

Level Electrode

NRG 16-41

NRG 16-41.1

NRG 17-41

NRG 17-41.1

NRG 19-41

NRG 19-41.1



CANopen

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Important Notes

Usage for the intended purpose

Use level electrode type NRG 16-41, NRG 17-41 or NRG 19-41 only in conjunction with control equipment **NRS 1-41** or **NRS 1-40.1** as high-water level limiter (high-level alarm).

Use level electrode type NRG 16-41.1, NRG 17-41.1 or NRG 19-41.1 only in conjunction with control equipment **NRS 1-40.1** as high-water level limiter (high-level alarm).

Safety note

The equipment must only be installed and commissioned by qualified staff.

Maintenance and service work must only be performed by adequately trained persons who have a recognized level of competence.



Danger

When loosening the electrode steam or hot water might escape.

This presents the danger of severe scalding. It is therefore essential not to remove the electrode unless the boiler pressure is verified to be zero.

The electrode is hot during operation. This presents the danger of severe burns to hands and arms. Installation and maintenance work should only be carried out when the system is cold.

If the internal ceramic insulation breaks, hot steam can escape through the lateral vent hole on the electrode body. This presents the risk of severe scalding. Do not stay near the electrode during operation.



Attention

The name plate indicates the technical specification of the equipment.
Do not commission or operate equipment without a name plate.

ATEX (Atmosphère Explosible)

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

Note on the Declaration of Conformity / Declaration by the Manufacturer **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.com/documents or can be requested from us.

Explanatory Notes

Scope of supply

NRG 16-41, NRG 16-41.1

- 1 Level electrode type NRG 16-41 or NRG 16-41.1
- 1 S. S. joint ring D 27 x 32 mm to DIN 7603 (made of 1.4301), bright annealed
- 1 Terminating resistor 120 Ω
- 1 Installation manual

NRG 17-41, NRG 17-41.1

- 1 Level electrode type NRG 17-41 or NRG 17-41.1
- 1 S. S. joint ring D 27 x 32 mm to DIN 7603 (made of 1.4301), bright annealed
- 1 Terminating resistor 120 Ω
- 1 Installation manual

NRG 19-41, NRG 19-41.1

- 1 Level electrode type NRG 19-41 or NRG 19-41.1
- 1 S. S. joint ring D 27 x 32 mm to DIN 7603 (made of 1.4301), bright annealed
- 1 Terminating resistor 120 Ω
- 1 Installation manual

Description

The level electrode operation is based on the conductive measuring principle.

The NRG 1...-41 and NRG 1...-41.1 are designed for signalling the max. liquid level in electrically conductive liquids.

■ One liquid level with **one** switchpoint

The NRG 1...-41 is to be used in conjunction with the switching controller **NRS 1-41** or **NRS 1-40.2**, the NRG 16-41.1 is designed for use with switching controller **NRS 1-40.1**.

The level data are transferred from the electrode NRG 1...-41 and NRG 1...-41.1 to the control equipment via a CAN bus using the CANopen protocol.

Function

The conductivity of the liquid is used to signal the liquid level. Some liquids are conductive, which means that they allow an electric current to flow through them. For the safe functioning of this device a minimum conductivity of the liquid to be measured is required.

The conductivity measurement method can detect two conditions: electrode rod submerged or exposed, meaning switchpoint reached (or exceeded) or not yet reached. Before installation, the length of the electrode rod must be cut to the required switching level, e. g. for “Pump OFF” or “Control valve CLOSED” or, in case of economiser and air heaters that are installed close to the steam-generating unit and exposed to a risk, “Firing/Burner OFF”.

An additional electrode fully integrated in the system automatically monitors the electrical resistance path between earth and measuring electrode. As soon as the actual value falls below the admissible resistance value the protection circuit is interrupted and cuts off the pump or heat supply to the boiler.

At regular intervals the level electrode NRG 1...-41 / NRG 1...41.1 sends a data telegram to the switching controller NRS 1-41, NRS 1...40.1. The data are transferred via a CAN bus to DIN ISO 11898 using the CANopen protocol.

System components

NRS 1-41

Digital switching controller for high-level limiter NRG 1...-41

Functions: High-level alarm (MAX)

Data exchange: CAN bus to DIN ISO 11898 using CANopen protocol.

NRS 1-40.1

Digital multi-purpose switching controller for high-level limiter NRG 1...-41.1, the low-level electrode NRG 1...-40 and the temperature limiter TRV 5-40

Functions: Signalling high-level alarm (MAX), low-level alarm (MIN)

Data exchange: CAN bus to DIN ISO 11898 using CANopen protocol.

NRS 1-40.2

Digital multi-purpose switching controller for high-level limiter NRG 1...-41 and the temperature limiter TRV 5-40

Functions: Signalling high-level alarm (MAX)

Data exchange: CAN bus to DIN ISO 11898 using CANopen protocol.

