



Switching Controller

NRS 1-40



CANopen

EN
English

Original Installation Instructions
810635-07

Contents

Page

Important Notes

Usage for the intended purpose	5
Safety note	5
Danger	5
Attention	5
ATEX (Atmosphère Explosible).....	5
Note on the Declaration of Conformity / Declaration by the Manufacturer CE	5

Explanatory Notes

Scope of supply	6
Description	6
Function	6, 7
System components	7
Design	7

Technical Data

NRS 1-40.....	8
Name plate / marking	9
Dimensions.....	10

Design

NRS 1-40.....	11
Key	13

Functional Elements

NRS 1-40.....	12
Key	13

Installation

NRS 1-40.....	14
Note	14
Tools.....	14
Example of installation.....	15
Key	16

Electrical Connection

Control cable	16
Note	17
CAN bus voltage supply	17
Attention	17
Wiring diagram	18
Attention	18
Assignment diagram for sensor-connector union	19
Key	19
CAN bus wiring diagram	20
Attention	20
Note	21
Tools	21

Basic Settings

CAN Bus	21
Node ID	22
Note	23
Factory setting	23
Assigning / changing node ID	23
Attention	23
Code switch settings	24

Commissioning

NRS 1-40	25
Note	25

Operation

NRS 1-40	25
----------------	----

Test Cycle

NRS 1-40	25, 26
----------------	--------

Alarm

NRS 1-40	26
Low-level alarm for water level limiter	26
Low-level alarm for water level limiting system	26
Note	26

Contents – continued –

Page

Emergency Operation

Danger	27
Emergency operation of water-level limiting system.....	27
Attention.....	27

Malfunctions

Danger	28
Fault finding list for troubleshooting	28

System Malfunctions

Danger	29
NRS 1-40.....	29
Danger	30
Systematic malfunction analysis	30
Error message 1	31
Error message 2	32
Error message 3	33, 34
Error message 4	35
Error message 5	35
Error message 6	36
Error message 7	36

Decommissioning

Danger	37
Disposal.....	37

Important Notes

Usage for the intended purpose

Use switching controller NRS 1-40 only in conjunction with GESTRA level electrodes NRG 16-40, NRG 17-40, NRG 19-40 or NRG 111-40 for signalling low-water level (min. alarm).

Safety note

The equipment must only be installed and commissioned by qualified and adequately trained personnel.

Maintenance and retrofitting must only be performed by entrusted personnel who – through adequate training – have achieved a recognised level of competence.



Danger

The terminal strip of the NRS 1-40 is live during operation. This presents the danger of electric shock.

Cut off power supply before mounting or removing the terminal strips and the housing cover.



Attention

The name plate specifies the technical features of the equipment.

Note that any piece of equipment without its specific name plate must neither be commissioned nor operated.

ATEX (Atmosphère Explosible)

According to the European Directive ATEX 2014/34/EU the equipment must not be used in potentially explosive atmospheres.

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.de ► Documents or can be requested from us.

Explanatory Notes

Scope of supply

NRS 1-40

- 1 Switching controller NRS 1-40 (plug-in unit in plastic case with terminals)
- 1 Terminating resistor 120 Ω
- 1 Installation and service manual

Description

The controller type NRS 1-40 is a self-monitoring low-water level limiter with periodic self-checking and monitoring feature of the output relay contacts, to be used in conjunction with **one** level electrode type NRG 16-40, 17-40, 19-40 or NRG 111-40.

The controller has the following function:

■ Low-water level alarm with **one** level electrode

The equipment detects the min. water level (low-level limiter) and complies with the German regulations for use in steam and hot-water plants operating without constant supervision according to TRD 604, sheet 1 and sheet 2 (24 h/72 h operation) as well as DIN EN 12952 and DIN EN 12953.

When used with **two** level electrodes type NRG 16-40, 17-40, 19-40 or NRG 111-40, the controller NRS 1-40 constitutes a high-integrity low-water level limiter **system** with periodic self-checking. The controller features the following function:

■ Low-water level alarm with **two** level electrodes

This equipment combination detects the min. water level (low-level limiting system) and complies with the German regulations for use in steam and hot-water plants operating without constant supervision according to TRD 604, sheet 1 and 2 (24/72 hours operation without constant supervision).

This item of electrical equipment complies with the Technical Regulations on Protection Circuits to DIN EN 50156-1.

The level data are transferred from the electrode NRG 1...-40 to the controller via CAN bus using the CANopen protocol. Only **one** low-level limiting system may be used per CAN-based network.

Function

At regular intervals the level electrode NRG 1...-40 sends a data telegram to the controller NRS 1-40. The data transfer is effected by means of a CAN bus according to ISO 11898. The transferred measuring data are constantly evaluated by the controller.

A periodic self-checking routine tests every 3 seconds the integrity of the system and its safety functions, with a malfunction in the controller resulting in immediate boiler shut-down. When the CAN bus line and, consequently, the data transmitting cycle are interrupted, the controller sends a visual signal to indicate a faulty condition and the relays are instantaneously de-energized (fail-safe position).

The controller also facilitates user-friendly performance tests and detection/evaluation of malfunctions. To guarantee the correct and safe functioning of the low-level limiter a min. electrical conductivity of 0.5 $\mu\text{S}/\text{cm}$ at 25 °C is required.

The relay de-energizing delay is normally set to 3 seconds at the factory but delays of 15 to 25 seconds are available on request.

Apart from the burner protection circuit there is also a separate instantaneous Photo-MOS make contact output for remote indication.

Explanatory Notes – continued –

Function – continued –

The automatic self-testing routine checks the switching controller every 3 seconds and the sensors (e.g. the level electrodes) every 10 seconds. During each self-testing routine the error messages will be stored in the switching controller. The error messages remain stored until the cause of the fault(s) is eliminated. If a malfunction is detected the signal output of the switching controller (terminals 7 and 8) will be opened and closed as a function of the triggering pulse. As part of the automatic self-testing routine the function of the output relays will also be checked every 6 hours.

System components

NRG 16-40

Level electrode NRG 16-40, PN 40

NRG 17-40

Level electrode NRG 17-40, PN 63

NRG 19-40

Level electrode NRG 19-40, PN 160

NRG 111-40

Level electrode NRG 111-40, PN 320

Design

NRS 1-40

Enclosure made from insulating material with box terminals for installation in control cabinets.

