FLOWSERVE GESTRA

GESTRA Steam Systems

NRG 16-40
NRG 17-40
NRG 19-40
NRG 111-40

GB

Installation Instructions 810590-03

Level Electrode NRG 16-40
Level Electrode NRG 17-40
Level Electrode NRG 19-40
Level Electrode NRG 111-40

spector bus CANopen

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Important Notes

Usage for the intended purpose

Use level electrodes type NRG 16-40, NRG 17-40, NRG 19-40 and NRG 111-40 in conjunction with level switch NRS 1-40 or NRS 1-40.1 only as low-water level limiters (low-level alarms).

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.

PED (Pressure Equipment Directive)

The equipment fulfills the requirements of the Pressure Equipment Directive (PED) 97/23/EC. Applicable in fluids of group 1 and 2. With CE marking (apart from equipment according to section 3.3).

ATEX (Atmosphère Explosible)

According to the European Directive 94/9/EC the equipment must **not** be used in explosion-risk areas.

Explanatory Notes

Scope of supply

NRG 16-40

1 Level electrode type NRG 16-40
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 17-40

1 Level electrode type NRG 17-40
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 19-40

1 Level electrode type NRG 19-40
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 111-40

1 Level electrode type NRG 111-40
1 S. S. joint ring D 33 x 39 mm to DIN 7603 (made of 1.4301), bright annealed
1 Terminating resistor 120 Ω
1 Installation manual

Description

The level electrode NRG 1...-40 works according to the conductivity measurement principle.
The NRG 1...-40 is designed for use in conductive liquids to detect the minimum liquid level:

■ One level with **one** switchpoint.

The NRG 1...-40 is used in combination with switching controller NRS 1-40 or NRS 1-40.1 or further system components. NRG 1...-40 in conjunction with the associated control equipment constitutes a water level limiter with periodic self-testing routine (SMART function) in accordance with TRD 604, sheet 1 and 2 and EN regulations. The level data are transferred from the electrode NRG 1...-40 to the control unit via a CAN bus using the CANopen protocol.

Explanatory continued

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 the monitored 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 levels, e. g. cut-out of the burner circuit or interruption of the burner-protection circuit.

The system incorporates an additional electrode that provides automatic monitoring of the electrical resistance path between the measuring electrode and the earth. When the measured value falls below the admissible resistance value the burner shutdown is endorsed by interruption of the burner protection circuit.

At regular intervals, the level electrode NRG 1...-40 sends a data telegram to the switching controller NRS 1-40. The data transfer is effected by means of a CAN bus according to DIN ISO 11898 using the CANopen protocol.

One switching controller type NRS 1-40 or NRS 1-40.1 can be used for **two** level electrodes NRG 1...-40 (**low-level limiting system**).

System components

NRS 1-40
Digital switching controller for low-level limiter NRG 1...-40
Functions: Low-level alarm (MIN)
Data exchange: CAN bus to DIN ISO 11898 using CANopen protocol.

NRS 1-40.1
Digital control equipment for level electrodes NRG 1...-40 (low water), one level electrode NRG 1...-41 (high level) and a safety temperature limiter TRG 5-6... / TRV 5-40.
Functions: MIN alarm, MAX alarm, MAX temperature (freely configurable combinatons)
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 16-40, NRG 17-40, NRG 19-40:
Screwed ¾", EN ISO 228-1. **Fig. 2**

NRG 111-40:
Screwed 1", EN ISO 228-1. **Fig. 3**

Technical Data

NRG 16-40, NRG 17-40, NRG 19-40, NRG 111-40

Type Approval Nº
TÜV · SWB / SHWS · 02-403
EG BAF-MUC 02 02 103881 002

Service pressure

NRG 16-40, PN 40	NRG 17-40, PN 63	NRG 19-40, PN 160	NRG 111-40, PN 320
32 bar g (464 psig) at 238°C	60 bar g (870 psig) at 275°C	100 bar g (1450 psig) at 311 °C	183 bar g (2652 psig) at 357°C

Connection
Screwed ¾" BSP, EN ISO 228-1 (NRG 16-40, NRG 17-40, NRG 19-40)
Screwed 1" BSP, EN ISO 228-1 (NRG 111-40)

Materials
Terminal box: Die cast aluminium 3.2161 (G AlSi8Cu3)
Stem: S. S. 1.4571 (X6CrNiMoTi17 12 2)
Measuring electrode: S. S. 1.4401 (X5CrNiMo17 12 2)
Electrode insulation: Gylon® (NRG 16-40, NRG 17-40, NRG 19-40)
Electrode insulation: PEEK (NRG 111-40)

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

Sensitivity of response
> 0.5 µS/cm at 25°C.