URB 1, URB 2

Control terminal and display unit

Functions: Parameterization and visual display (LCD)

Data exchange: CAN bus to DIN ISO 11898 using CANopen protocol.

Design

NRG 16-41, NRG 16-41.1, NRG 17-41, NRG 17-41.1, NRG 19-41, NRG 19-41.1:
Screwed $\frac{3}{4}$ " , EN ISO 228-1. **Fig. 2, Fig. 3**

Technical Data

NRG 16-41, -41.1; NRG 17-41, -41.1; NRG 19-41, 19-41.1

Type Approval

TÜV · SWB / SHWS · ...-403

TÜV · SWB / SHWS · ...-413

Service pressure

NRG 16-41, NRG 16-41.1

32 bar g at 238 °C

NRG 17-41, NRG 17-41.1

46 bar g at 260 °C

NRG 19-41, NRG 19-41.1

100 bar g at 311 °C

Connection

Screwed 3/4", EN ISO 228-1

Materials

Terminal box: Die cast aluminium 3.2161 (G AISi8Cu3)

Sheath: 1.4301 X5 CrNi18-10

Screwed union: S. S. 1.4571 (X6CrNiMoTi17-12-2)

Measuring electrode: S. S. 1.4401 (X5CrNiMo17-12-2)

Electrode insulation: PEEK

Lengths supplied

500 mm, 1000 mm, 1500 mm

Sensitivity of response

> 0.5 μ S/cm at 25 °C

Supply voltage

18–36 V DC (coming from NRS 1-41, NRS 1-40.1, NRS 1-40.2)

Current consumption

35 mA

Fuse

Electronic thermal fuse $T_{max} = 85$ °C

Hysteresis

-2 K

Electrode voltage

2 V_{SS}

Data exchange

CAN bus to DIN ISO 11898, CANopen Protocol

Indicators and adjustors

One 10-pole code switch for setting node ID and baud rate

Two LEDs "PROGRAM RUNNING"

Two LEDs "CAN BUS COMMUNICATION"

Electric connection

M 12 sensor plug, 5 poles, A-coded,

M 12 sensor socket, 5 poles, A-coded

Protection

IP 65 to DIN EN 60529






Max. admissible ambient temperature

70 °C

Weight

Approx. 2.5 kg

Name plate / Marking

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NRG 16 - 41	PN 40	<input type="checkbox"/>												
NRG 17 - 41	PN 63	<input type="checkbox"/>												
NRG 19 - 41	PN 160	<input type="checkbox"/>												
G 3/4	1.4571	IP65												
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 <p>T_{amb} = 70°C (158°F)</p>														
		18-36 V DC												
IN/OUT: CAN-Bus														
Node ID: _ _ _ _														
TÜV.SWB / SHWS . xx - 403 TÜV . SWB/SHWS STW(STB) . xx - 413		 0525												
GESTRA AG Münchener Str. 77 D-28215 Bremen														






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NRG 17 - 41.1	PN 63	<input type="checkbox"/>												
NRG 19 - 41.1	PN 160	<input type="checkbox"/>												
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TÜV . SWB/SHWS STW(STB) . xx - 413		 0525												
GESTRA AG Münchener Str. 77 D-28215 Bremen														