The terminals are externally accessible.

Mounting on a standardised supporting rail TS 35 x 15 to DIN EN 50022.

External dimensions: 73 x 100 x 118

Technical Data

NRS 1-40

Type approval no.

TÜV · SWB/SHWS · 07-403

EG BAF-MUC 02 02 103881 002

Input / Output

Interface for CAN bus to ISO 11898 CANopen protocol

Output voltage supply for electrodes

18 – 36 V, short-circuit protected

Output for protection circuit

Two volt-free relay contacts, locally connected in series.

Max. contact rating for switching voltages 24 V AC/DC, 115 V AC and 230 V AC:

4 A resistive/inductive. Contact material: AgNi 0,15

Interference suppression

Provide contactor with external RC combination (100 Ω / 47 nF)

Signal output

Photo-MOS output, instantaneous with low level, pulse triggered malfunction signal, max. contact rating for switching voltages 24 V AC, 115 V AC and 230 V AC/DC: 100 mA resistive

Relay de-energizing delay

Output “Low-level alarm”, set to 3 sec. (standard), 15 sec. or 25 sec., internally linked for relay contact test

Indicators and adjustors

4 pushbuttons “Parameterisation/TEST”

1 red LED “Low-level alarm electrode 1”

1 red LED “Low-level alarm electrode 2”

2 red LEDs “Multifunction”

1 red LED “Bus status”

1 green LED “Power”

1 ten-pole code switch: 7 poles for setting node ID, 3 poles for setting baud rate

1 two-pole code switch for limiter/limiting system

Internal self-checking routine

Every 3 seconds

Periodic testing of output relay contacts

Every 6 hours

Supply voltage

230 V \pm 10 %, 50/60 Hz

115 V \pm 10 %, 50/60 Hz (optional)

Power consumption

10 VA

Sensitivity

$\geq 0.5 \mu\text{S/cm}$ at 25 °C

Protection

Enclosure: IP 40 to DIN EN 60529

Terminal strip: IP 20 to DIN EN 60529

Admissible ambient temperature

0 °C to 55 °C

Enclosure material

Front panel: polycarbonate, grey. Enclosure: polycarbonate, black

Weight

Approx. 0.8 kg

Name plate / marking



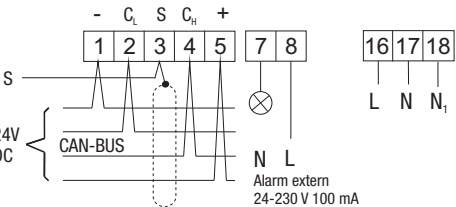





 Betriebsanleitung beachten See installation instructions Voir instructions de montage	Steuergerät control device appareil de commande		NRS 1-40		
	Node ID: _____				
IN / OUT: CAN-Bus 18-36 V DC		Tamb = 55 °C (131 °F)		230V~ -15/+10%	
				10VA	
				IP 40 (IP20)	
					
S 24V DC				Alarm ← 3sec.	
				  	
				25 29 250 V T 2,5 A	
				Sicherheitsstromkreis protection circuit circuit de securite	
Funktionale Sicherheit Functional safety Sécurité fonctionnelle IEC 61508 SIL 2		TÜV . SWB / SHWS . xx-403			
GESTRA AG Münchener Str. 77 D-28215 Bremen					