Supply voltage
18 – 36 V DC (coming from NRS 1-40 / NRS 1-40.1)

Current consumption
35 mA

Fuse
Electronic thermal fuse T_{max} = 85 °C, hysteresis 2K

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 node ID and baud rate settings
One wire link (for switching between electrode 1 and electrode 2)

Electric connection
M 12 sensor connector, 5 poles, A-coded,
M 12 sensor jack, 5 poles, A-coded

Protection
IP 65 to DIN EN 60529

Max. admissible ambient temperature
70 °C

Weight
approx. 2.5 kg

Technical Data continued

Corrosion resistance

When used for its intended purpose the safe functioning of the electrode will not be impaired by corrosion.

Sizing

The electrode body must not be subjected to sharp increases in pressure. Welds and flanges of the electrode are designed to withstand dynamic loading (bending and alternating stress). The dimensional allowances for corrosion reflect the latest state of technology.

Name plate / marking

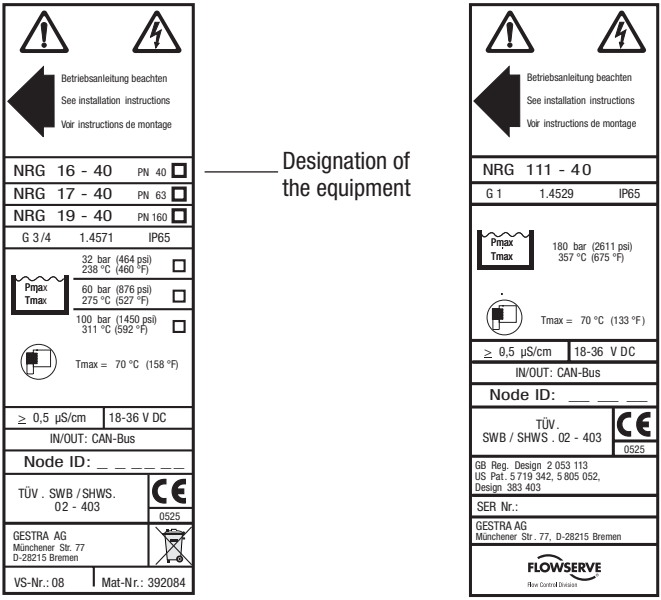


Fig. 1

Dimensions NRG 16-40, NRG 17-40, NRG 19-40

