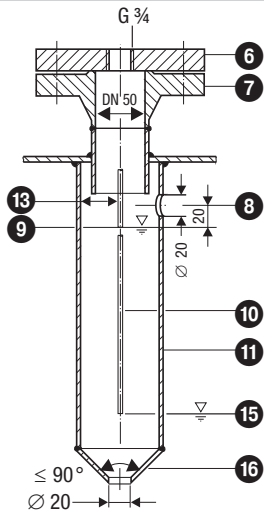


Fig. 6 Protection tube (provided on site) for installation inside the boiler

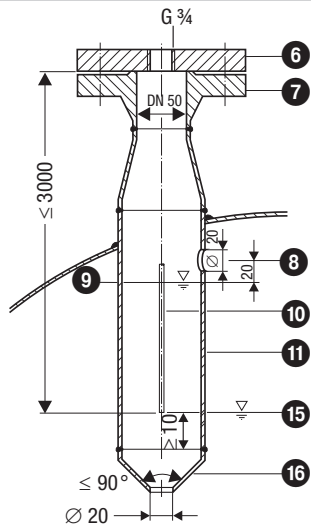


Fig. 7 Protection tube (provided on site) for installation inside the boiler

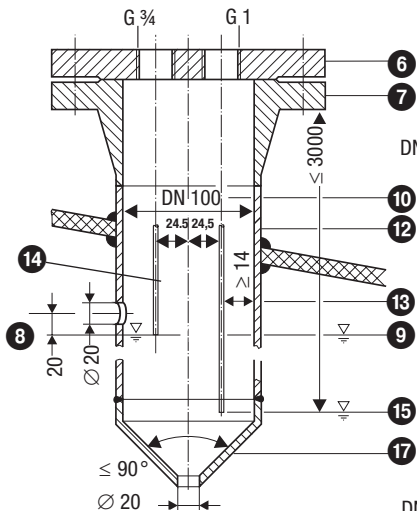


Fig. 8 Protection tube (provided on site) for installation inside the boiler and in combination with other GESTRA equipment

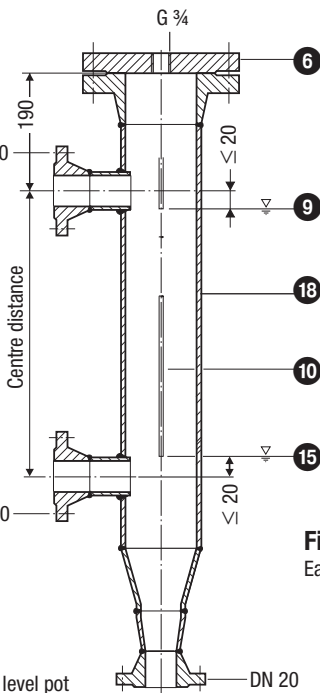


Fig. 9 External level pot

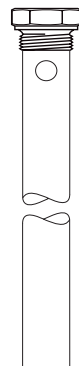


Fig. 10 Earth wire G 3/4 to G 1 1/2

Examples of installation - continued -

Key

- ⑥ Flange PN 40, DN 50, DIN EN 1092-01 (single electrode)
Flange PN 40, DN 100, DIN EN 1092-01 (combination of electrodes)
- ⑦ For the approval of the boiler standpipe with connecting flange the relevant regulations must be considered.
- ⑧ Vent hole Provide vent hole as close to the boiler wall as possible!
- ⑨ High water HW
- ⑩ Electrode rod
- ⑪ Protection tube DN 80 (in France according to AFAQ \geq DN 100)
- ⑫ Protection tube DN 100
- ⑬ Distance between electrode rod and protection tube \geq 14 mm
- ⑭ Distance between electrode rod (NRG 1...-50 or NRG 1...-51) \geq 14 mm (creepage distances and clearances)
- ⑮ Low water LW
- ⑯ Reducer DIN 2616-2, K-88.9 x 3.2-42.4 x 2.6 W
- ⑰ Reducer DIN 2616-2, K-114.3 x 3.6-48.3 x 2.9 W
- ⑱ Level pot \geq DN 80