Fig. 1

Dimensions

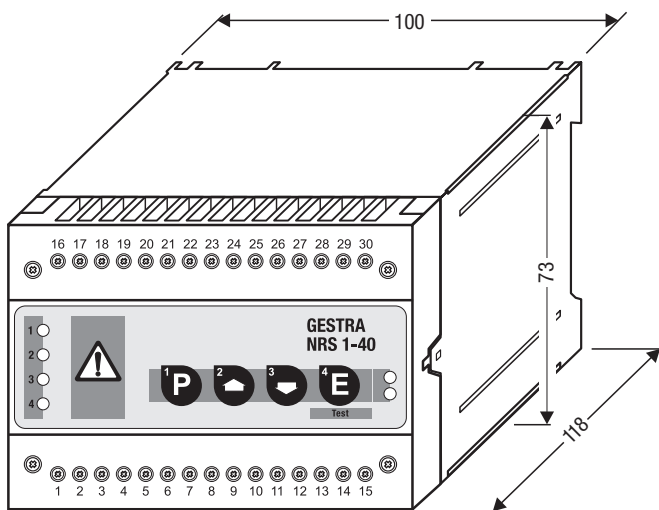


Fig. 2

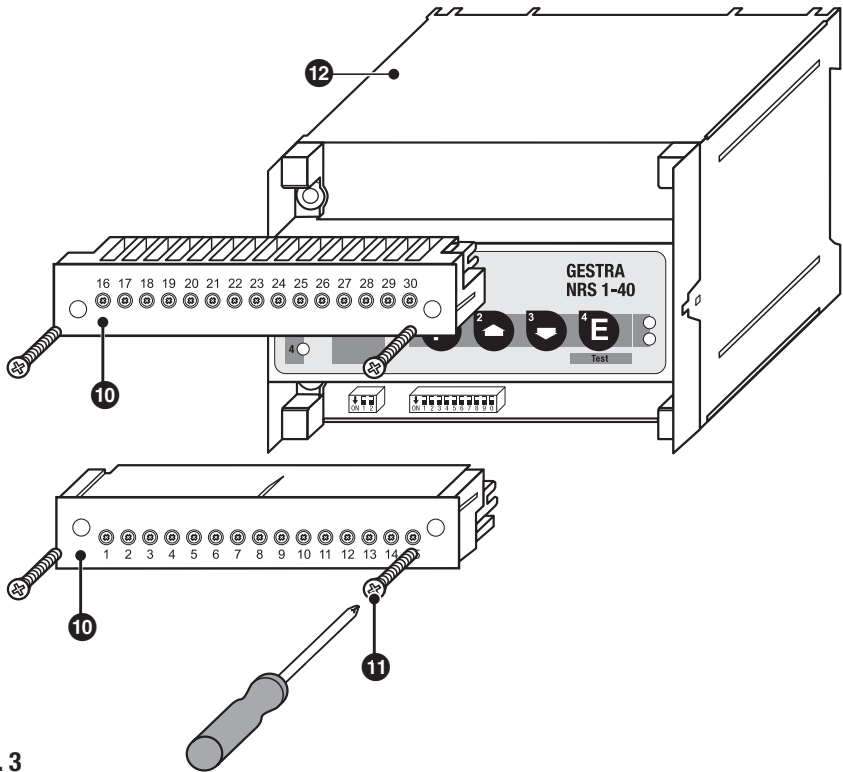


Fig. 3

Functional Elements

NRS 1-40

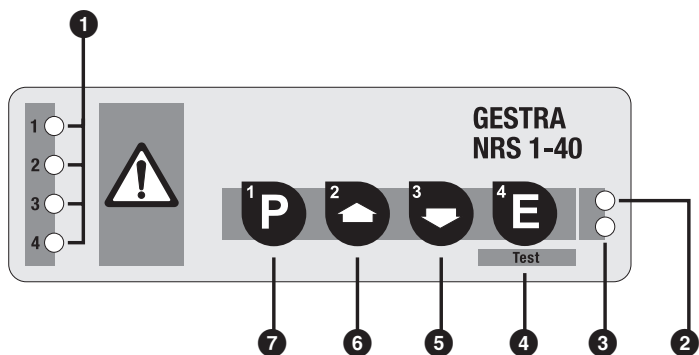


Fig. 4

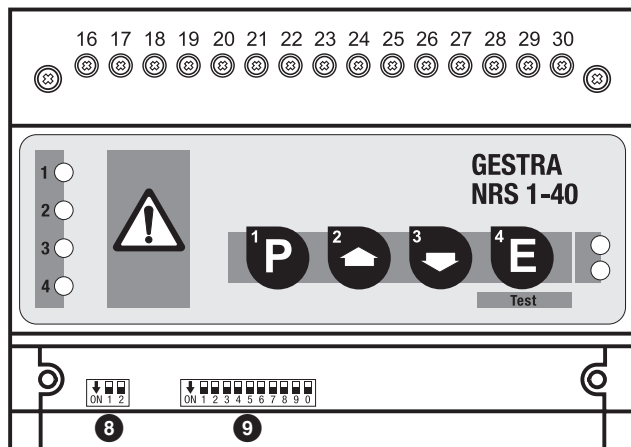


Fig. 5

Key

1 Indicator LED	Alarm	Malfunction
LED 1: Electrode 1	Low-level alarm	Malfunction message
LED 1: Electrode 2	Low-level alarm	Malfunction message
LED 3	No function	Malfunction message
LED 4	No function	Malfunction message
2 LED “Bus status”		
3 LED “Power”		
4 Enter / Test mode		
5 Decrease		
6 Increase		
7 Program key		
8 Two-pole code switch		
9 Ten-pole code switch		
10 Terminal strip		
11 Screws for terminal strip		
12 Enclosure		
13 Supporting rail TS 35 x 15 to DIN EN 50022		

Installation

NRS 1-40

Installation on mounting rail

1. Clip switching controller onto mounting rail 35 x 15 mm (DIN EN 50022):
2. Align switching controller, see **Fig. 7**



Note

- If an external measuring pot is used, each level electrode type NRG 1...-40 requires **one** switching controller NRS 1-40 and **one** GESTRA monitoring unit SRL 6-40.

Tools

- Screwdriver (5.5/100)

Example of installation

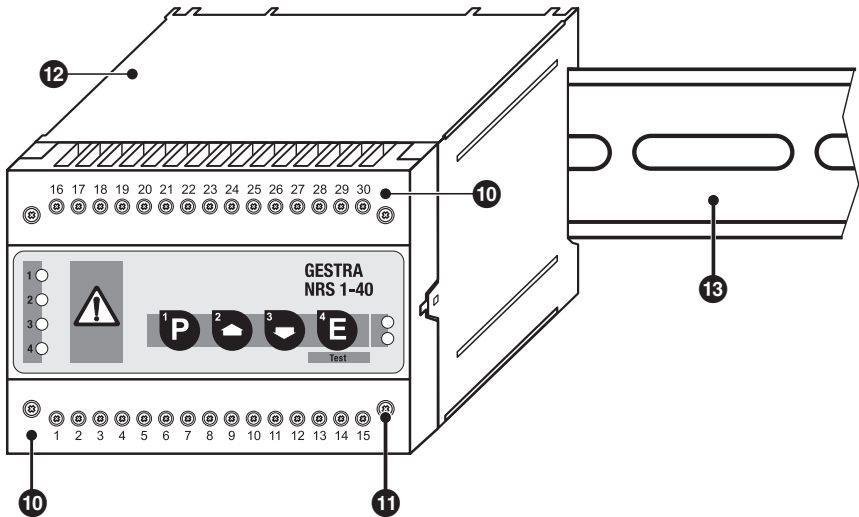


Fig. 6

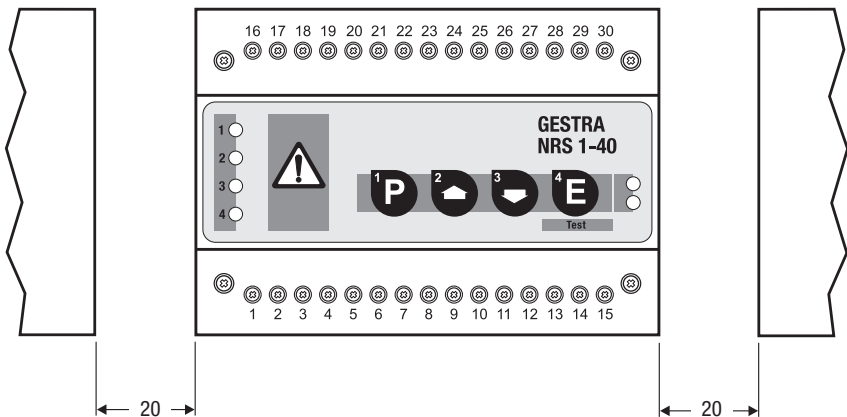


Fig. 7

Key

- 10 Terminal strips
- 11 Screws for terminal strip
- 12 Enclosure
- 13 Mounting rail TS 35 x 15 DIN EN 50022

Electrical Connection

Control cable

NRS, NRR, LRR, TRS, URB 1

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.

Control cable assemblies (2 x 2 x 0.32 mm² with connector and coupler) of various lengths are available as optional extra.