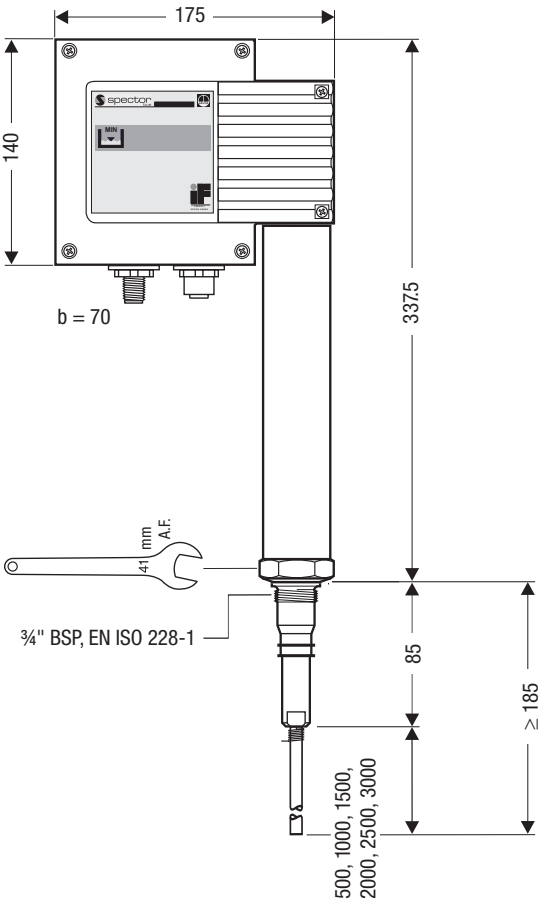


Fig. 2

Dimensions NRG 111-40

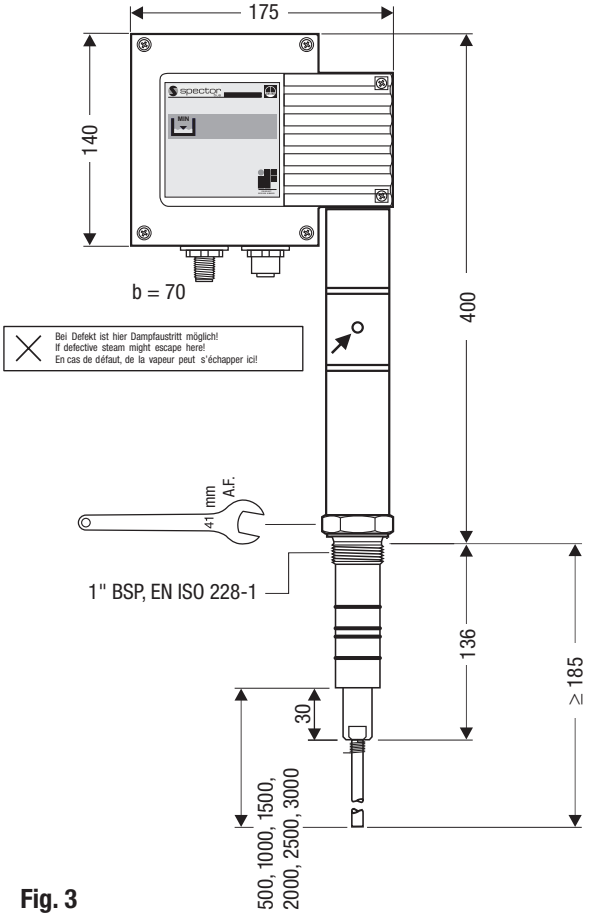


Fig. 3

Design

NRG 16-40, NRG 17-40, NRG 19-40

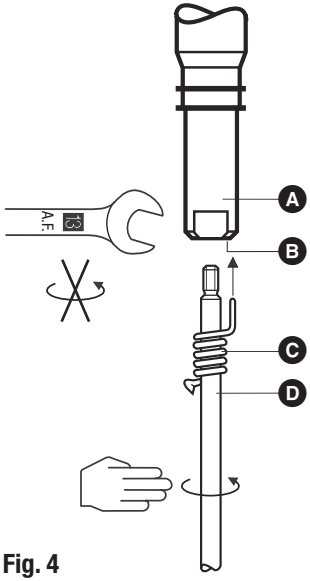


Fig. 4

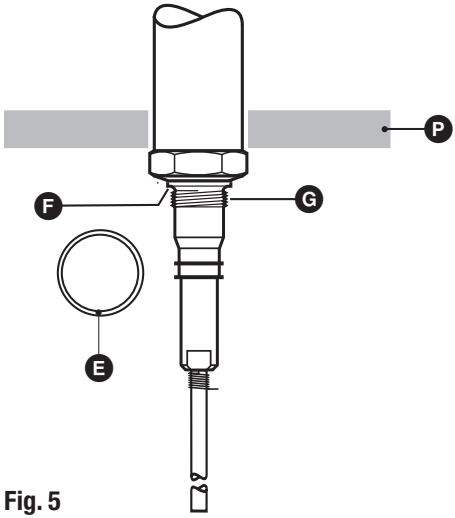


Fig. 5

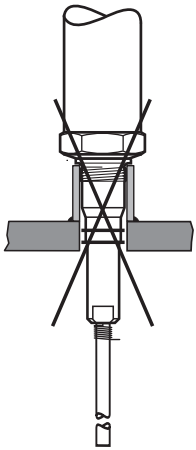


Fig. 6

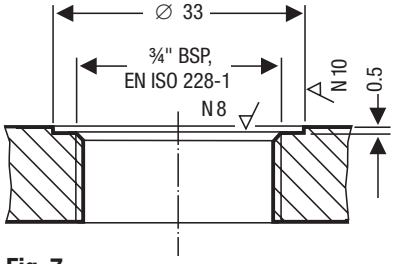


Fig. 7

NRG 111-40

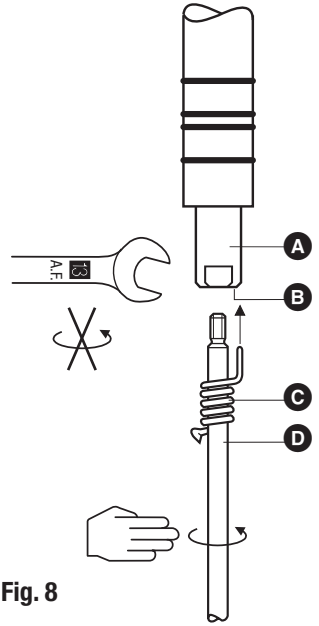


Fig. 8

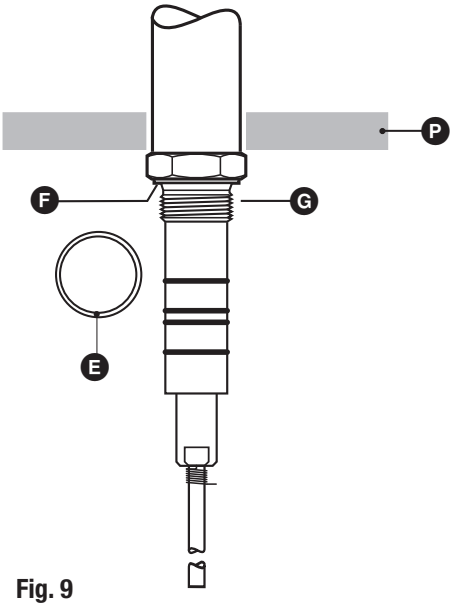


Fig. 9

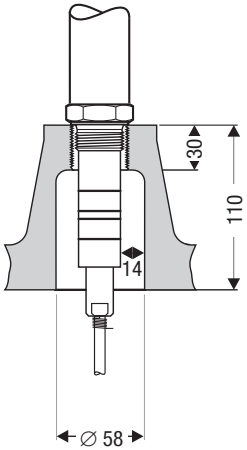


Fig. 10

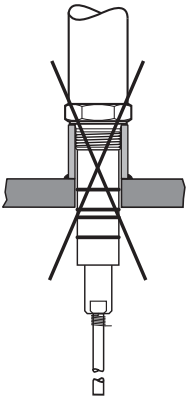


Fig. 11

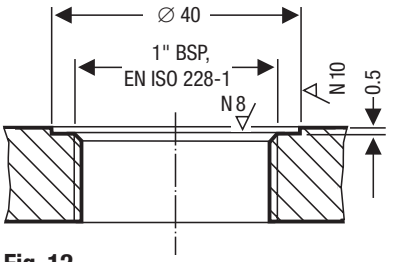
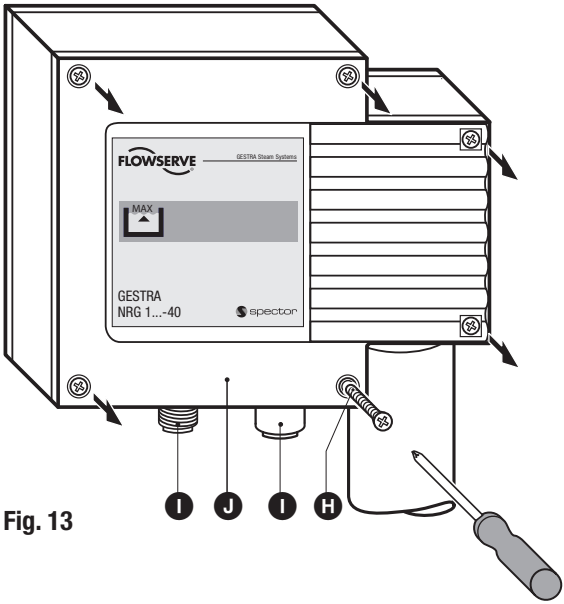


Fig. 12

Functional Elements

NRG 16-40, NRG 17-40, NRG 19-40, NRG 111-40



MAX 70 °C

%

MAX 95 %

IP 65

CE

Fig. 13

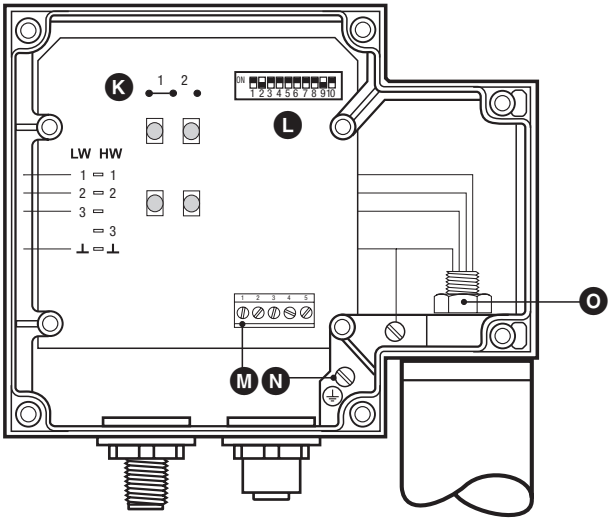


Fig. 14

Design / Functional Elements continued

Key

- **A** Electrode rod
- **B** Bore
- **C** Spring
- **D** Electrode tip
- **E** S. S. joint ring D 27 x 32 mm to DIN 7603 (made of 1.4301), bright annealed (NRG 1...-40)