Fig. 1

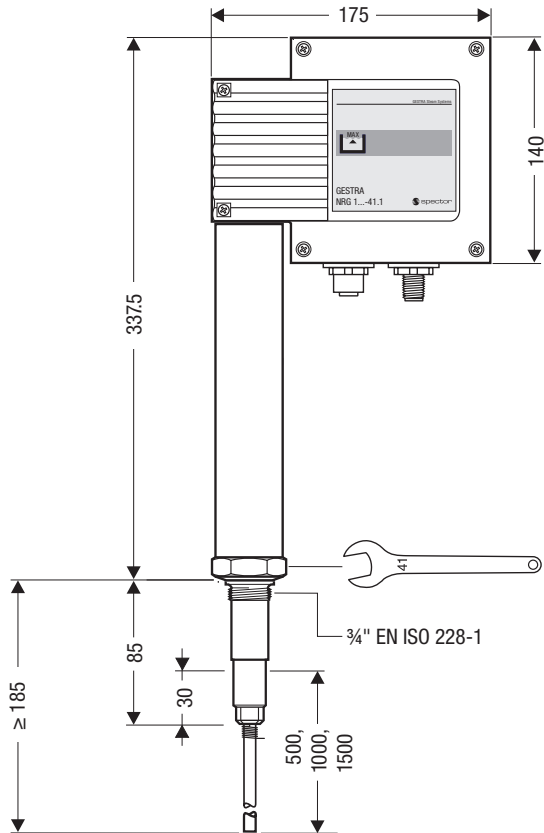


Fig. 2

Dimensions NRG 19-41, -41.1

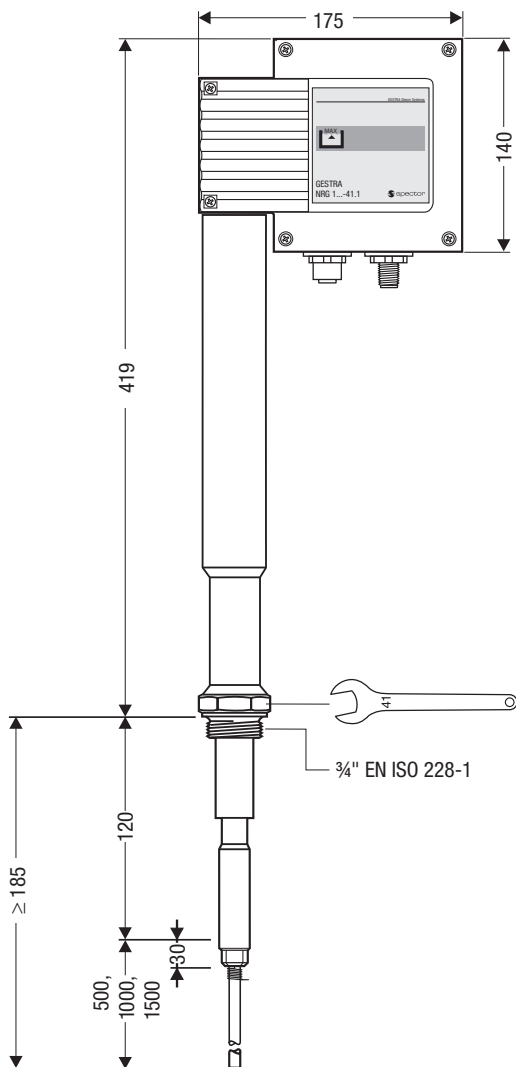


Fig. 3

Design

NRG 16-41, -41.1; NRG 17-41, -41.1; NRG 19-41, 19-41.1

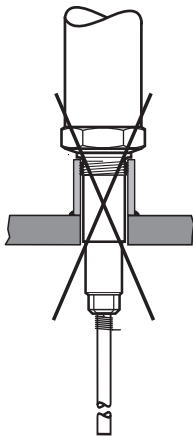
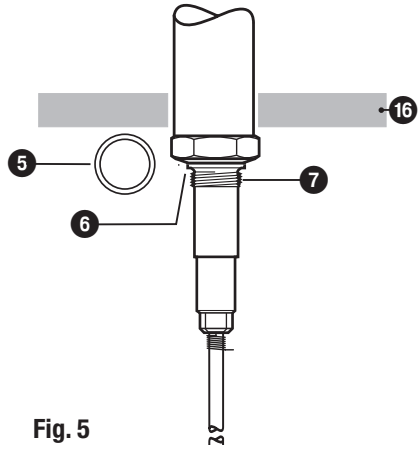
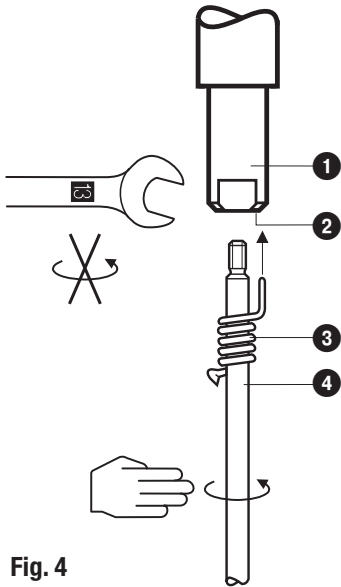
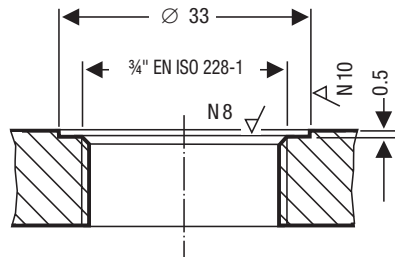