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

The equipment is fitted with a sensor-connector union (5 poles, A-coded). For the connection of the BUS devices control cable assemblies (with connector and coupler) of various lengths are available as optional extra.

Note that the recommended control cables are not UV resistant and, if installed outdoors (apart from URB 2), must be protected by a UV resistant plastic jacket or a cable duct.

The baud rate (data transfer rate) dictates the cable length and conductor size of the cable between the bus nodes. The total power consumption must also be taken into account when selecting the conductor size. The total power consumption is calculated 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 no. 1501214) and to 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 0.32
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 the code switch 9. Make sure that all bus nodes have the same settings.



Note

- The max. baud rates and cable lengths indicated above are based on empirical values obtained by GESTRA. In certain cases it may be necessary to reduce the baud rate in order to ensure trouble-free operation.
- The design of the data cable has a strong influence on the electromagnetic immunity (EMC). Take special care when connecting the equipment.
- If you do not use the control cable assemblies connect the connectors and jacks for the control cables as indicated in the assignment diagram for sensor connector unions.

CAN bus voltage supply

To ensure troublefree operation the CAN bus system must be supplied with sufficient voltage. Please use the following table to check the voltage supply of your bus system.

Control units with voltage supply	Qty.	X	Power rating per equipment	=	Sum
		X	6 W	=	W
Please enter data!			Sum 1	=	W
Measuring transducers, transmitters, control units, operating & display unit URB 1	Qty.	X	Power rating per equipment	=	Sum
		X	3 W	=	W
Operating & display unit URB 2		X	5 W	=	W
Please enter data!			Sum 2	=	W

If sum 2 exceeds sum 1, the CAN bus voltage must be supplied by a separate, stabilised safety power supply unit (e.g. SITOP smart 24 V, 2.5 A) with 24 V DC.

The power supply unit must be electrically isolated from dangerous contact voltages, meeting at least the requirements on double or reinforced isolation acc. to DIN EN 50178 or DIN 61010-1 or DIN EN 60730-1 or DIN EN 60950 (safe isolation).

The power supply unit must be provided with an overcurrent protective device in accordance with EN 61010-1.



Attention

If a safety power supply unit (e.g. SITOP smart, 24 V, 2.5 A) is used for the voltage supply of the CAN bus do not tap the supply voltage from the terminals 1 and 5 of the GESTRA control devices.

Wiring diagram

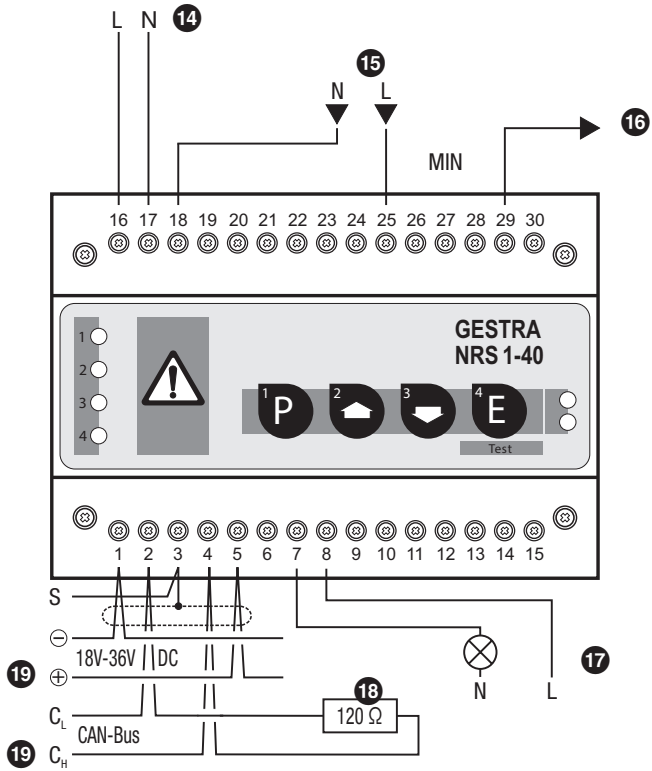


Fig. 8



Attention

- NRS 1-40 is the first device in the safety circuit.
- Do not connect the terminals 10 to 12, 19 to 24 and 26, 27, 28 and 30.

Assignment diagram for sensor-connector union

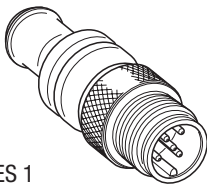
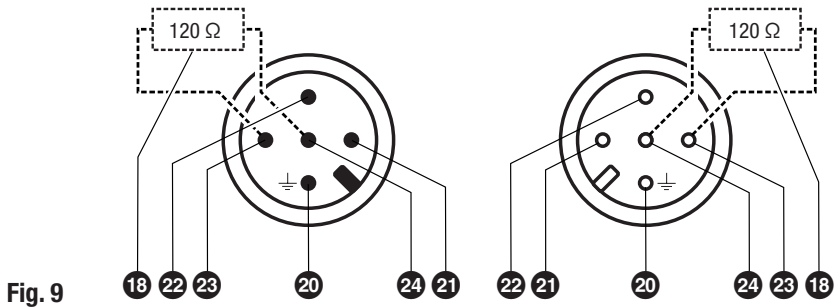


Fig. 10 RES 1

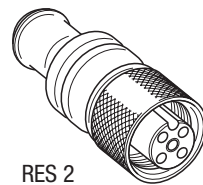
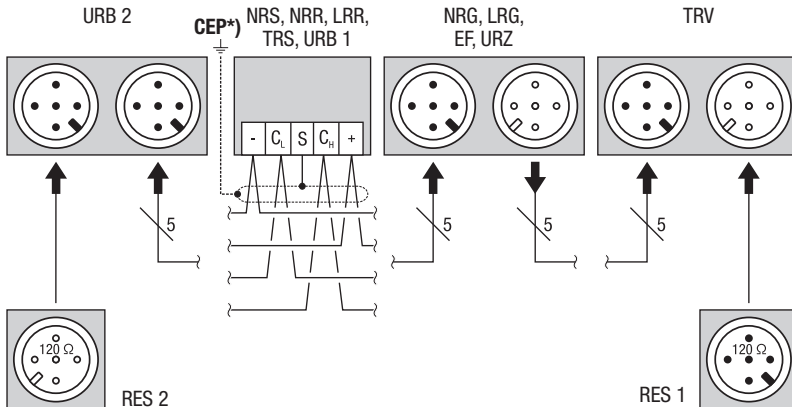