- **E** S. S. joint ring D 33 x 39 mm to DIN 7603 (made of 1.4301), bright annealed (NRG 111-40)
- **F** Seating surface
- **G** Electrode thread
- **H** Screws M 4
- **I** M 12 sensor connector, 5 poles, A-coded, M 12 sensor jack, 5 poles, A-coded
- **J** Cover
- **K** Wire link (for selecting “Electrode 1” or “Electrode 2”)
- **L** 10-pole code switch for setting node ID and baud rate
- **M** Terminal strip
- **N** PE connection
- **O** Plug
- **P** Thermal insulation (provided on site), d = 20 mm (outside of thermal insulation of steam generating unit)

Installation

NRG 16-40, NRG 17-40, NRG 19-40, NRG 111-40, step 1

1. Screw electrode tip Ⓓ into measuring electrode Ⓐ , **Fig. 4, Fig. 8.**
2. Carefully determine required measuring length of electrode. Observe min. length, **Fig. 2, Fig. 3.**
3. Mark length of electrode tip Ⓓ.
4. Unscrew electrode tip Ⓓ from measuring electrode Ⓐ and cut tip.
5. After visual inspection screw electrode tip Ⓓ into measuring electrode Ⓐ. Slide spring Ⓒ along electrode tip Ⓓ, so that its bent end completely enters into small bore Ⓑ.