Tools

- Open-end spanner A. F. 41, DIN 3110, ISO 3318
- Open-end spanner A. F. 55, DIN 3110, ISO 3318

Electrical connection

NRV 2-29

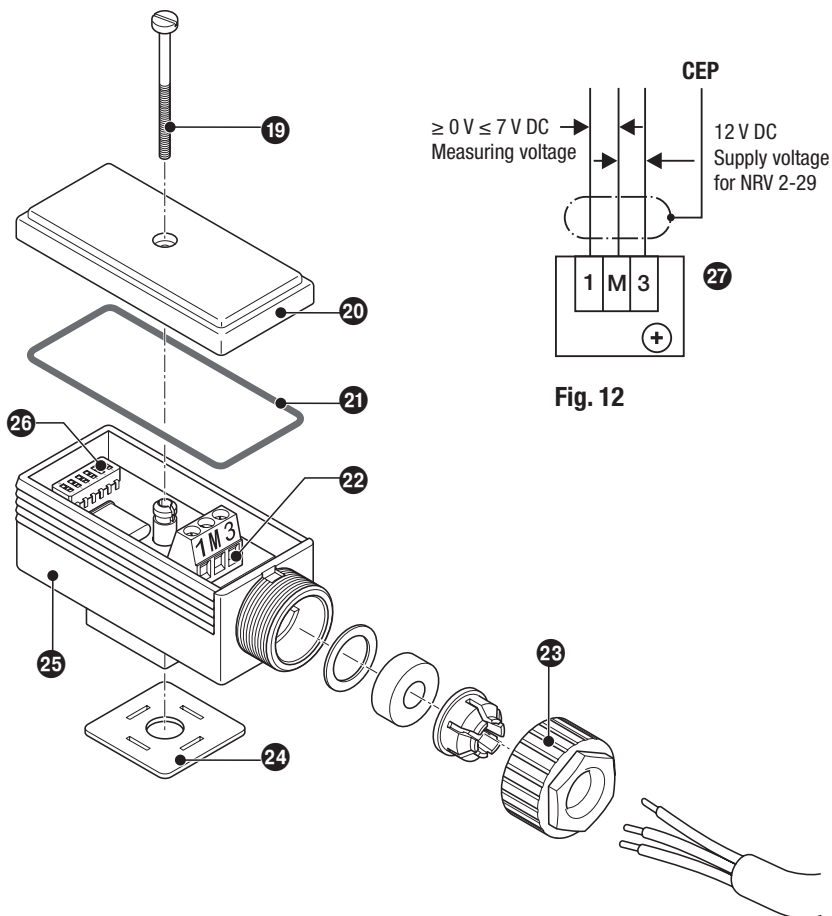


Fig. 12

Fig. 11 Pre-amplifier NRV 2-29 integrated in terminal box

Key

- | | |
|----------------------------|--|
| 19 Screw M4 | 24 Sealing plate |
| 20 Cover | 25 Terminal box (electronic module NRV 2-29) |
| 21 Seal | 26 Code switch |
| 22 Terminals | 27 Wiring of terminals |
| 23 Cable gland M 16 (PG 9) | |

Connection of level electrode

To connect the equipment use screened multi-core control cable with a min. conductor size 0.5 mm², e. g. LiYCY 4 x 0.5 mm², max. length: 100 m.

A maximum of 3 switches / controllers NRS /NRR 2-5.. can be connected to one level electrode.

Connect only one screen to the central earthing point (**CEP**) in the control cabinet. Wire terminal strip in accordance with the wiring diagram. **Fig. 12**

NRV 2-29, connecting the terminal strip

1. Loosen screw **19**. **Fig. 11**
2. Detach terminal box (electronic module NRV 2-29) **25** from level electrode. Leave sealing plate **24** on contact plate.
3. Remove cover **20** and seal **21**.
4. Unscrew cable gland **23**.
5. Pull cable through cable gland **23** in terminal box **25** and wire terminals **22** in accordance with wiring diagram **Fig. 12**.
6. Replace cover **20** and insert screw **19**.
7. Put terminal box **25** onto level electrode and fix it with screw **19**.

