NRS 1-41

GB

Installation Instructions 810830-00

Level Switch NRS 1-41

spectorbus CANopen

FLOWSERVE

Flow Control Division

Contents

Wiring Diagram

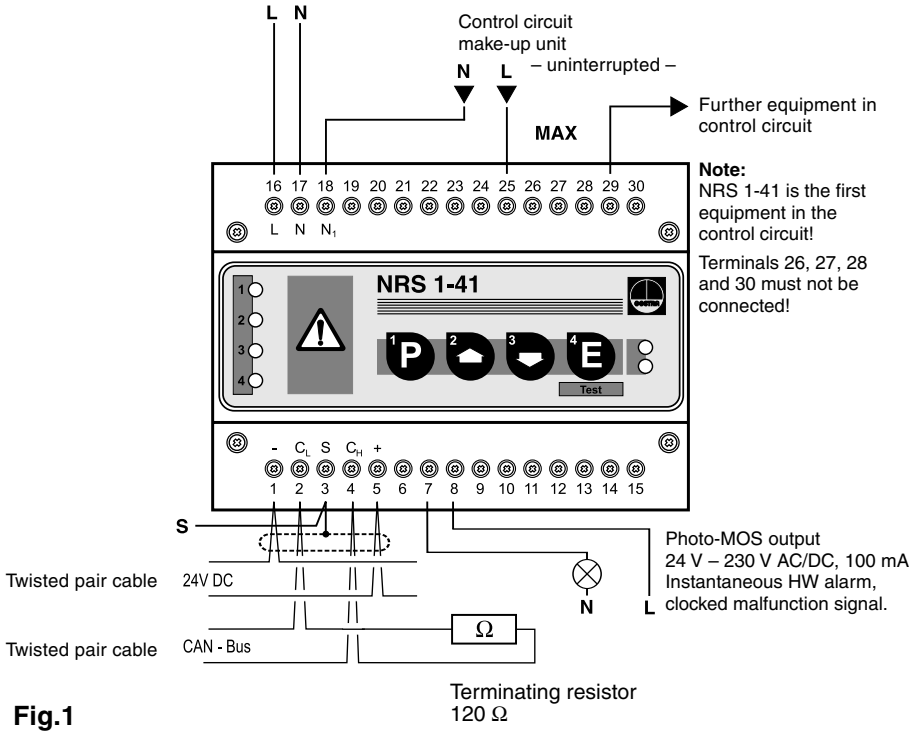


Fig.1

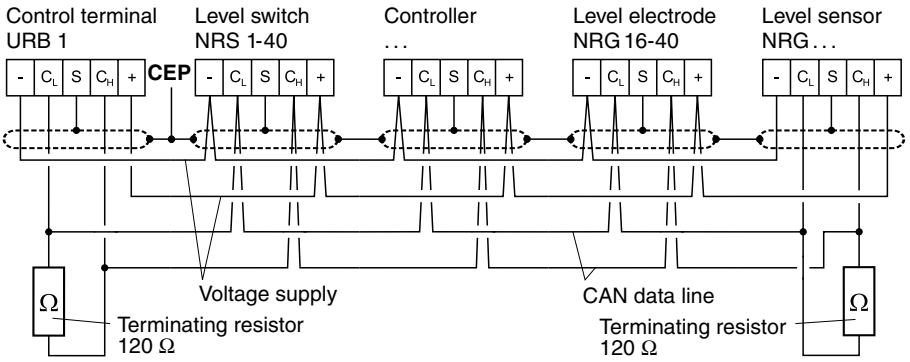


Fig. 2

Parts Drawings

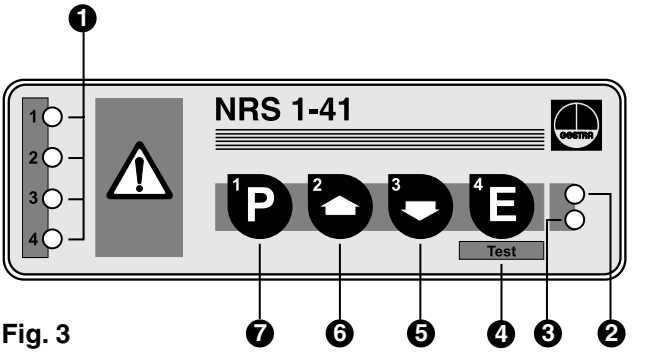


Fig. 3

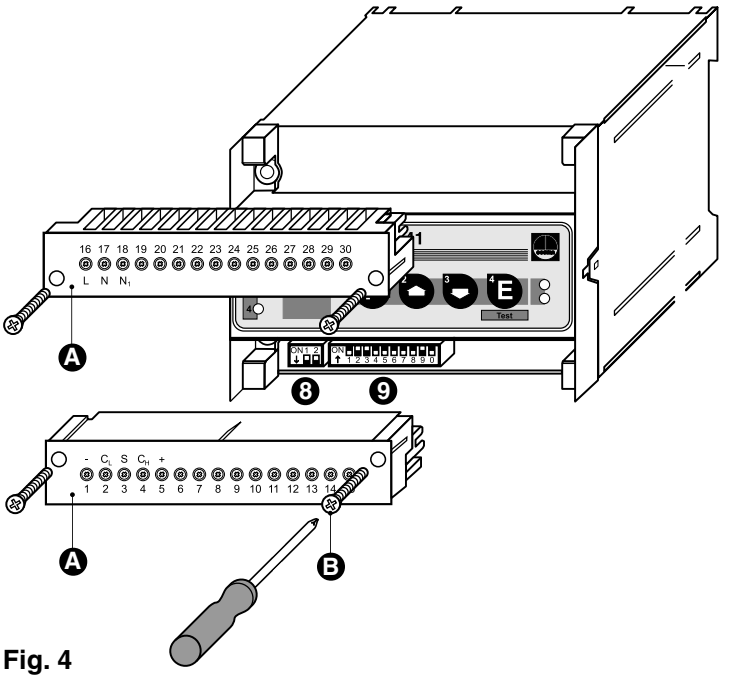


Fig. 4

Key

❶ Indicator LED	**Alarm**	**Malfunction**
LED 1 Electrode 1	High-level alarm	Multifunction
LED 2 Electrode 1	High-level alarm	Multifunction

❷ LED “Bus status”

❸ LED “Power”

❹ Enter / Test mode

❺ Decrease

❻ Increase

❼ Program key

❽ Two-pole code switch **Note: Do not change factory setting!**

❾ Ten-pole code switch

Ⓐ Terminal strip

Ⓑ Screws for terminal strip

Important Notes

Usage for the intended purpose

Use level switch NRS 1-41 only in conjunction with GESTRA level electrode NRG 16-41, NRG 17-41 or NRG 19-41 for signalling high water level (max. alarm).

Safety Note

Installation must only be performed by qualified staff.

Qualified staff are those persons who – through adequate training in electrical engineering, the use and application of safety equipment in accordance with regulations concerning electrical safety systems, and first aid & accident prevention – have achieved a recognised level of competence appropriate to the installation and commissioning of this safety device.

Danger

The terminal strip of the NRS 1-41 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting or removing the terminal strips and housing lid.

Explanatory Notes

Scope of supply

NRS 1-41

1 Level switch NRS 1-41 (plug-in unit in plastic case with terminals)