Fig. 11 RES 2

Key

- 14 Mains voltage
- 15 Safety circuit, uninterrupted, ≥ 18 V AC/DC
- 16 Further devices in the safety circuit
- 17 Photo MOS output 24 V – 230 V AC/DC, 100 mA.
With low-level alarm: instantaneous, with malfunction signal: pulse-triggered
- 18 Terminating resistor 120 Ω , RES 1 or RES 2
- 19 CAN bus line, twisted pairs (control cable)
- 20 Pin 1: Screen
- 21 Pin 2: Voltage supply 24 V DC+ (red)
- 22 Pin 3: Voltage supply 24 V DC– (black)
- 23 Pin 4: CAN data line C_H (white)
- 24 Pin 5: CAN data line C_L (blue)

CAN bus wiring diagram



*) Central Earthing Point

Fig. 12



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). If equipotential currents may occur, e.g. in outdoor installations, separate the screen from the central earthing point (CEP).
- To protect the switching contacts fuse circuit with 2.5 A (slow blow) or according to TRD regulations (1.0 A for 72 hrs operation).
- If more than one system component is connected to a CAN bus network provide the first and last equipment with a terminating resistor of 120 Ω. **Fig. 10, Fig. 11**
- Use only **one** water-level limiting system per CAN bus network.
- The CAN bus line must **not** be interrupted while operating with one or more system components.

In the event of an interruption the safety circuit will be opened!

If the switching controller has to be replaced first remove the terminal strips **10**, **Fig. 3**

Note: Make sure that all system components connected are *not operating* before removing the CAN bus line from the terminal strip.



Note

- Connect screen only to terminal 3, ensuring electrical continuity and connect equipment once to the central earthing point (CEP).
- The loop resistance must be under 10 Ω .
- The rated voltage is stated on the name plate.
- When switching off inductive loads, voltage spikes are produced that may impair the operation of control and measuring systems. Connected contactors must therefore be provided with RC combinations, e. g. 0.1 μF / 100 Ω .
- Despite correct wiring system failure and malfunction messages may occur because of high frequency malfunctions caused by the system. For more information refer to the section “Troubleshooting”.
- In the event of a shut-down caused by malfunction the signal output (terminals 7 and 8) is opened and closed in a clock-pulse controlled way in order to ensure an optical differentiation between “Low water level” (signal output permanently closed) and “Shut off due to a malfunction”. If required you can wire terminals 7 and 8 with an external signal lamp, **Fig. 8**.

Tools

- Screwdriver for slotted screws, size 2.5, completely insulated according to VDE 0680-1

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 **99**.

The NRS 1-40 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).

If the length of the CAN bus cable exceeds 125 m, use code switch  to change the switch positions.

For more information refer to the section “**Basic Settings – Code switch settings**”.

Basic Settings – continued –

Node ID

Low-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. pressurised hot-water generating unit)

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. pressurised hot-water generating unit)

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			
	98	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 (low-level limiter / high-level 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 continuous blowdown control

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

Operating unit

URB 1, URB 2					
60					Factory setting



Note

- The node ID “3” for the second level electrode NRG 1...-40 must be set on site, because the level electrode NRG 1...-40 features the default factory setting node ID “2” when supplied. Note that a wire link on the electronic circuit board of the second level electrode NRG 1...-40 must also be repositioned. For more information please refer to the installation manual of the level electrode.

Factory setting

The switching controller features the following factory set default values:

- Baud rate: **250 kb/s for max. cable length 125 m**
- Measuring sensitivity: **0.5 µS/cm**
- Node ID: **1**
- Relay de-energizing delay: **3 s**
- Configuration: **Operation with two level electrodes NRG 1...-40**

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). In most cases it is sufficient to commission the equipment with the default factory setting.

Detach the lower terminal strip ⑩ in order to change the code switch settings ⑧ and ⑨.



Attention

- We recommend that you commission the CAN bus equipment with their default factory settings.
- The node ID “3” for the second level electrode NRG 1...-40 must be set on site and the wire link on the electronic circuit board of the second level electrode must also be repositioned, because the level electrode NRG 1...-40 features the default factory setting node ID “2” when supplied.
- Make sure that no node ID is used twice in the CAN bus network!

Code switch settings



		NRG...
S1	<i>ON</i>	1 + 2
S2	<i>ON</i>	

Fig. 13



		NRG...
S1	OFF	1
S2	OFF	

Fig. 14



		Node ID	1
S1	<i>ON</i>	1	
S2	OFF	2	
S3	OFF	4	
S4	OFF	8	
S5	OFF	16	
S6	OFF	32	
S7	OFF	64	

Fig. 15 (Factory setting)



		Node ID	12
S1	OFF	1	
S2	OFF	2	
S3	<i>ON</i>	4	
S4	<i>ON</i>	8	
S5	OFF	16	
S6	OFF	32	
S7	OFF	64	

Fig. 16 (Example)

S8	S9	S0	Baud rate	Cable length
OFF	<i>ON</i>	OFF	250 kBit/s	125 m
<i>ON</i>	<i>ON</i>	OFF	125 kBit/s	250 m
OFF	ON	<i>ON</i>	100 kBit/s	335 m
<i>ON</i>	ON	<i>ON</i>	50 kBit/s	500 m
OFF	<i>ON</i>	<i>ON</i>	20 kBit/s	1000 m
<i>ON</i>	<i>ON</i>	<i>ON</i>	10 kBit/s	1000 m

Fig. 17 (Factory setting: 250 kBits/s)

Commissioning

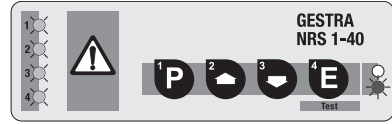
NRS 1-40

Apply power to the unit.

The four indicator LEDs flash rapidly.

The LED "Power" lights up.

The test cycle takes about 3 sec.



Note

- To analyse and eliminate malfunctions that may occur during the commissioning procedure refer to section "Malfunctions" and "System Malfunctions".

