NRS 2-40

GB

Installation Instructions 810371-02

Level Switch Type NRS 2-40

spectorbus CANopen

FLOWSERVE

Flow Control Division

Contents

Wiring Diagram

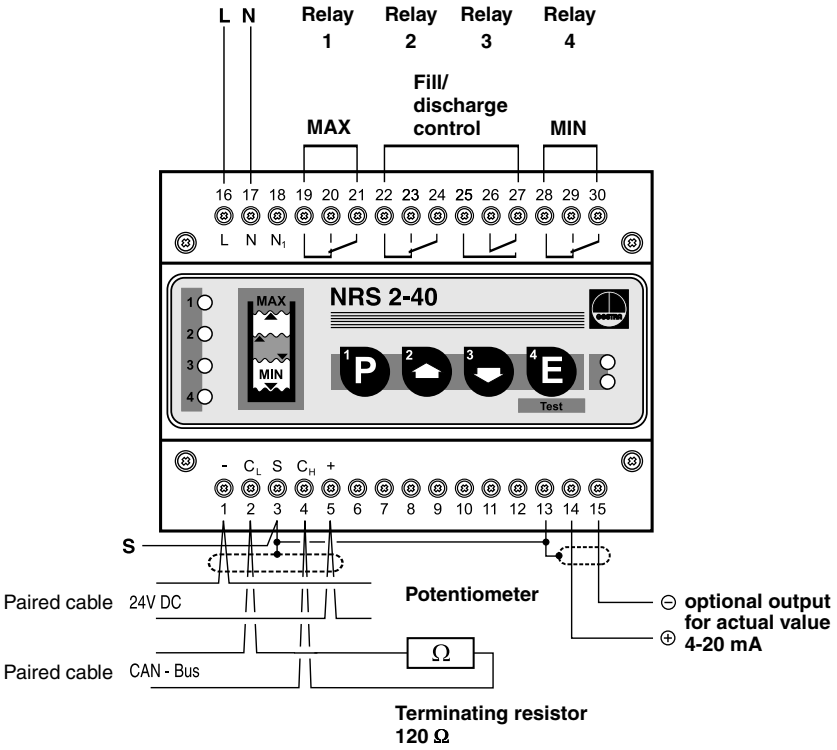
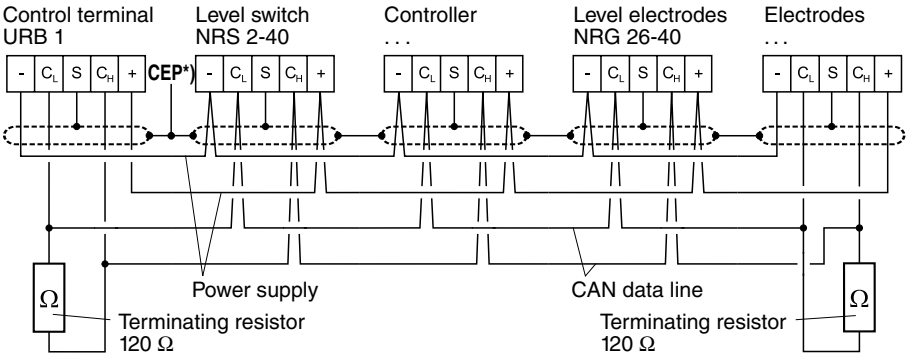


Fig. 1



*) CEP = central earthing point

Fig. 2

Wiring Diagram

Discharge control –
Pump OFF at low level (MIN)