Wiring diagram

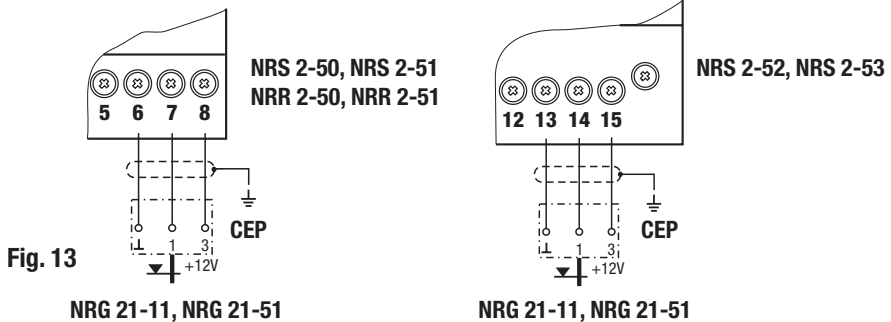


Fig. 13



Attention

- Please observe the instructions given in the installation & operating manual for the 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!
- Make sure that connecting cables leading to the level electrode are segregated and run separately from power cables.

Tools

- Screwdriver, size 1
- Screwdriver, size 2.5, completely insulated according to DIN VDE 0680-1

Basic settings

Factory setting

The code switch 23 is set at our factory so that the max. measuring range for water (conductivity $\geq 20 \mu\text{S}/\text{cm}$) is activated. The max. measuring range is found as follows: lower end plus 26 mm up to top measuring point of the electrode rod. **Fig. 14, Fig. 15**

The level electrode NRG 21-11 features the following factory set default values:

- | | |
|--|---|
| ■ Measuring range up to 350 mm: | Code switch 23 Switch S4, S5 ON, S1, S2, S3, S6 OFF |
| ■ Measuring range 350 mm up to 750 mm: | Code switch 23 Switch S4 ON, S1, S2, S3, S5, S6 OFF |
| ■ Measuring range 750 mm up to 1500 mm: | Code switch 23 Switch S3 ON, S1, S2, S3, S4, S6 OFF |
| ■ Measuring range 1500 mm up to 2500 mm: | Code switch 23 Switch S2 ON, S1, S3, S4, S5, S6 OFF |

The level electrode NRG 21-51 features the following factory set default values:

Settings for use in conductive fluids

- | | |
|---|---|
| ■ Measuring range 500 mm up to 1000 mm: | Code switch 23 Switch S4, S5 ON, S1, S2, S3, S6 OFF |
| ■ Measuring range 1000 mm up to 2000 mm: | Code switch 23 Switch S4 ON, S1, S2, S3, S5, S6 OFF |
| ■ Measuring range 2000 mm up to 3800 mm: | Code switch 23 Switch S3 ON, S1, S2, S4, S5, S6 OFF |
| ■ Measuring range 3800 mm up to 7500 mm: | Code switch 23 Switch S2 ON, S1, S3, S4, S5, S6 OFF |
| ■ Measuring range 7500 mm up to 15000 mm: | Code switch 23 Switch S1 ON, S2, S3, S4, S5, S6 OFF |

Settings for use in non-conductive fluids

- | | |
|---|---|
| ■ Measuring range up to 1000 mm: | Code switch 23 Switch S4, S5, S6 ON, S1, S2, S3 OFF |
| ■ Measuring range 1000 mm up to 2000 mm: | Code switch 23 Switch S4, S5 ON, S1, S2, S3, S6 OFF |
| ■ Measuring range 2000 mm up to 3800 mm: | Code switch 23 Switch S4 ON, S1, S2, S3, S5, S6 OFF |
| ■ Measuring range 3800 mm up to 7500 mm: | Code switch 23 Switch S3 ON, S1, S2, S4, S5, S6 OFF |
| ■ Measuring range 7500 mm up to 15000 mm: | Code switch 23 Switch S2 ON, S1, S3, S4, S5, S6 OFF |

Establishing active measuring range (control range)

Within the measuring range of the electrode you can establish the active measuring range. Use code switch **Ⓜ** to establish the length of the active measuring range.