NRG 16-40, NRG 17-40, NRG 19-40, NRG 111-40, step 2

1. Check seating surfaces, **Fig. 7, Fig. 12**
2. Place ring joint Ⓔ onto seating surface Ⓕ of electrode, **Fig. 5, Fig. 9**
3. Apply a light smear of silicone grease (e.g. Molykote® 111) to electrode thread Ⓖ.
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**, for NRG 111-40 **475 Nm.**
5. When installing two electrodes together in one flange install the first electrode as described in 4. Before mounting the second electrode undo plug Ⓞ, remove PE connection Ⓝ and strip cable lugs from the board. Screw in electrode. Slightly tighten plug Ⓞ. Install PE connection Ⓝ 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, Fig. 12.**
- Do not bend electrode tip when mounting.
- Use only ring joint (of stainless steel 1.4301) D 27 x 32 (D 33 x 39 for NRG 111-40) to DIN 7603 supplied with the electrode.
- Do not lag electrode body above the hexagonal section, **Fig. 5, Fig. 9.**
- Do not insulate electrode thread with hemp or PTFE tape.
- Do not screw electrode directly into a screwed socket, **Fig. 6, Fig. 11.**
- Observe min. spacing when installing the electrode, **Fig. 10, Fig. 15, Fig. 19.**

Note

- For the approval of the boiler standpipe the relevant regulations must be considered.
- Refer to pages 16 and 17 for typical installation examples.