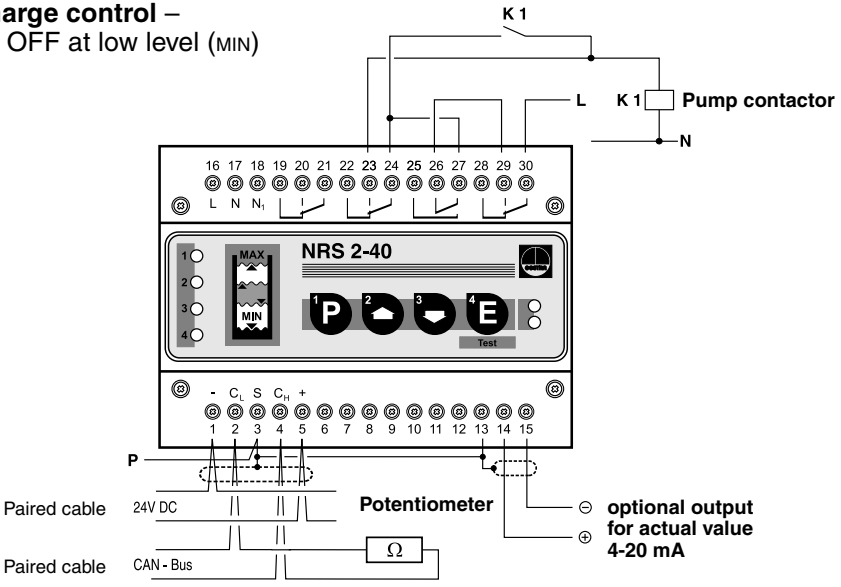


Fig. 3

Fill control – Pump OFF at high level (MAX)