- Ⓧ** Selected (active) measuring range [mm]
- ④** Measuring range (mm) = xxx % **see Fig. 2, 3**
- ⑲** Lower end of measuring range, adjustable
- ⑳** Upper end of measuring range, adjustable
- ㉑** Diagram for water, conductivity $\geq 20 \mu\text{S/cm}$
- ㉒** Diagram for water, conductivity $\geq 0.5 \mu\text{S/cm}$
- ㉓** Diagram for fuel oil EL, dielectric constant $\epsilon_r 2.3$

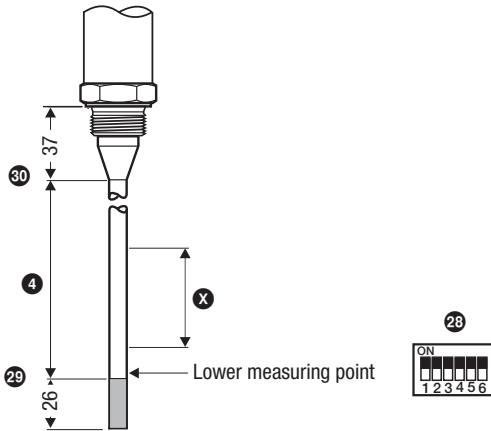


Fig. 14
NRG 21-11

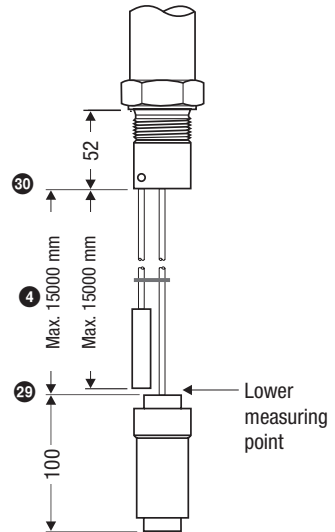


Fig. 15
NRG 21-51 with earth rope (special design)



Attention

- If **Ⓧ** is clearly below **④** change the code switch settings according to the diagrams **㉑**, **㉒** and **㉓** for the fluid to be measured

Establishing active measuring range (control range) - continued -

Ascertain the type of fluid that will be measured. Determine the active measuring range (control range) in mm. Refer to diagrams 31, 32 or 33 for the required code switch settings for water and fuel oil EL.

Example: Max. measuring range at 25 °C: 1500 mm, selected active measuring range: 1000 mm, toggle switch 3 of the code switch must be set to ON, all other toggle switches to OFF.

If a fluid other than water or fuel oil EL is to be measured, the position of the code switches must be determined by measuring the voltage. For this purpose apply supply voltage to the connected level switch / level controller.

1. Unscrew screw 19 and remove cover 20.
2. Fill vessel to required maximum level and connect a voltmeter between terminals "1" (+) and "M" (-). Before starting the measurement set all toggle switches of the code switch to OFF.
3. Now operate each individual switch in turn: only switch 1 to ON, only 2 to ON, only 3 to ON, only 4 to ON, only 4 + 5 to ON and only 4 + 5 + 6 to ON. As soon as with one of the switch positions the value measured by the voltmeter exceeds 7 V, stop operating switches, and select the preceding switch position.
4. After having set the code switch, place cover 20 onto the terminal box 25 and fasten with screw 19.