Fig. 6



Functional Elements

NRG 16-41, -41.1; NRG 17-41, -41.1; NRG 19-41, 19-41.1

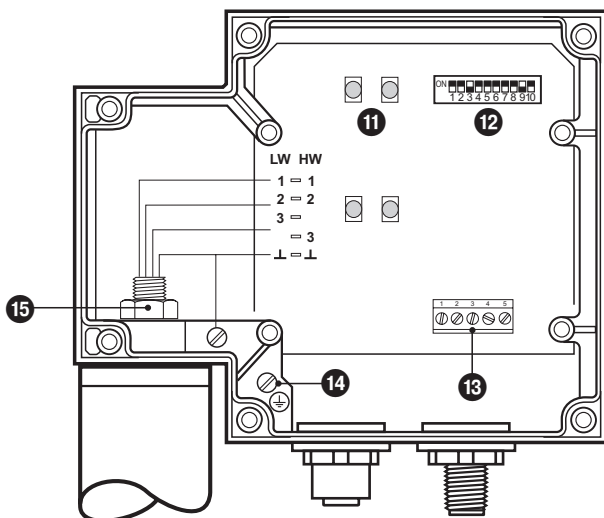
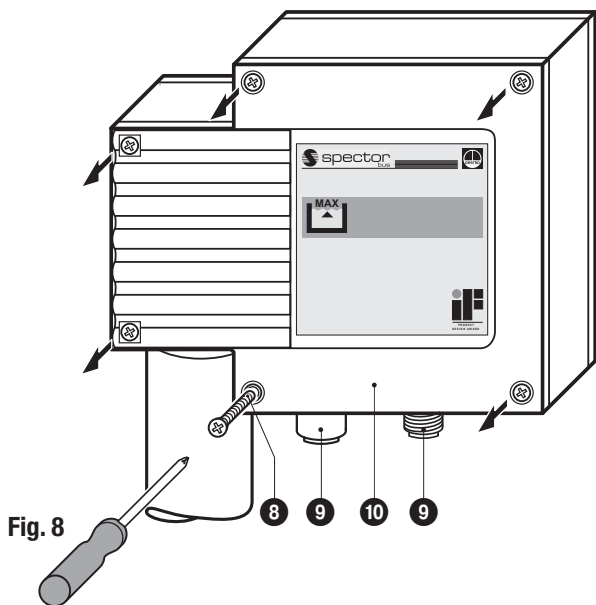


Fig. 9

Key

- 1 Electrode rod
- 2 Bore
- 3 Spring
- 4 Electrode tip
- 5 S. S. joint ring D 27 x 32 mm to DIN 7603 (made of 1.4301), bright annealed
- 6 Seating surface
- 7 Electrode thread
- 8 Screws M 4
- 9 M 12 sensor plug, 5 poles, A-coded, M 12 sensor socket, 5 poles, A-coded
- 10 Cover
- 11 LED green “Program running”, LED red “CAN bus communication”
- 12 10-pole code selector for setting node ID and baud rate
- 13 Terminal strip
- 14 PE connection
- 15 Plug
- 16 Thermal insulation (provided on site), $d = 20$ mm (outside of thermal insulation of steam generating unit)

Installation

NRG 16-41, -41.1; NRG 17-41, -41.1; NRG 19-41, 19-41.1, step 1

1. Screw electrode tip ④ into measuring electrode ①, Fig. 4.
2. Carefully determine required measuring length of electrode. Observe min. length, Fig. 2, Fig. 3.
3. Mark length of electrode tip ④.
4. Unscrew electrode tip ④ from measuring electrode ① and cut tip.
5. After visual inspection screw electrode tip ④ into measuring electrode ①. Slide spring ③ along electrode tip ④, so that its end completely enters into small bore ②.

NRG 16-41, -41.1; NRG 17-41, -41.1; NRG 19-41, 19-41.1, step 2

1. Check seating surfaces, Fig. 6
2. Place ring joint ⑤ supplied with electrode onto seating surface ⑥ of electrode, Fig. 5
3. Apply a light smear of silicone grease (e.g. Molykote® 111) to electrode thread ⑦.
4. Screw level electrode into threads of flange provided on vessel and tighten with a 41 mm open end spanner. The torque required is **160 Nm when cold**.
5. When installing two electrodes together in one flange install the first electrode as described in 4. Before mounting the second electrode undo plug ⑮, remove PE connection ⑭ and strip cable lugs from the board. Screw in electrode. Slightly tighten plug ⑮. Install PE connection ⑭ and insert cable lugs.



Attention

- The seating surfaces of the standpipe or the flange provided on the vessel must be accurately machined, see Fig. 7.
- Do not bend electrode tip when mounting.
- Use only ring joint (of stainless steel 1.4301) D 27 x 32 to DIN 7603 supplied with the electrode.
- Do not lag electrode body above the hexagonal section, Fig. 5.
- Do not insulate electrode thread with hemp or PTFE tape.
- Do not screw electrode directly into a screwed socket, Fig. 6.
- Observe min. spacing when installing the electrode, Fig. 6, Fig. 10, Fig. 11, Fig. 12



Note

- For the approval of the boiler standpipe the relevant regulations must be considered.
- Refer to page 15 for three typical installation examples.

Tools

- Open-end spanner A. F. 17 mm
- Hacksaw
- Open-end spanner A. F. 41 mm
- Flat file, medium cut

Molykote® 111 is a registered trademark of DOW Corning Corp., Midland Michigan, USA