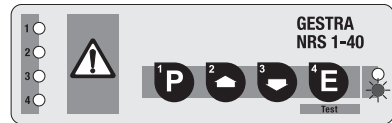
Operation

NRS 1-40

Normal operation, electrode(s) submerged.

The four indicator LEDs are not illuminated.



The LED "Power" lights up.



Test Cycle

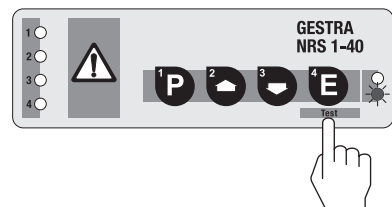
NRS 1-40

Press button **E** briefly (1sec.).

The test mode is activated for about 10 sec. Be sure to press button  or  within these 10 sec.

Note:

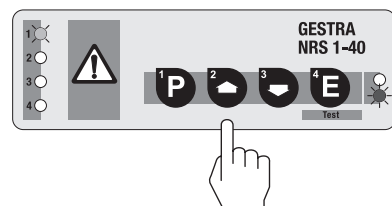
The safety circuit will be interrupted during the test cycle.



Press button  for 3 sec.

LED 1 flashes rapidly and remains permanently illuminated after 3 sec.

A low-level alarm is simulated for electrode 1.



Test Cycle – continued –

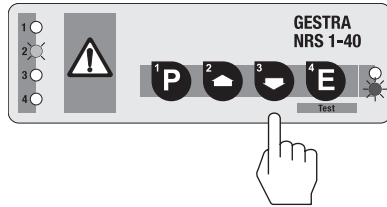
NRS 1-40 – continued –

Press button  briefly (1 sec.).

LED 2 flashes rapidly and remains permanently illuminated after 3 s.

A low-level alarm is simulated for electrode 2.

This test cycle is performed for the water-level limiting system (**two** level electrodes).

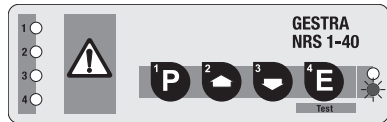


Alarm

NRS 1-40

There are two different alarm conditions:

- **Low-level alarm for water-level limiter (one level electrode).**
- **Low-level alarm for water-level limiting system (two level electrodes).**

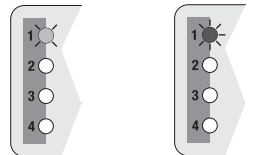


Low-level alarm for water level limiter

LED 1 flashes rapidly.

LED 1 remains permanently illuminated after the de-energizing delay.

De-energizing delay: 3 sec. (default)

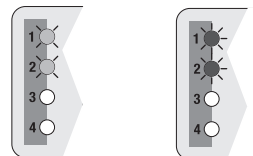


Low-level alarm for water level limiting system

LED 1 and 2 flash rapidly.

LED 1 and 2 remain permanently illuminated after the de-energizing delay.

De-energizing delay: 3 sec. (default)



Note

- In the event of an alarm the equipment does not lock automatically. If a lock function is required an external interlocking device must be provided.
- The signal output of the terminals 7 and 8 is instantaneously energised when an alarm is raised.
- The different lengths of the electrode rods or an inclined water level in the steam boiler can cause the LED 1 and LED 2 to respond at different times.

Emergency Operation



Danger

The terminal strip of the NRS 1-40 is live during operation.

This presents the danger of electric shock.

Cut off power supply before mounting or removing the terminal strips or the housing cover.

Emergency operation of water-level limiting system

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

1. Undo screws ⑪ and detach lower terminal strip ⑩, **Fig. 3**
2. Set code switch ⑧ “S1” and “S2” to OFF, **Fig. 5, Fig. 14**
3. Set code switch ⑨ “S1” to ON, “S2” to “S7” to OFF.
The switching controller NRS 1-40 features now the node ID “1”. **Fig. 15**
4. Set node ID of the working level electrode to “2”, cf. section “**Emergency Operation**” in the Operating Instructions for the NRG 16-40, 17-10, 19-40, 111-40.
5. Re-attach lower terminal strip ⑩.



Attention

- Enter beginning of emergency operation in the boiler log.
- An installation operating in emergency mode has to be constantly supervised.
- Put up a sign indicating the emergency operation of the switchgear unit.
- Immediately replace faulty level electrode.
- Enter end of emergency operation in the boiler log.

Malfunctions



Danger

The terminal strip of the NRS 1-40 is live during operation. This presents the danger of electric shock. Cut off power supply before mounting or removing the terminal strips or the housing cover.

Fault finding list for troubleshooting

Water level below switchpoint LOW LEVEL – no function

Fault: LED “Power” does not light up.

Remedy: Apply power. Connect the equipment properly, referring to wiring diagram.

Water level not yet below switchpoint LOW LEVEL – Low level alarm is raised

Fault: Low-level alarm is given despite the electrode being submerged.

Remedy: The conductivity of the fluid to be monitored is $< 0.5 \mu\text{S}/\text{cm}$. Increase the conductivity of the fluid.

Fault: The electrode body does not have earth connection to the vessel.

Remedy: Clean seating surfaces and insert metal joint ring (of stainless steel 1.4301) D 27 x 32 to DIN 7603. Do **not** insulate the 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.

Equipment does not work – Malfunction message

Fault: In spite of correct wiring and commissioning of the equipment an error message is indicated.

Remedy: Cut off power supply to the system. Detach terminal strips and re-attach them. Restart the system after 5 sec.

Remedy: Carry out a systematic fault diagnosis as specified in the section “System Malfunctions”.

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

System Malfunctions



Danger

The terminal strip of the NRS 1-40 is live during operation.

This presents the danger of electric shock.

Cut off power supply before mounting or removing the terminal strips or the housing cover.

NRS 1-40

Faulty installation and/or configuration of CAN bus components, excessive temperatures in the devices, defective electronic component parts or electromagnetic interferences of the supply system can result in system malfunctions. In the event of a system malfunction the safety circuit (terminal 25 and 29) is instantly interrupted.

There are four system malfunctions that might occur in the level electrode and the switching controller.

- Max. admissible temperature in electrode terminal box exceeded
- No or faulty communication between controller and electrode
- Fault in CAN bus
- Failure of 24 V power supply unit built in switching controller NRS 1-40

The automatic self-testing routine checks the switching controller every 3 seconds and the sensors (e.g. the level electrodes) every 10 seconds. During each self-testing routine the error messages will be stored in the switching controller. The error messages remain stored until the cause of the fault(s) is eliminated. If a malfunction is detected the signal output of the switching controller (terminals 7 and 8) will be opened and closed as a function of the triggering pulse. As part of the automatic self-testing routine the function of the output relays will also be checked every 6 hours.