31 Diagram for water, conductivity $\geq 20 \mu\text{S/cm}$

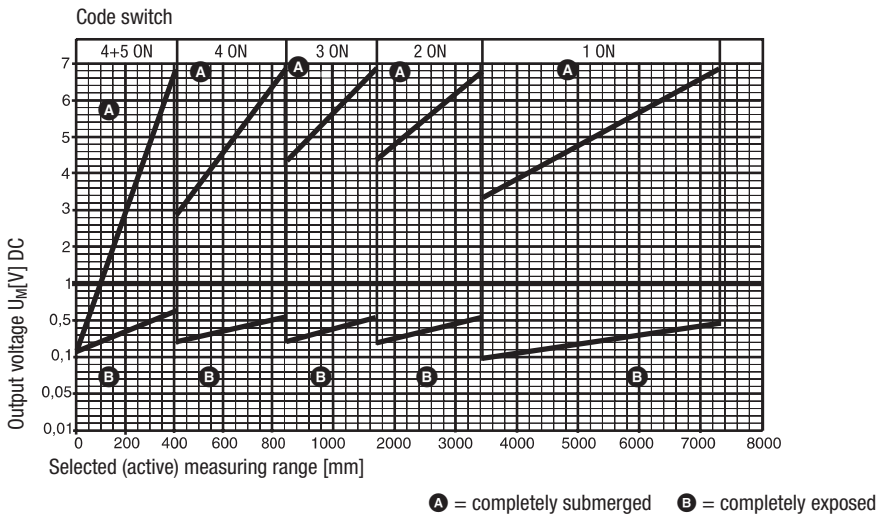


Fig. 16

Establishing active measuring range (control range) - continued -

32 Diagram for water, conductivity $\geq 0.5 \mu\text{S/cm}$

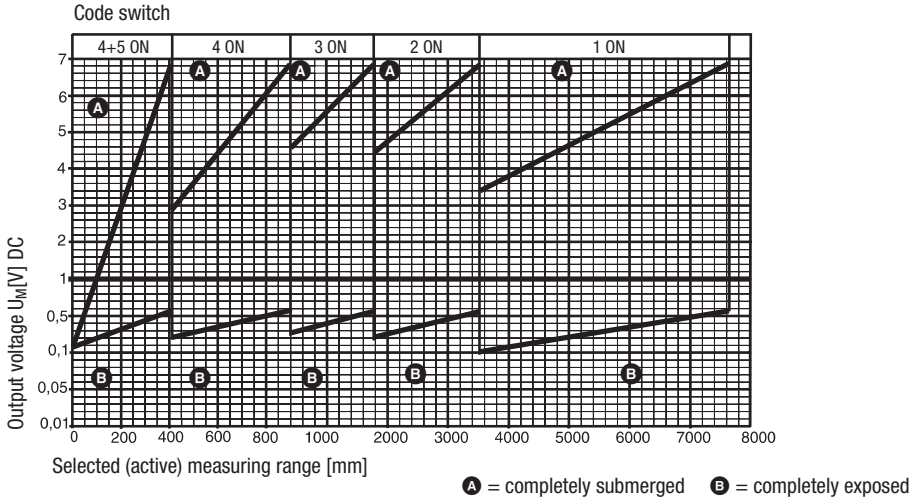


Fig. 17

33 Diagram for fuel oil EL, dielectric constant $\epsilon_r 2.3$

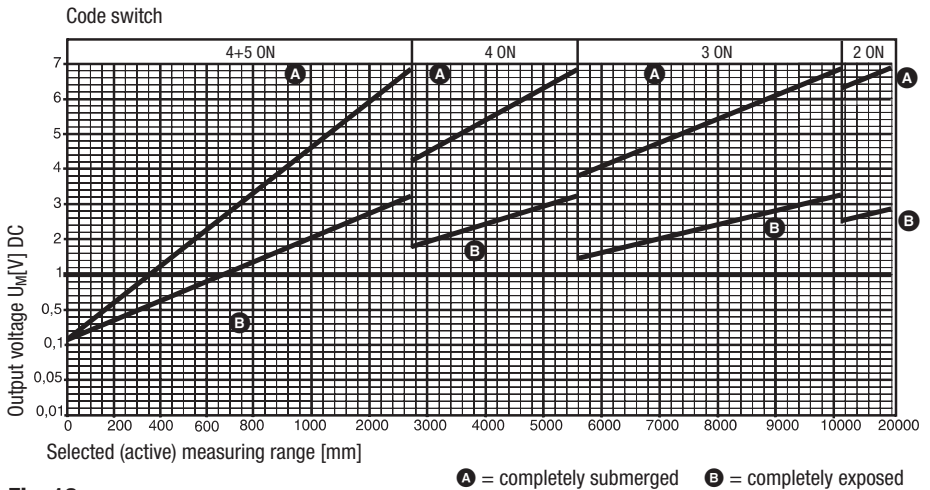


Fig. 18

Commissioning procedure

Applying supply voltage

Please check that the level electrode is wired in accordance with the wiring diagram (Fig. 11, 12) and switch on supply voltage of the connected level switch / controller.

Checking measuring range

Before commissioning the level electrode make sure that the active measuring range (= control range) agrees with the service conditions of your installation.

Checking measuring voltages

The supply voltage can be measured between terminals "3" and "M" in the terminal box 25. The voltage should be 12 V DC. If this voltage is not present, check the connected level switch / level controller.

The level-proportional voltage UM can be measured between terminals "1" (+) and "M" (-). Raise level in vessel to the maximum value of the utilized measuring range (e. g. 1000 mm) and measure the voltage.

Compare the value measured with the value of the corresponding chart (in diagram 31 UM for 1000 mm is 4.6 V). The following values must be obtained in any case: Level electrode completely exposed: $UM \geq 0$ V, level electrode completely submerged: $UM \leq 7$ V DC

If the electrode is submerged and you measure $UM = 0$ V or $UM > 7$ V DC, replace the level electrode.



Note

- When adjusting the measuring range when the system is **cold**, the adjusted measuring points will shift with rising temperature as a result of the longitudinal expansion of the electrode rod. Correct the settings accordingly.

Troubleshooting

Indication, diagnosis and remedy



Attention

Before carrying out the fault diagnosis please check:

Supply voltage:

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

Wiring:

Is the wiring in accordance with the wiring diagram?

Indication of malfunctions	
Equipment does not work accurately	
Error	Remedy
The level electrode was installed without a protection tube. The protection tube is required because it serves as reference electrode.	Install a protection tube.