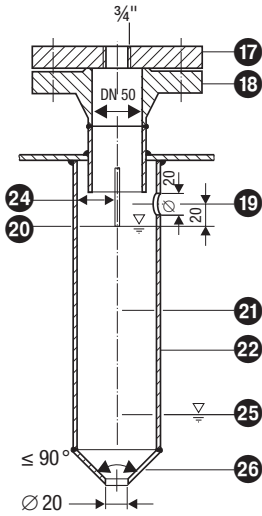


Fig. 10

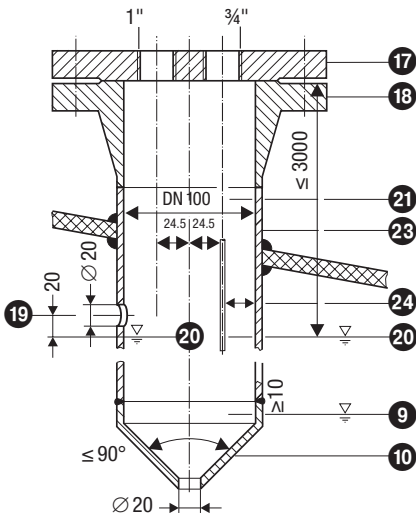


Fig. 11

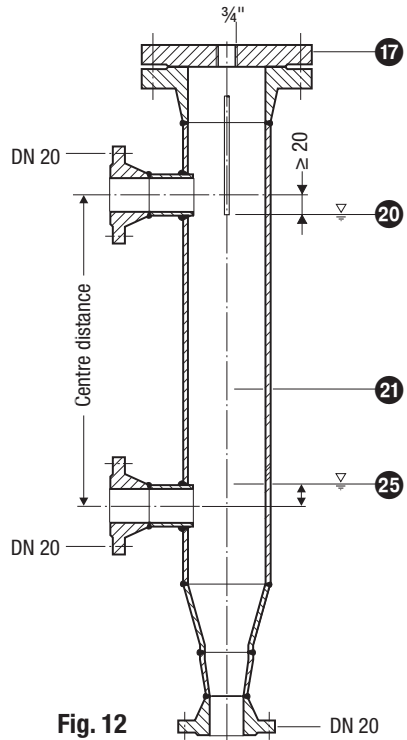


Fig. 12

Key

- 17 Flange PN 40, DN 50, DIN 2527
Flange PN 40, DN 100, DIN 2527
- 18 For the approval of the boiler standpipe with connecting flange the relevant regulations must be considered.
- 19 Vent hole (Provide vent hole as close to the boiler wall as possible)
- 20 High water level (HW)
- 21 Electrode rod $d = 8$ mm
- 22 Protection tube DN 80
- 23 Protection tube DN 100
- 24 Electrode distance ≥ 14 mm
- 25 Low water level
- 26 Reducer DIN 2616-2, K-88.9 x 3.2 - 42.4 x 2.6 W
- 27 Reducer DIN 2616-2, K-114.3 x 3.6 - 48.3 x 2.9 W

Electrical Connection

Aligning terminal box

1. Unscrew screws **8** and remove cover **10**. **Fig. 13**
2. Loosen nut **15** with 19 mm spanner. Do not remove it! **Fig. 14**
The electrode terminal box can now be turned through +/- 180°.
3. Turn electrode terminal box into desired position (+/- 180°).
4. Tighten nut **15** with a torque of **25 Nm**.
5. Set node ID (see **"Basic Settings"**, **"Configuring level electrode"**).
6. Re-attach cover **10** and fix it with screws **8**.



Note

- Wire the control cable according to the wiring diagram with connector socket and plug.

Control cable

NRS, NRR, LRR, TRS, URB 1

To wire the equipment screened multi-core twisted-pair control cable **must** be used for the bus line, e. g. UNITRONIC® BUS CAN 2 x 2 x ... mm² or RE-2YCYV-fl 2 x 2 x ... mm².

Control cable assemblies (2 x 2 x 0.32 mm² cable with plug and socket) of various lengths are available as add-on equipment.

NRG, LRG, EF, URZ, TRV, URB 2

The equipment is fitted with sensor plug-in connectors (5 poles, A-coded). For connecting the bus devices control cable assemblies (with plug and socket) of various lengths are available as add-on equipment.

Note that the recommended control cables are not UV-resistant and must be protected by a UV-resistant plastic tube or cable duct if the equipment is installed outdoors (except for URB 2). The baud rate (data transfer rate) dictates the cable length and size between the bus nodes. The total power consumption must also be taken into consideration when selecting the conductor size. The total power consumption is obtained from the number of bus nodes. If the cable length between the steam boiler and the control cabinet exceeds 15 m, we recommend that you fit a branching box that is resistant to electromagnetic interference (stock code 1501214) and use a control cable with a larger conductor size for the distance to the control cabinet.

S 8	S 9	S 10	Baud rate	Cable length	Number of pairs and conductor size [mm ²]
OFF	ON	OFF	250 kBit/s	125 m	2 x 2 x 0.34
Factory setting					
ON	ON	OFF	125 kBit/s	250 m	2 x 2 x 0.5
OFF	OFF	ON	100 kBit/s	335 m	2 x 2 x 0.75
ON	OFF	ON	50 kBit/s	500 m	on request, depending on bus configuration
OFF	ON	ON	20 kBit/s	1000 m	
ON	ON	ON	10 kBit/s	1000 m	

Set baud rate via code switch **12**. Make sure that all bus nodes feature the same settings.