Danger

The terminal strip of the NRS 1-40 is live during operation.

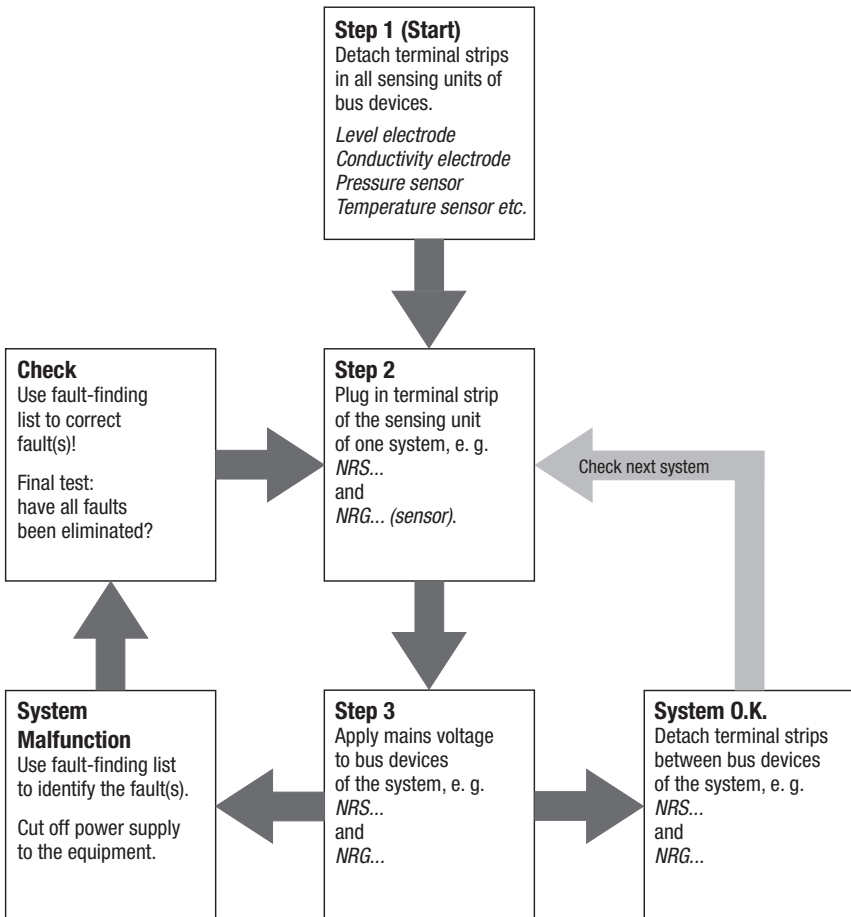
This presents the danger of electric shock.

Cut off power supply before mounting or removing the terminal strips or the housing cover.

Systematic malfunction analysis

The sources of malfunctions occurring in CAN bus systems operating with several bus-based stations must be analysed systematically since faulty components or incorrect settings can give rise to negative interactions with intact bus devices in the CAN bus system. These unwanted interactions can cause error messages in fully functional bus devices, which will make fault detection even more difficult.

We recommend the following systematic fault finding procedure:

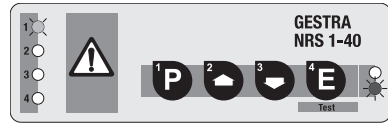



System Malfunctions – continued –

Error message 1

LED 1 is flashing slowly.

A system malfunction in **level electrode 1** was detected.



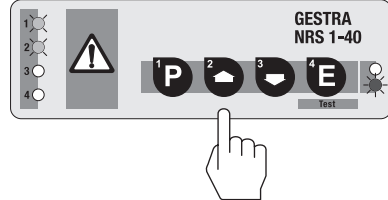
Hold down button .



LED 1 and 2 are flashing slowly.



A



Fault: The max. admissible temperature in the terminal box of the electrode has been exceeded.

Remedy: Insulate electrode flange against heat radiation.

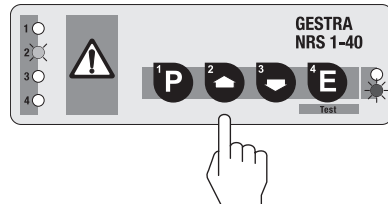
Hold down button .



LED 2 is flashing slowly.



B



Fault: The electronic circuit board of the level electrode is defective.

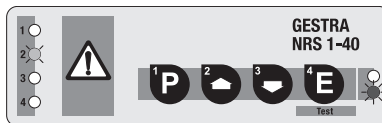
Remedy: Replace electronic circuit board of the level electrode 1.

System Malfunctions – continued –

Error message 2

LED 2 is flashing slowly.

A system malfunction in **level electrode 2** was detected.



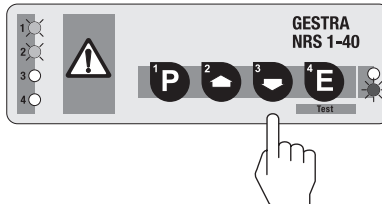
Hold down button .



LED 1 and 2 are flashing slowly.



A



Fault: The max. admissible temperature in the terminal box of the electrode has been exceeded.

Remedy: Insulate electrode flange against thermal radiation.

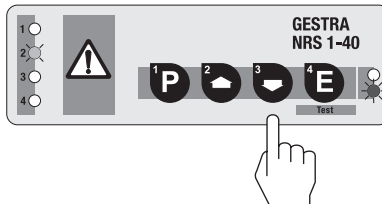
Hold down button .



LED 2 is flashing slowly.



B



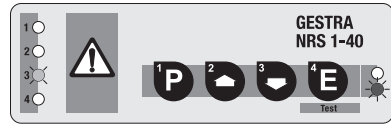
Fault: The electronic circuit board of the level electrode is defective.

Remedy: Replace the electronic circuit board of the level electrode 2.

Error message 3

LED 3 is flashing slowly.

A malfunction in the bus communication between level switch and **level electrode 1** has been detected.