1 Terminating resistor 120 Ω
1 Installation manual

Explanatory Notes – continued –

Description

The switching controller type NRS 1-41 is a self-monitoring high-water level limiter with periodic self-checking and monitoring feature of the output relay contacts designed to be used in conjunction with **one** level electrode type NRG 16-41, 17-41 or 19-41. The switching controller has the following function:

- High-water level alarm with **one** level electrode

The equipment detects the max. water level (high-level limiter) and complies with the German regulations for use in steam and hot-water plants operating without constant supervision according to TRD 604, sheets 1 and 2 (72 hrs operation).

This item of electrical equipment complies with the Technical Regulations on Protection Circuits DIN VDE 0116 (prEN 50156).

The level data are transferred from the electrode NRG 1…-41 to the switching controller via CAN bus using the CANopen protocol. Only **one** high-level limiting system may be used per CAN-based network.

Function

At regular intervals the level electrode NRG 1…-41 sends a data telegram to the switching controller NRS 1-41. 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 switching controller resulting in immediate boiler shutdown. 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 switching controller also facilitates user-friendly performance tests and detection/evaluation of malfunctions.

To guarantee the correct and safe functioning of the high-level limiter a min. electrical conductivity of 0.5 μS/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 Photo-MOS make contact output for remote indication.