The vent hole in the protection tube does not exist, is obstructed or flooded.	Check protection tube and, if necessary, provide vent hole.
The isolating valves of the external level pot (optional) are closed.	Open isolating valve.
The desired lower measuring point is outside the measuring range of the level transmitter. The level electrode is too short.	Install a sufficiently long level electrode.
The adjustment of the measuring range is wrong.	Correct the code switch 29 settings. See Basic Settings
The electrode rod / electrode rope is covered with dirt deposits.	Remove level electrode and clean the electrode rod / electrode rope with a wet cloth.
The level electrode is submerged and UM = 0 V or > 7 V DC.	Replace level electrode.

Equipment fails to work	
Error	Remedy
Power failure.	Switch on supply voltage. Check all electrical connections.
The earth connection to the vessel is interrupted.	Clean sealing surfaces and screw in level electrode with metallic joint 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 with hemp or PTFE tape!

Maintenance

Safety note

The equipment 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.



Danger

When loosening the level electrode steam or hot water might escape! This presents the risk of severe scalding all over the body! It is therefore essential not to dismantle the electrode unless the boiler pressure is verified to be 0 bar.

The level electrode becomes hot during operation. Risk of severe burns to hands and arms. Before carrying out installation and maintenance work make sure that the equipment is cold.

Cleaning the electrode rod

The equipment may only be installed and removed by qualified personnel. Observe note in chapter "Installation" on page 9.

Before cleaning the electrode rod decommission and remove the level electrode.

Clean the electrode rod / electrode rope with a wet cloth.

Removing and disposing of the level electrode

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

1. Switch off supply voltage.
2. Unscrew screw 25 and remove cover 20.
3. Detach the connecting cables from the connecting terminals 22 and pull cables out of the cable gland.
4. Before removing the equipment make sure that it is neither hot nor under pressure.

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

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



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