Tools

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

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

Examples of installation NRG 16-40, NRG 17-40, NRG 19-40

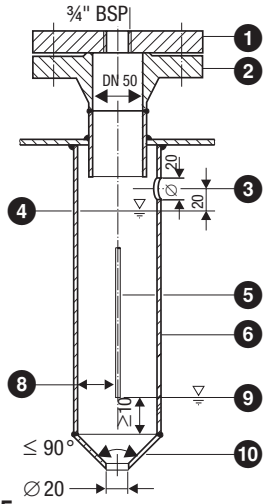


Fig. 15

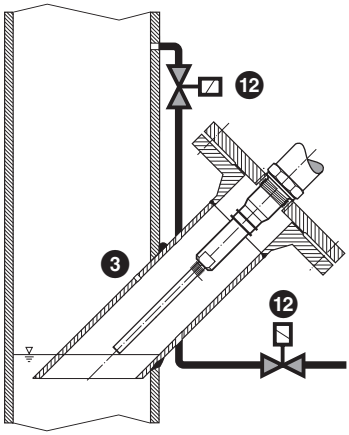


Fig. 16

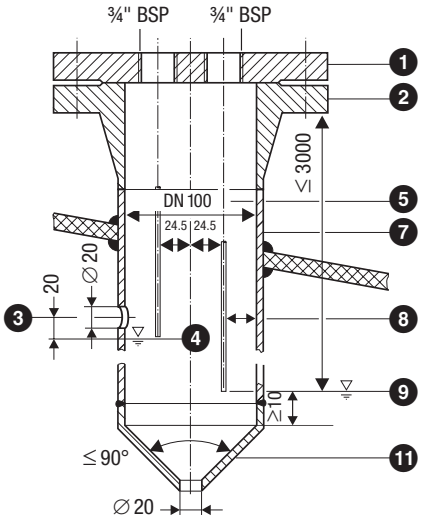


Fig. 17

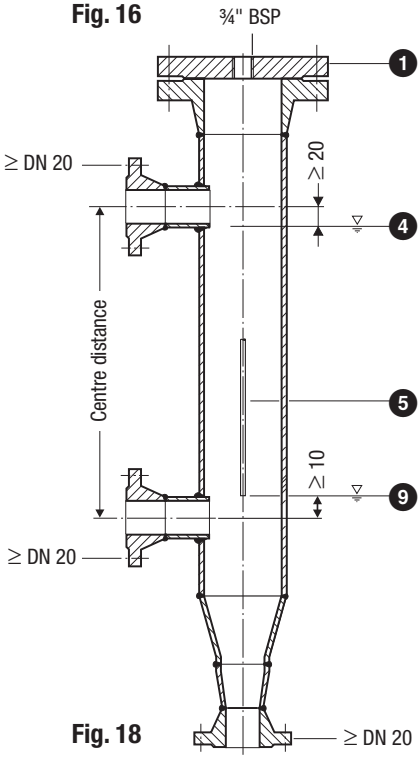


Fig. 18

Examples of installation NRG 111-40

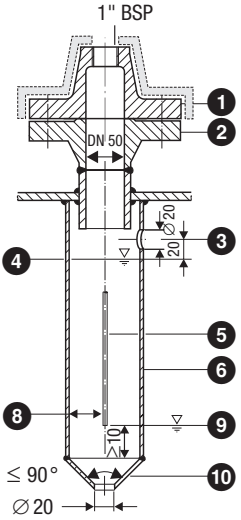


Fig. 19

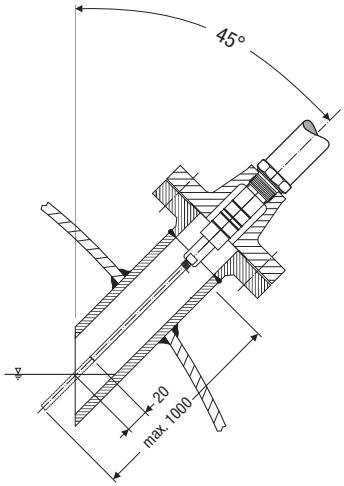


Fig. 20

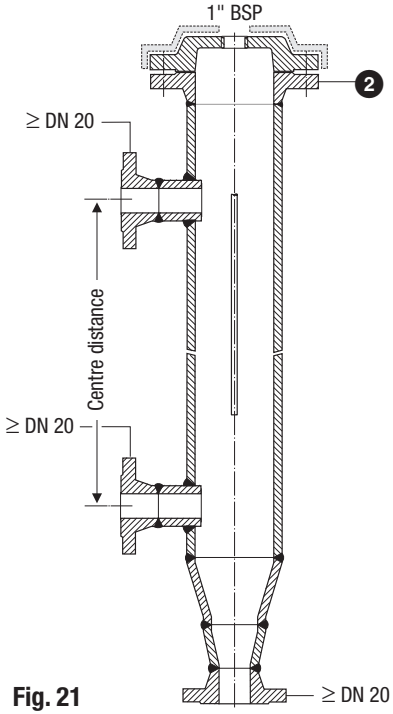


Fig. 21

Key

❶ Flange PN 40 , DN 50, DIN 2527
Flange PN 40, DN 100, DIN 2527

❷ For the approval of the boiler standpipe with connecting flange the relevant regulations must be considered.

❸ Vent hole (Provide vent hole as close to the boiler wall as possible)

❹ High water (HW)

❺ Electrode rod d = 8 mm

❻ Protection tube DN 80

❼ Protection tube DN 100

❽ Electrode distance ≥ 14 mm

❾ Low water (LW)

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

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

⓬ Solenoid valve

Wiring

NRG 16-40, NRG 17-40, NRG 19-40, NRG 111-40

Important Note

Note that screened multi-core twisted-pair control cable is required for the BUS line, e. g. UNITRONIC® BUS CAN 2 x 2 x ... mm² or RE-2YCYV-fl 2 x 2 x ... mm².

Prefabricated control cables (with connector and coupler) for connecting the equipment are available as accessories.

The baud rate (data transfer rate) dictates the cable length between the bus nodes and the total power consumption of the sensor dictates the conductor size.

S 8	S 9	S 10	Baud rate	Cable length	Number of pairs and conductor size [mm²]
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, dependent on bus configuration
OFF	ON	ON	20 kBit/s	1000 m	
ON	ON	ON	10 kBit/s	1000 m	

The baud rate is set via a code switch. Reduce baud if cable is longer than specified in the table. Make sure that all bus nodes have the same settings.

To protect the switching contacts fuse circuit with 2.5 A (anti-surge fuse) or according to TRD regulations (1.0 A for 72 hrs operation).

If a max. cable length of more than 125 m (up to 1000 m) is desired, make sure to modify the baud rate settings accordingly. Please refer to Fig. 26 on page 24 for more details.

Aligning terminal box

1. Undo screws ❽ and remove housing cover ❾. **Fig. 13**
2. Slacken plug ❿ with 17 mm open-end spanner but do not remove. **Fig. 14**