The automatic self-testing routine of the switching controllers checks every 3 seconds their safety functions. The corresponding functions of the level electrodes will be tested by the electrode's self-checking routine every 10 sec.

The malfunction information is updated with every self-test. If no faults have occurred the malfunction information will be deleted automatically. If faults persist the malfunction information remains stored.

As part of the automatic self-testing routine of the switchting controller, the switching-off of the output relays every 6 hrs is checked, too. If a fault is detected, the information on this malfunction will be saved accordingly.

Explanatory Notes – continued –

Technical Data

Type approval no.
TÜV · WB · 99-403
EG BAF-MUC 0202 103881 002
Input/Output
Interface for CAN bus to DIN ISO 11898 CANopen protocol
Output voltage supply for electrode
18 – 36, short-circuit protected
Output for control circuit
Power supply of level electrode: 24 V DC, short-circuit protected
Two volt-free relay contacts, locally connected in series.
Max. contact rating for switchting voltages 24 V AC/DC, 115 V AC and 230 V AC:
4 A resistive/inductive. Contact material: hard-gold plated
Interference suppression
Provide contactor with external RC combination (100 Ω / 47 nF)
Signal output
Photo-MOS output, instantaneous with high level, timed 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 “High-level alarm”, set to 3 sec. (standard);
optional (for e. g. marine applications): 15 sec. or 25 sec.
Indicators and adjustors
4 pushbuttons “Parameterisation/TEST”
1 red LED for “High-level alarm electrode 1”
3 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, without function. **Do not change factory setting!**
Internal self-checking routine
Every 3 seconds
Periodic testing of output relay contacts
Every 6 hours
Mains voltage
230 V +/– 10 %, 50/60 Hz, 115 V +/– 10 %, 50/60 Hz (optional)
Power consumption
10 VA
Sensitivity
≥ 0.5 µS/cm at 25 °C
Protection
Enclosure: IP 40 to DIN EN 60529
Terminal strip: IP 2o 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

Installation

NRS 1-41

Installation on mounting rail

1. Clip switching controller onto mounting rail 35 x 15 mm (DIN EN 50022).
2. Align switching controller, **Fig. 9, Fig. 10**

Note

- If an external measuring pot is used, each level electrode type NRG 1…-41 requires **one** switching controller type NRS 1-41 and **one** GESTRA monitoring unit SRL 6.

Tool

- Screwdriver (5.5/100)

Wiring

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

The baud rate (data transfer rate) dictates the cable length between the bus nodes and the total power consumption 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 rate if cable is longer than specified in the table above. Make sure that all bus nodes feature 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).

When a max. cable length of more than 125 m (up to 1000 m) is desired, make sure to modify the baud rate accordingly. Refer to pages 23 and 24 for more details.

Wiring Diagram

Wiring diagram see page 3.

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).
- To protect the switching contacts fuse circuit with 2.5 A (slow blow fuse) 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. 2**.
- 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.

  Any interruption will open the control circuit!

  If the switching controller has to be replaced be sure to remove first the terminal strips Ⓐ, **Fig. 4**

  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. Inductive loads should therefore be provided with commercial arc suppressor RC combinations, e. g. 0.1 µF / 100 Ω.
- Despite correct wiring H. F. interference caused by the installation may lead to system breakdowns and malfunction messages. If necessary refer to the “Fault finding list for troubleshooting” on page 21.
- In the event of a shut-down due to a malfunction the signal output (terminals 7 and 8) is cyclically openend and closed in order to ensure an optical distinction between “High level” (signal output closed) and “Malfunction shut-down”. If necessary conncect terminals 7 and 8 externally to an indicator lamp, **Fig. 1.**

Wiring – continued –

Tool

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

Basic Adjustments

CAN Bus

All level and conductivity controllers and associated electrodes are interconnected by means of a CAN bus using 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 NRS 1-41 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 pages 22 and 23 for more details.

Node ID

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

Reserved area

Factory setting

The switching controller features the following factory set default values:

- Baud rate: **250 kb/s**
- Sensitivity: **0,5 µS/cm**
- Node ID: **006**
- Relay de-energizing delay: **3 s**

Commissioning

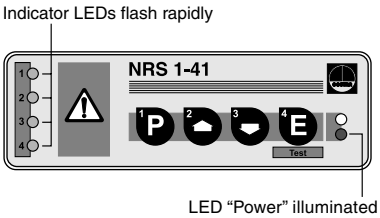
NRS 1-41

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 “System Malfunctions” on page 14.