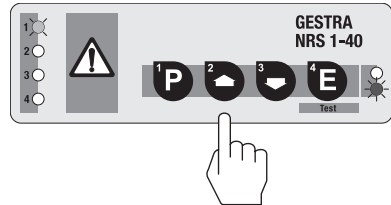
Hold down button .



LED 1 is flashing rapidly.



A



Fault: Bus lines C_L and C_H are interchanged.
Remedy: Connect bus lines according to the wiring diagram.

Fault: The operating mode setting is not correct: Water level limiter (**one** level electrode) or water level limiting system (**two** electrodes).
Remedy: Check and, if necessary, correct the settings in the switching controller and the sensor.

Fault: The data transfer between level switch and electrode is interrupted.
Remedy: Make sure that the bus lines are wired in accordance with the wiring diagram (observe polarity). All end-of-line devices must be provided with a terminating resistor of 120Ω (see wiring diagram). Cut off power supply and re-start the system after 5 sec.

Fault: The baud rate of one or more bus devices is not set correctly.
Remedy: Check baud rate settings of all bus devices.
 The baud rate settings must be identical.
 Cut off power supply and re-start the system after 5 sec.

Fault: The overall length of the bus line does not correspond to the baud rate setting.
Remedy: Change baud rate settings of all bus based equipment.
 Cut off power supply and re-start the system after 5 sec.

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. Restart the system after installation.

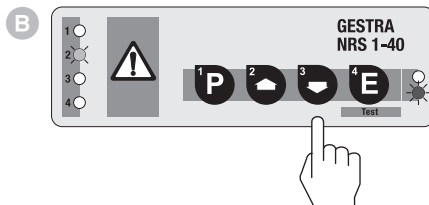
System Malfunctions – continued –

Error message 3 – continued –

Hold down button .



LED 2 flashes rapidly.



Fault: Bus lines C_L and C_H are interchanged.
Remedy: Connect bus lines according to the wiring diagram.

Fault: The operating mode setting is not correct: Water level limiter (**one** level electrode) or water level limiting system (**two** electrodes).
Remedy: Check and, if necessary, correct the settings in the switching controller and the sensor.

Fault: The data transfer between level switch and electrode is interrupted.
Remedy: Make sure that the bus lines are wired in accordance with the wiring diagram (observe polarity). All end-of-line devices must be provided with a terminating resistor of 120 Ω ! (see wiring diagram).
Cut off power supply and re-start the system after 5 sec.

Fault: The baud rate of one or more bus devices is not set correctly.
Remedy: Check baud rate settings of all bus devices.
The baud rate settings must be identical.
Cut off power supply and re-start the system after 5 sec.

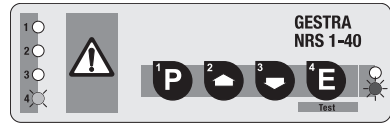
Fault: The overall length of the bus line does not correspond to the baud rate setting.
Remedy: Change baud rate settings of all bus based equipment.
Cut off power supply and re-start the system after 5 sec.

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. Restart the system after installation.

Error message 4

LED 4 is flashing slowly.

A malfunction in the level switch has been detected.



Fault: No voltage or pulse-triggered voltage across terminal 25, self-checking routine unsuccessful.
Remedy: Wire NRS 1-40 as first device in the safety chain.
Wire NRS 1-40 according to wiring diagram (ensure constant voltage supply across terminal 25).
Restart system.

Fehler: The electronic circuit board of the level switch is defective.
Abhilfe: Replace level switch. Restart system.

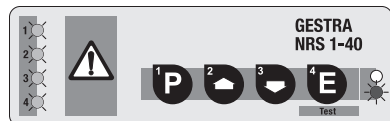
Fault: Temperature in control cabinet too high (> 60 °C).
Remedy: Make sure there is sufficient spacing between the equipment installed in the control cabinet (20 mm to both sides).
Remedy: Improve the ventilation of the control cabinet.

Fault: The electronic circuit board of the level switch is defective.
Remedy: Replace level switch. Restart system.

Error message 5

LEDs 1 to 4 are flashing rapidly.

A general malfunction in the communication has been detected.

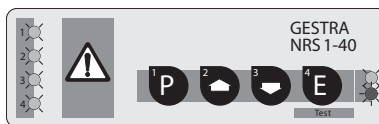


Fault: No communication between bus devices possible.
Remedy: Check wiring, node ID, baud rate setting, bus cable and terminating resistor.
Cut off power supply and re-start system after 5 sec.

System Malfunctions – continued –

Error message 6

LEDs 1 to 4 are flashing slowly and/or LED “Bus status” is flashing slowly.



Fault: Data transfer between switching controller and electrode interrupted.
Remedy: The bus cables have to be connected correctly according to the wiring diagram (observe polarity!).
Make sure that all end-of-line nodes are provided with 120 Ω terminating resistors. Cut off power supply and re-start system after 5 sec.

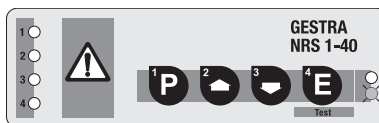
Fault: The baud rate of one or more nodes is not set correctly.
Remedy: Check baud rate settings of all bus nodes. The baud rates must be identical.
Cut off power supply and re-start system after 5 sec.

Fault: The overall length of the bus cable does not correspond to the selected baud rate.
Remedy: Change baud rate settings of all nodes accordingly.
Cut off power supply and re-start system after 5 sec.

Fault: The electronic circuit board of the equipment is defective.
Remedy: Replace the equipment. Restart the system.

Error message 7

LED “Power” is flashing slowly.



Fault: The power supply unit (PSU) is overloaded. The power supply unit may be misused for other components.

Remedy: Check load of power supply unit. Be sure to use the PSU only for the voltage supply of bus-based network components.
Cut off power supply and restart the system after 5 sec.

Fault: Power supply unit defective.
Remedy: Replace power supply unit.

Decommissioning



Danger

The terminal strip of the equipment is live during operation. This presents the danger of electric shock. Cut off power supply before mounting or removing the terminal strip and the housing cover.

Disposal

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

For your notes

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Agencies all over the world: www.gestra.de

GESTRA AG

Münchener Straße 77

28215 Bremen

Germany

Telefon +49 421 3503-0

Telefax +49 421 3503-393

E-mail info@de.gestra.com

Web www.gestra.de