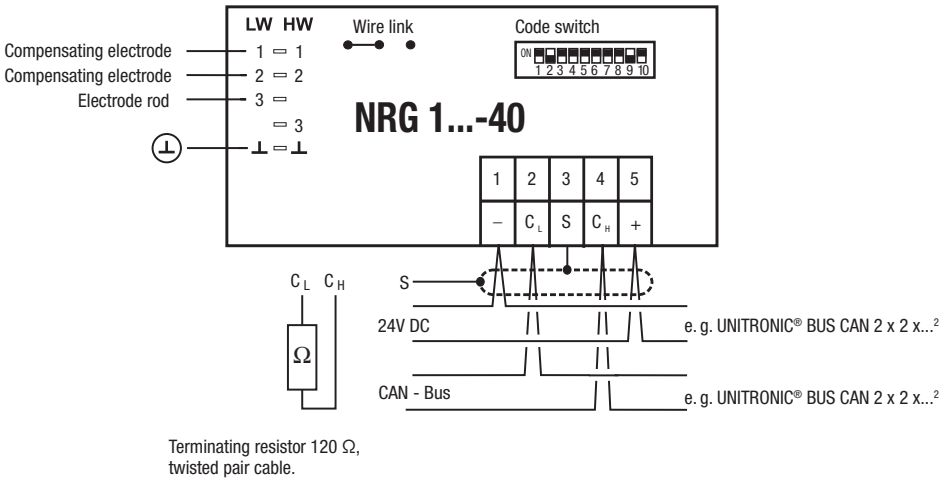
The electrode terminal box can now be turned through +/– 180 °.

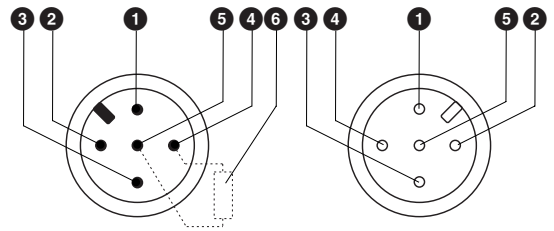
3. Turn electrode terminal box into desired position (+/– 180 °).
4. Tighten plug ❿ with **25 Nm**.
5. Set node ID (see sections **"Basic Settings"** and **"Factory set default node IDs"**).
6. Re-attach housing cover ❾ and fix it by using screws ❽.

Note

■ Wire the control cable according to the wiring diagram with connector and coupling.

Wiring diagram





❶ Screen
❷ Voltage supply 24V DC+
❸ Voltage supply 24V DC-
❹ CAN Data line C_H
❺ CAN Data line C_L
❻ Terminating resistor 120 Ω

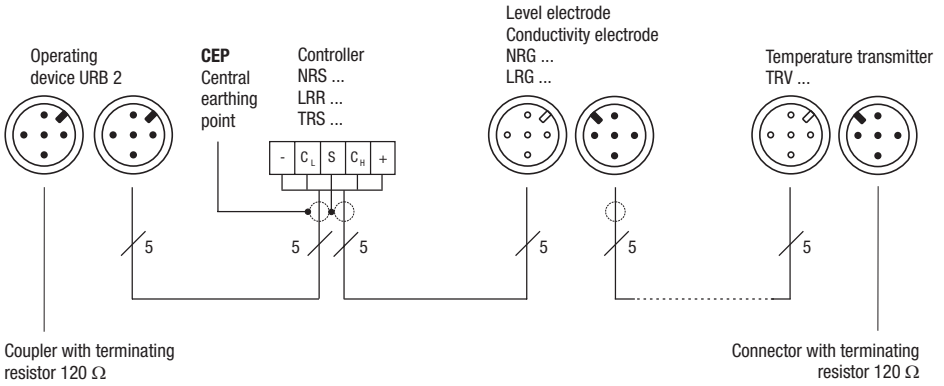


Fig. 22

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Wiring continued

Attention

- Wire equipment in series. Star-type wiring is not permitted!
- Interlink screens of control cables such that electrical continuity is ensured and connect them **once** to the central earthing point (CEP).
- In a CAN bus network the first and last equipment **must** be provided with a terminating resistor of 120 Ω. **Fig. 22.**
- The CAN bus network must **not** be interrupted while operating.

  An interruption will result in high/low level alarm!

Tools

- Screwdriver for cross head screws, size 1
- Screwdriver for slotted screws, size 2.5, completely insulated according to VDE 0680
- Open-end spanner 17 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). Refer to the following pages for more details.

Node-ID

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

Reserved area

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

Reserved area

Attention

The node IDs of the respective devices must be set manually.
Refer to the installation & operating manual of the equipment in question.

Factory set default values

The level electrode features the following factory set default values:

- Baud rate: **250 kB/s**
- Sensitivity: **0.5 µS/cm**
- Node ID: **002**
- Configuration: **Level electrode 1,** wire link Ⓚ set left.

Water-level limiting system

The water-level limiting system consists of one switching controller type NRS 1-40 and **two** level electrodes type NRG 1...-40. Before starting the system make sure to configure **one** of the two level electrodes as **level electrode 2**.

- Set wire link Ⓚ on circuit board to the **right (electrode 2), Fig. 14**
- Set code switch Ⓛ according to the table "Node ID" (example: **003***). For more information see **Fig. 24** and **25** on page 24.