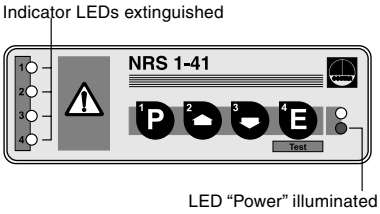
Operation

NRS 1-41

Normal operation, electrode submerged.

The four indicator LEDs are not illuminated.

The LED “Power” lights up.



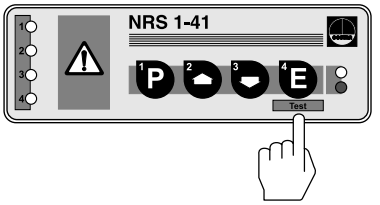
Test Cycle

NRS 1-41

Press button E briefly.

The test mode is activated for about 10 sec. Be sure to press button 2 or 3 within these 10 sec.

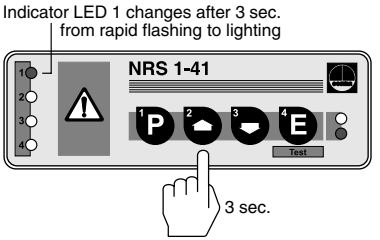
Note: The control circuit of the make up unit will be interrupted during the test cycle.



Press button 2 for 3 sec.

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

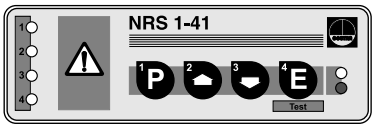
A high-level alarm is simulated for the level electrode.



Alarm

There is one alarm condition:

- **High-level alarm**
  (**one** level electrode)



High-water level alarm

LED 1 flashes rapidly.

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

Note

- The switching controller does not have its own lock-out circuit. Lock-out and manual reset facilites are to be provided externally.
- The signal output (terminal 7 and 8) is instantaneously energized (no delay of response) in the event of an alarm.

System Malfunctions

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.

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 1-41

The malfunction information is updated with every self-test (switching controller: every 3 sec., level electrode: every 10 sec.) If no faults have occurred the malfunction information will be deleted automatically. If faults persist the malfunction information remains stored.

As part of the automatic self-testing routine of the switching controller, the switching off of the output relays every 6 hrs is checked, too. If a fault is detected the signal output (terminals 7 and 8) will be opened and closed as a function of time.

Danger

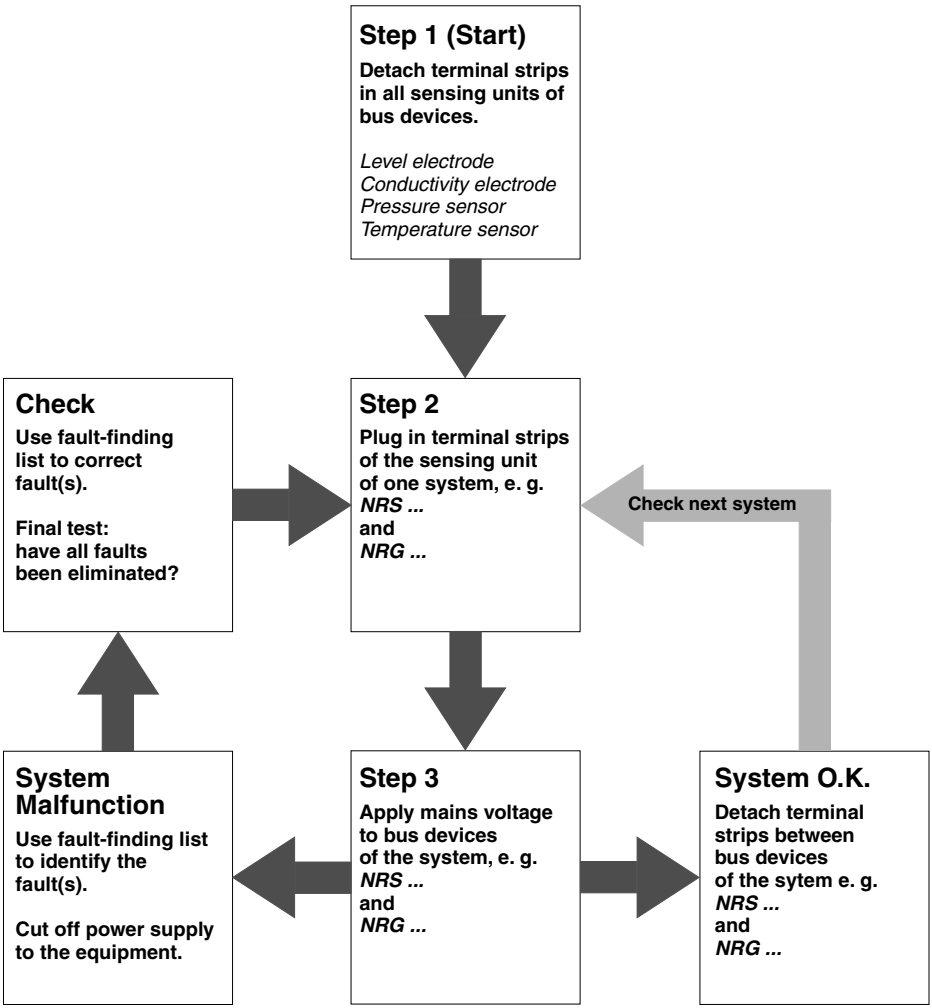
The terminal strip of the NRS 1-41 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting or removing the equipment.