Wiring diagram

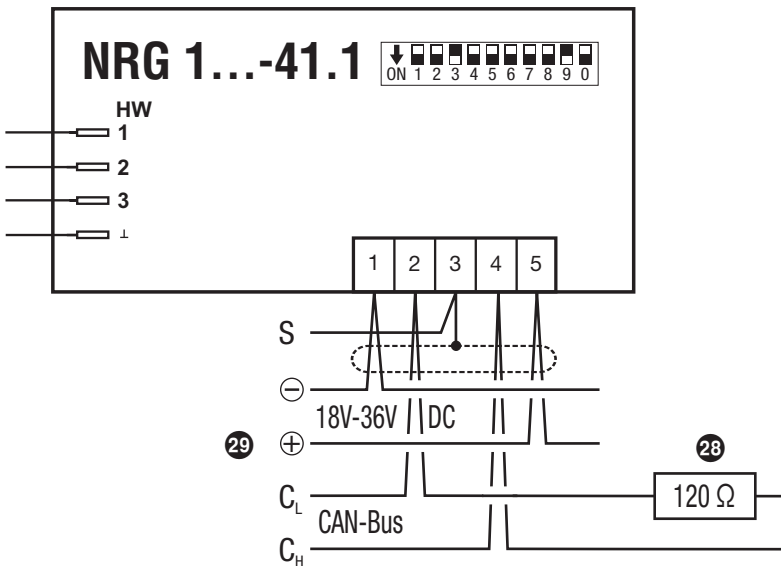
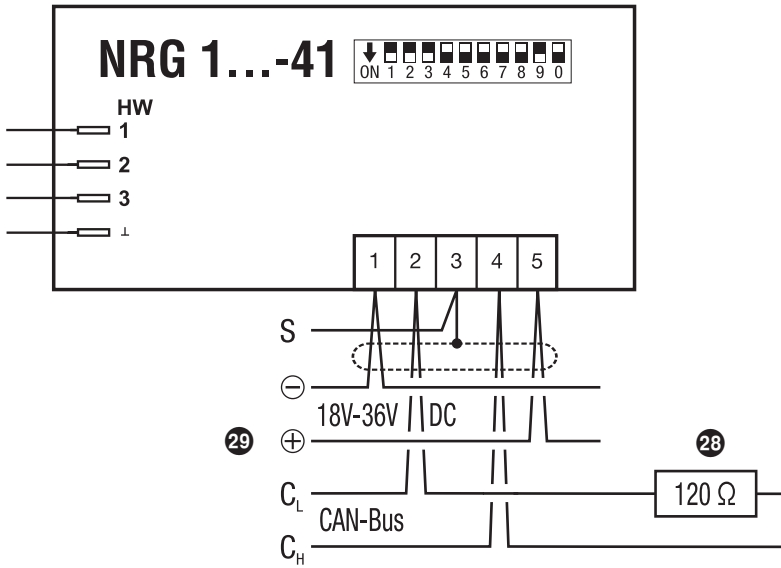
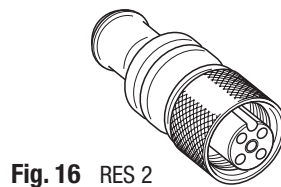
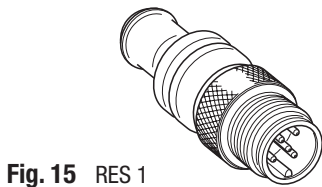
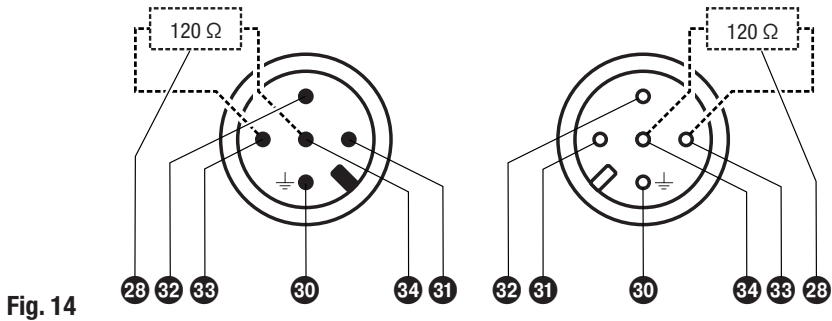


Fig. 13

Wiring diagram for the sensor plug-in connections



Key

- 28 Terminating resistor 120 Ω , RES 1 or RES 2
- 29 CAN bus line, twisted pair control cable
- 30 Pin 1: Screen
- 31 Pin 2: Power supply 24 V DC+ (red)
- 32 Pin 3: Power supply 24 V DC- (black)
- 33 Pin 4: CAN data line C_H (white)
- 34 Pin 5: CAN data line C_L (blue)