Factory set default node IDs

Switching Controller		Level Electrode	
NRS 1-40	ID: 001	NRG 16-40	ID: 002
NRS 1-40.1	ID: 001	NRG 16-40	ID: 003
NRS 1-41	ID: 006	NRG 16-41.1	ID: 004
NRS 1-42	ID: 020	TRV 5-40	ID: 005
NRS 2-40	ID: 039	NRG 16-41	ID: 007
NRR 2-40	ID: 040	NRG 16-42	ID: 021
LRR 1-40	ID: 050	NRG 26-40	ID: 041
		LRG 16-40	ID: 051

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 screws Ⓗ and remove housing cover Ⓙ.
2. Change code switch Ⓛ settings as required. For more information refer to page 24.
3. Re-attach housing cover Ⓙ and fix it with screws Ⓗ.

Attention

- Do **not** assign the same node ID twice within the CAN bus network.

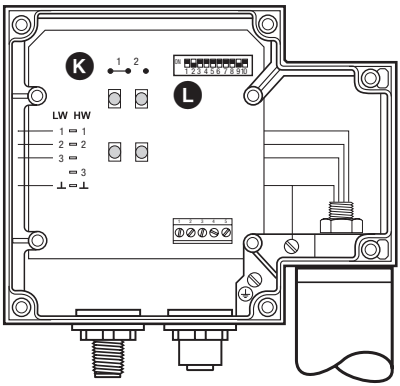

Fig. 23

Setting code switch

		Node ID	2
S1	OFF	1	
S2	**ON**	2	
S3	OFF	4	
S4	OFF	8	
S5	OFF	16	
S6	OFF	32	
S7	OFF	64	

Fig. 24 (Factory setting)

		Node ID	3
S1	**ON**	1	
S2	**ON**	2	
S3	OFF	4	
S4	OFF	8	
S5	OFF	16	
S6	OFF	32	
S7	OFF	64	

Fig. 25 (Level electrode 2)

S8	S9	S0	Baud rate	Cable length
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**	50 kBit/s	1000 m

Fig. 26 (Factory setting 250 kBit/s)

Commissioning

Wiring check

Make sure that the level electrode NRG 1..-40 is properly connected to the switching controller NRS 1-40 or NRS 1-40.1 according to the wiring diagram, **Fig. 22**

Apply mains voltage

Apply power to switching controller NRS 1-40 or NRS 1-40.1.

Operation

Water-level limiter, water-level limiting system

Use in combination with switching controller NRS 1-40 or NRS 1-40.1 in pressurized hot-water plants and steam boilers working in accordance with TRD 401, TRD 602, TRD 604, EN 12952, EN 12953 or other national regulations.

Note

- To analyse and eliminate malfunctions use “Fault finding list for troubleshooting” on page 26!

Emergency Operation

Emergency operation of water-level limiting system

If one level electrode fails to operate the installation can continue to operate in emergency mode under constant supervision according to TRD 401 with **one** level electrode.

1. Undo screws ⓗ and remove housing cover ⓙ, **Fig. 13**
2. Set wire link ⓚ of the working electrode to the **left (electrode 1), Fig. 14**
3. Set node ID of the working electrode to **“002”, Fig. 14, Fig. 24**
4. Attach housing cover ⓙ and tighten screws ⓗ.

Attention

- Enter beginning of emergency operation in the boiler log.
- An installation operating in emergency mode has to be constantly supervised.
- Immediately replace faulty level electrode.
- Enter end of emergency operation in the boiler log.

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.

Level electrode submerged – Low-level alarm

Fault: Mains voltage not applied.
Remedy: Apply mains voltage. Connect electrode according to wiring diagram.

Fault: Thermal fuse has been triggered.
Remedy: The ambient temperature must not exceed 70 °C.

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: No data exchange with CAN bus.
Remedy: Check switching controller NRS 1-40. Connect level electrode according to wiring diagram.

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

Level below “Low water level” – no function

Fault: The electrode rods have earth contact.
Remedy: Change installation position.

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.

Decommissioning

Danger

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

Disposal

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

Annex

Declaration of conformity CE

We hereby declare that the equipment **NRG 16-40**, **NRG 17-40**, **NRG 19-40** and **NRG 111-40** conform to the following European guidelines:

- LV guideline 73/23/eec version 93/68/eec
- EMC guideline 89/336/eec version 93/68/eec
- ATEX Directive 94/9/EC of 23 March 1994
- Pressure Equipment Directive PED 97/23/EC of 29th May 1997 (provided that the equipment is not excluded from the scope of this directive according to section 3.3)

Applied conformity assessment procedure: Annex III, Module B and D, verified by the notified body 0525.

This declaration is no longer valid if modifications are made to the equipment without consultation with us.

Bremen, 3rd January 2005
GESTRA AG

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