System Malfunctions – continued –

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 –

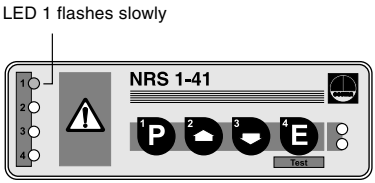
Danger

The terminal strip of the NRS 1-41 is live during operation. This presents the danger of electric shock. Cut off power supply before mounting and removing the equipment.

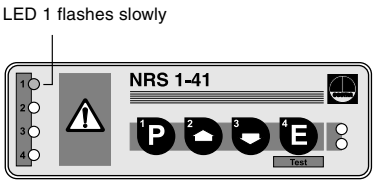
System Malfunction 1

LED 1 flashes slowly.

A system malfunction in the level electrode was detected.

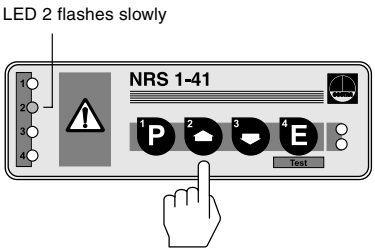


Hold down button 2.
LED 1 flashes slowly.



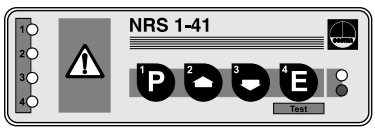
Fault: The max. admissible temperature in the terminal box of the electrode NRG 1…-41 has been exceeded.
Remedy: Insulate electrode flange against heat radiation.

Hold down button 2.
LED 2 flashes slowly.



Fault: The electronic circuit board of the level electrode NRG 1…-41 is defective.
Remedy: Replace electronic circuit board of the level electrode.

The system will continue to work once the causes of the system malfunction are completely eliminated.

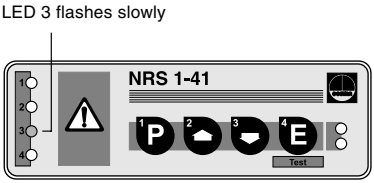


System Malfunctions – continued –

System Malfunction 2

LED 3 flashes slowly.

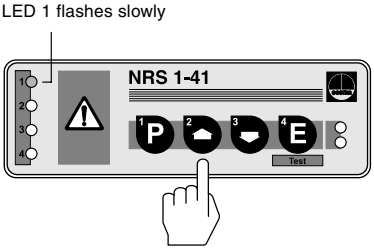
A communication malfunction in the bus line was detected.



Hold down button 2.

LED 1 flashes slowly.

A communication malfunction in the bus line between **level switch** and **level electrode** was detected.



Fault: The data transfer between level switch and electrode is interrupted.
Remedy: Make sure that the bus lines are all 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 restart 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. Please refer to section “Annex”.
Cut off power supply and restart 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 as described under “Annex”.
Cut off power supply and restart system after 5 sec.

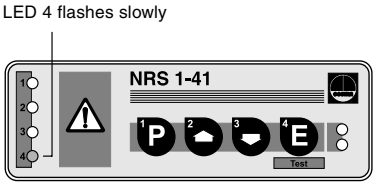
Fault: In spite of correct wiring and commissioning of the equipment an interference signal is indicated.
Remedy: The interference signal is caused by H. F. interferences coming from the installation. For interference suppression of the voltage supply we supply ferrite rings, stock code 147253. The 230 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 –

System Malfunction 3

LED 4 flashes slowly.