CAN bus wiring diagram

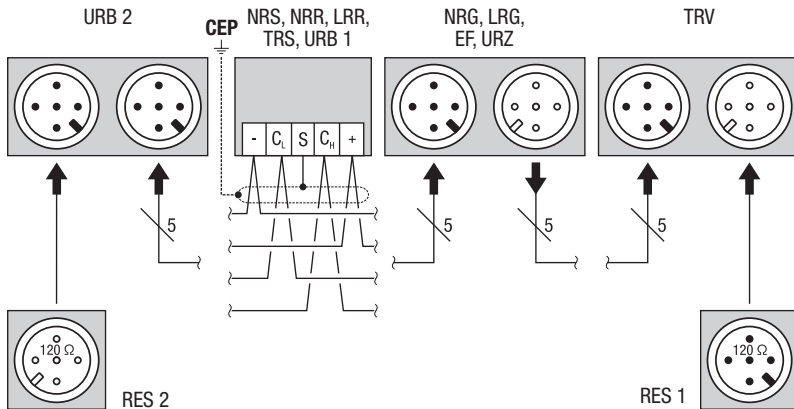


Fig. 17



Attention

- Wire equipment in series. Star-type wiring is not permitted!
- The Bus line must run separately from signal and mains lines.
- Link screens of control cables such that electrical continuity is ensured and connect them **once** to the central earthing point (CEP). If equipotential bonding currents are to be expected, for instance in outdoor installations, make sure that the screen is separated from the central earthing point (CEP).
- To protect the switching contacts fuse circuit with T 2.5 A or according to TRD regulations (1.0 A for 72 h operation).
- If two or more system components are connected in a CAN bus system, provide the first and the last device with a terminating resistor of 120 Ω, **Fig. 15, Fig. 16**
- Note that in a CAN bus network only **one** water-level limiting system may be used.
- Do **not** interrupt the CAN bus network during operation with one or more system components!

If the CAN bus network is interrupted the safety circuit will be opened.

Before taking the CAN bus line from the terminal strip, make sure that all connected system components are out of service.



Note

- The loop resistance must be below 10 Ω .
- The rated voltage is indicated on the name plate.
- When switching off inductive loads, voltage spikes are produced that may impair the operation of control and measuring systems. Provide connected contactors with RC combinations, e. g. 0.1 $\mu\text{F}/100 \Omega$.
- Even in correctly wired systems high frequency interference caused by the installation can lead to system outages and malfunction alarms. For more information please refer to the fault-finding list in the section **Troubleshooting**.

Tools

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

Basic Settings

CAN bus

All level and conductivity controllers and associated electrodes are interconnected by means of a CAN bus adopting the CANopen protocol. Every item of equipment features an electronic address (Node ID). The four-core bus cable serves as power supply and data highway for high-speed data exchange.

The CAN address (Node ID) can be set between **1** and **123**.

The equipment is configured at our works and ready for service with other GESTRA system components without having to set the node ID.

If several systems of the same kind are to communicate in one CAN bus network, be sure to assign one node ID for each individual system component (e. g. controller).

Change code switch setting  if the length of the CAN bus cable exceeds 125 m.

For more information on switch settings see section **Basic Settings / Code Switch Settings**.

Basic Settings – continued –

Node ID

Water level limiter

NRS 1-40	NRG 16-40 (1)	NRG 16-40 (2)	Reserved	Reserved	
X	X + 1	X + 2	X + 3	X + 4	
1	2	3			Factory setting

Safety system for steam boilers with superheater

NRS 1-40.1	NRG 16-40 (1)	NRG 16-40 (2)	TRV 5-40	Limiter 4	
X	X + 1	X + 2	X + 3	X + 4	
1	2	3	4		Factory setting

Safety system (e. g. hot-water generating units)

NRS 1-40.1	NRG 16-40 (1)	NRG 16-40 (2)	Limiter 3	Limiter 4	
X	X + 1	X + 2	X + 3	X + 4	
1	2				Factory setting

Safety system (e. g. hot-water generating units)

NRS 1-40.2	TRV 5-40 (1)	TRV 5-40 (2)	Limiter 3	Limiter 4	
X	X + 1	X + 2	X + 3	X + 4	
6	7	8	9	10	Factory setting
	TRS 5-40 (1)	TRS 5-40 (2)			
	X + 1 + 90	X + 2 + 90			
	97	98			

High level alarm

NRS 1-41	NRG 16-41	Reserved	Reserved	Reserved	
X	X + 1	X + 2	X + 3	X + 4	
6	7	8	9	10	Factory setting

Further components

SRL 40		
X = (sensor: level limiter // hi alarm) + 2		Factory setting
ORT 6		
98		Factory setting

On-off level control

Reserved	NRS 1-42	NRG 16-42	
X - 1	X	X + 1	
19	20	21	Factory setting

Modulating level control

URZ 40	NRS 2-40	NRR 2-40	NRG 26-40	Reserved	
X - 2	X - 1	X	X + 1	X + 2	
38	39	40	41	42	Factory setting

Automatic continous blowdown control

EF 1-40	Reserved	LRR 1-40	LRG 1-4...	Reserved	
X - 2	X - 1	X	X + 1	X + 2	
48	49	50	51	52	Factory setting

Control unit

URB 1, URB 2		
60		Factory setting

Factory set default values

The level electrode features the following factory set default values:

- Baud rate: **250 kB/s**
- Node ID: NRG 1...-41: **007**, NRG 1...-41.1: **004**

Assigning / changing node ID

If several systems of the same kind are to communicate in one CAN bus network, be sure to assign one node ID for each individual system component (e. g. controller).

1. Undo and remove screws **8**. Remove housing cover **10**.
2. Set code switch **12** to the required position. Please observe the setting tables on page 22.
3. Mount housing cover **10** and tighten screws **8**.



Attention

- We recommend that you commission the CAN bus devices with the default factory setting.
- Do not use a node ID for more than one piece of equipment in the CAN bus system.

Code switch settings

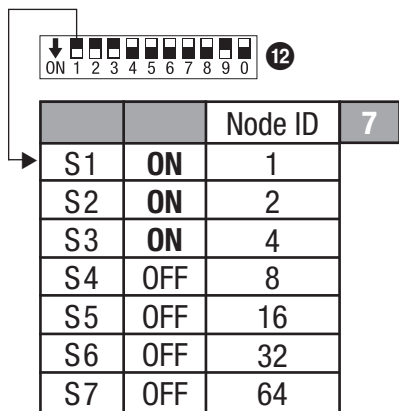


Fig. 18 (Factory setting NRG 1...-41)

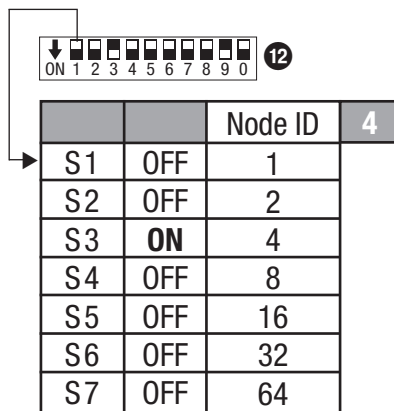


Fig. 19 (Factory setting NRG 1...-41.1)

S8	S9	S0	Baud rate	Length of cable
OFF	ON	OFF	250 kBit/s	125 m
ON	ON	OFF	125 kBit/s	250 m
OFF	OFF	ON	100 kBit/s	335 m
ON	OFF	ON	50 kBit/s	500 m
OFF	ON	ON	20 kBit/s	1000 m
ON	ON	ON	10 kBit/s	1000 m

Fig. 20 (Factory setting 250 kBit/s)

Commissioning Procedure

Check wiring

Make sure that the level electrode NRG 1...-41, NRG 1...-41.1 is properly connected to the switching controller NRS 1-41, NRS 1-40.1, NRS 1-40.2 according to the wiring diagram. **Fig. 13, 14**

Apply mains voltage

Apply power to switching controller NRS 1-41, NRS 1-40.1, NRS 1-40.2.

Operation

High-water level limiter (Max alarm)

Used in combination with switching controller NRS 1-41, NRS 1-40.1, NRS 1-40.2 in (pressurized) hot-water plants and steam boilers working in accordance with TRD 401, TRD 602, TRD 604 or other national regulations.



Note

- Should malfunctions occur during the commissioning procedure refer to section “Troubleshooting” on page 26 in order to find, analyse and eliminate the fault.

Malfunctions

Fault finding list for troubleshooting

Equipment fails to work – Indication of a malfunction

Fault: In spite of correct wiring and commissioning of the equipment an interference signal is indicated.

Remedy: The interference signal is caused by H. F. interferences coming from the installation. For interference suppression of the voltage supply we supply ferrite rings, stock code 147253. The 230 V supply lines should be looped through the ferrite ring five to ten times. If several controllers are used in the system, they can be fed from the interference suppressed supply lines. For the interference suppression of the bus line we supply hinged-shell ferrite rings, stock code 147254. The hinged-shell ferrite rings are clamped onto the bus line close to the terminal strip of the controller.

High water level not yet reached – High-level alarm

Fault: The electrode tip is too long.

Remedy: Cut electrode tips to the length required for the high level switchpoint.

Fault: The electrode tip has earth contact.

Remedy: Change installation position.

Fault: Thermal fuse has been triggered.

Remedy: The ambient temperature must not exceed 70 °C.

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

Remedy: Replace level electrode.

High water level reached – no function

Fault: Mains voltage not applied.

Remedy: Apply mains voltage. Connect electrode according to wiring diagram.

Fault: The electrode tip is too short.

Remedy: Remove electrode tip. Install new electrode tip and cut it to the length required for the high level switchpoint.

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

Remedy: Clean seating surfaces and insert metal joint ring (of stainless steel 1.4301) D 27 x 32 to DIN 7603. Do **not** insulate level electrode with hemp or PTFE tape.

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

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

Fault: The isolating valves of the external measuring pot (optional item) are closed.

Remedy: Open isolating valves.

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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