A malfunction in the level switch has been detected.



Fault: The electronic circuit board of the level switch is defective (e. g. output relay).
Remedy: Replace level switch. Restart system.

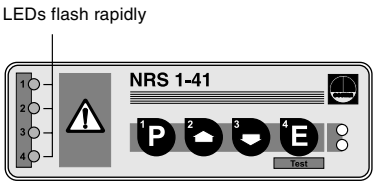
Fault: No voltage across terminal 25, self-checking routine unsuccessful.
Remedy: Wire NRS 1-41 as first device in the safety chain. Wire NRS 1-41 according to wiring diagram (ensure constant voltage supply across terminal 25). Restart system.

Fault: Voltage across terminal 26 and/or 30.
Remedy: Do not connect these terminals.

System Malfunction 4

LEDs 1 to 4 flash rapidly.

A general communication malfunction has been detected.

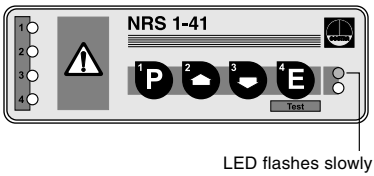


Fault: No communication between bus devices possible.
Remedy: Check wiring, node ID, baud rate setting and bus cable. Cut off power supply and restart system after 5 sec.

System Malfunctions – continued –

System Malfunction 5

LED "Bus status" flashes slowly.



Fault: Data transfer in CAN bus interrupted.
Remedy: The bus cables have to be correctly connected 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 restart system after 5 sec.

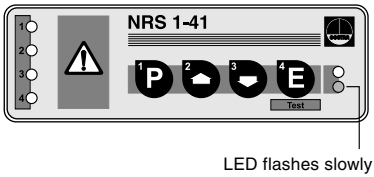
Fault: The baud rate of one or more nodes is not set correctly.
Remedy: Check baud rate settings of all bus nodes. The baud rates **must be identical**. Refer to section "Annex" for more details.
Cut off power supply and restart system after 5 sec.

Fault: The overall length of the bus cable does not correspond to the selected baud rate.
Remedy: Change baud rate settings of all nodes according to "Annex".
Cut off power supply and restart system after 5 sec.

System Malfunctions – continued –

System Malfunction 6

LED “Power” flashes slowly



Fault: The power supply unit (PSU) is overloaded. The PSU may be misused for other components.
Remedy: Check load of PSU. Be sure to use the PSU only for the voltage supply of bus-based network components.
Cut off power supply and restart system after 5 sec.

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

Operation Malfunctions

Danger

The terminal strip of the NRS 1-41 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting and removing the equipment.

Fault finding list for troubleshooting

Equipment does not work – Malfunction message

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.

High-water level switchpoint exceeded – No function

Fault: LED “Power” does not light up.
Remedy: Apply power. Connect the equipment properly according to wiring diagram.

High-water level switchpoint not reached – High level alarm

Fault: High-level alarm is given although the electrode is exposed.
Remedy: The electrode rod is too long! Cut electrode rod according to switchpoint.

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 27x32 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.

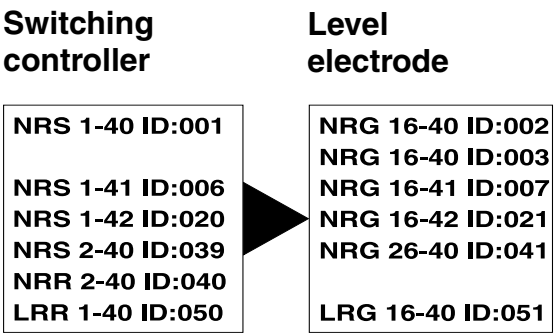
If faults occur that are not listed above or cannot be corrected, please contact our service centre or authorized agency in your country.

Annex

Danger

The terminal strip of the NRS 1-41 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting and removing the equipment.

Factory set default node IDs



The individual node IDs must be manually adjusted on the equipment.
Please observe the installation instructions of the device in question.

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).

Detach terminal strips Ⓐ in order to change the code switch setting ❾.

Attention

- Do **not** assign the same node ID twice within the CAN bus network.
- Do **not** change the settings of the code switch ❽.

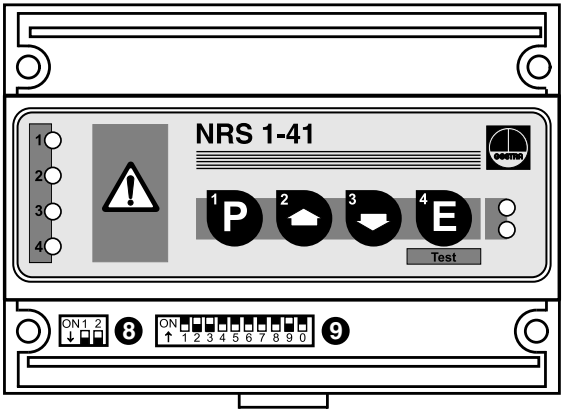


Fig. 5

❾

		Node ID	6
S1	OFF	1	
S2	***ON***	2	
S3	***ON***	4	
S4	OFF	8	
S5	OFF	16	
S6	OFF	32	
S7	OFF	64	

Fig. 6 (Factory setting)

❾

		Node ID	12
S1	OFF	1	
S2	OFF	2	
S3	***ON***	4	
S4	***ON***	8	
S5	OFF	16	
S6	OFF	32	
S7	OFF	64	

Fig. 7 (Example)

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. 8 (Factory setting 250 kBit/s)

For your notes

Annex – continued –

Declaration of conformity CE

We hereby declare that the equipment **NRS 1-41** conforms to the following European guidelines:

- LV guideline 73/23/eec version 93/68eec
- EMC guideline 89/336/eec version 93/68/eec

which are based on the following harmonised standards:

- LV standard DIN EN 50178
- EMC standard DIN EN 50 081-2, DIN EN 61000-6-2

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

Bremen, 27th October 2000
GESTRA GmbH

i. V. U. Bledschun

Head of the Design Dept.
Uwe Bledschun
(Academically qualified engineer)

i. V.

Quality Assurance Manager
Lars Bohl
(Academically qualified engineer)

Key

Ⓐ Terminal strips

Ⓒ Mounting rail 35 x 15 to DIN EN 50022

Example of Installation

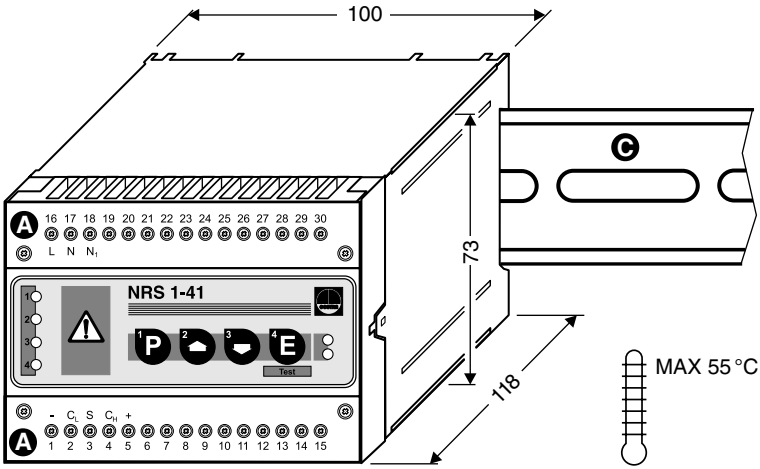


Fig. 9

MAX 95 %

IP 20

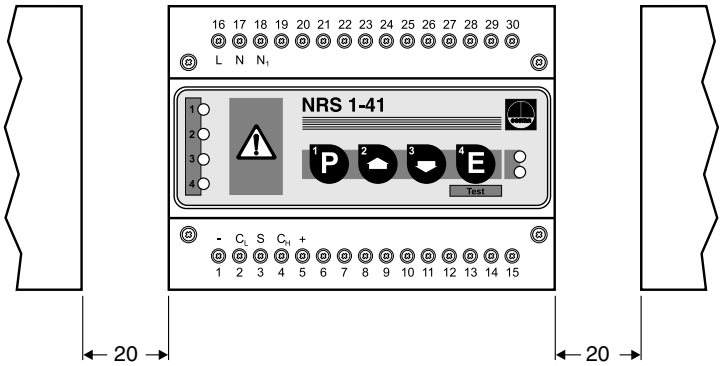


Fig. 10

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