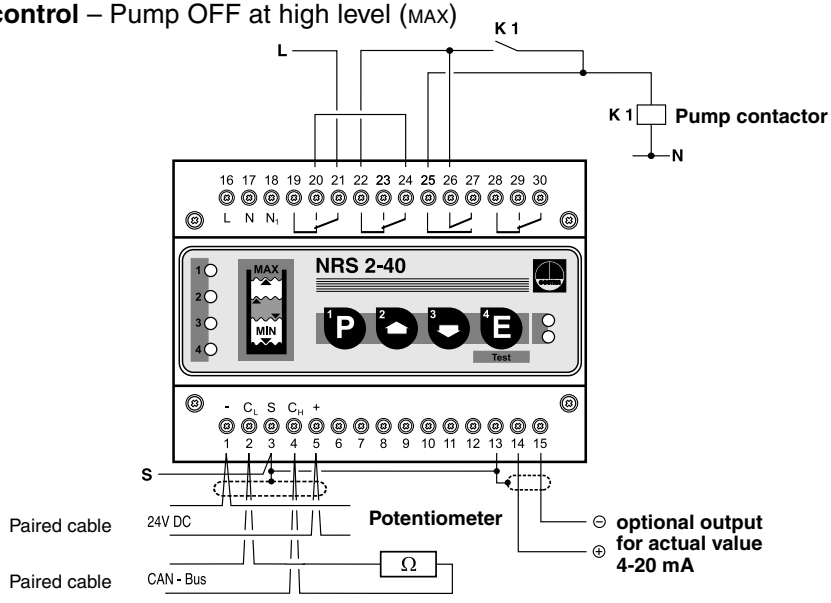


Fig. 4

Parts Drawing

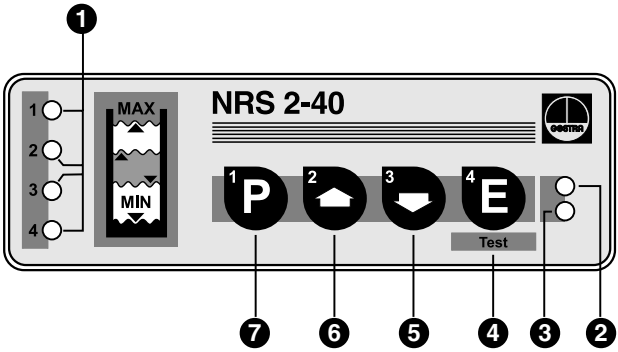


Fig. 5

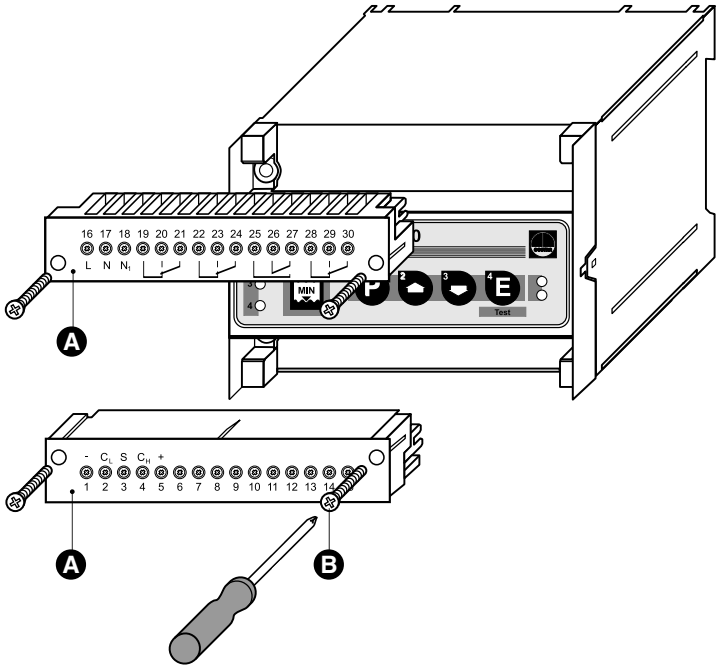


Fig. 6

Key

		Discharge control	**Fill control**
❶	Indicator LEDs		
	LED 1 – switchpoint 1	High-level alarm	High-level alarm
	LED 2 – switchpoint 2	Pump ON	Pump OFF
	LED 3 – switchpoint 3	PUMP OFF	Pump ON
	LED 4 – switchpoint 4	Low-level alarm	Low-level alarm

❷ LED “Bus status”

❸ LED “Power”

❹ Enter button / test mode

❺ Decrease button

❻ Increase button

❼ Program button

❽ Code switch, 10 poles

Ⓐ Terminal strip

Ⓑ Screws for terminal strip

Important Notes

Usage for the intended purpose

Use level switch NRS 2-40 in conjunction with level electrode NRG 26-40 only for liquid level monitoring and control.

Safety notes

The equipment must only be installed 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 device.

Danger

The terminal strip of the NRS 2-40 is live during operation.
This presents the danger of electric shock.
Cut off power supply before fixing or removing the cover.

Explanatory Notes

Scope of supply

NRS 2-40

1 Level switch type NRS 2-40 (plug-in unit in plastic case with box terminals)
1 Terminating resistor 120 Ω
1 Operating manual

Description

Use level switch type NRS 2-40 in combination with level electrode type NRG 26-40 for level monitoring. The level switch has the following functions:

- Four liquid levels with one switchpoint each.
- High-level alarm, low-level alarm, pump ON, pump OFF, with one switchpoint each.
- Continuous level monitoring within control band defined by two preset limits.
- Actual-value output 4-20 mA (optional)
- Contact multiplication by connecting in parallel a second level switch NRS 2-40 without optional actual value output.

The level data are transmitted via CAN-bus from the electrode NRG 26-40 to the level switch.

Function

At regular intervals the level electrode type NRG 26-40 sends a data telegram to the level switch NRS 2-40. The data transfer is effected by means of a CAN bus according to DIN ISO 11898. The transferred measuring data are then evaluated and assigned to the manually adjusted switchpoints. To guarantee the correct functioning and safety of the system the data transmitting cycle is constantly monitored by the level switch. When the CAN bus line is interrupted the level switch sends a visual signal to indicate a malfunction and the relays 1 and 4 will be instantaneously de-energized (alarm position).

Additional functions, e.g. (de)-energizing delay times of the output relays (1 to 25 sec.) can be adjusted with the control terminal and display unit URB 1.

Technical data

Type approval no.
NRS 2-40: TÜV · WR · 98-399

Input / Output
Interface for CAN bus to DIN ISO 11898 using CANopen

Output – voltage supply for electrodes
Power supply 24 V DC, short-circuit protected
Analogue output 4 – 20 mA, load 500 Ω for display of actual value (optional).
4 volt-free relay contacts.
Max. contact rating with switching voltages of 24 V AC,
115 V AC and 230 V AC: 4 A resistive, 0.75 A inductive at cos φ 0.5
Max. contact rating with a switching voltage of 24 V DC: 4 A.
Contact material: silver, hard-gold plated

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

Relay de-energizing delay
Output “MIN”, “MAX” 3 s

Indicators and adjustors
1 red LED for switchpoint “High level” (MAX)
1 red LED for switchpoint “Low level” (MIN)
2 green LEDs for switchpoints “PUMP ON” and “PUM OFF”
1 green LED “Power”
1 red LED “Bus fault”
1 ten-pole code switch for node ID and baud rate settings
4 pushbuttons

Supply voltage
230 V ± 10 %, 50/60 Hz
115 V ± 10 %, 50/60 Hz (option)

Power consumption
10 VA

Protection
Case: IP 40 to DIN ISO 60529
Terminal strip: IP 20 to DIN ISO 60529

Admissible ambient temperature
0 °C to 55 °C

Enclosure material
Front panel: polycarbonate, grey
Case: polycarbonate, black

Weight
Approx. 0.8 kg

Installation

NRS 2-40

Installation on mounting rail

1. Clip level switch onto mounting rail 35 x 15 mm (DIN EN 50022).
2. Align level switch, **fig. 14, fig. 15**

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 ... ^{2} or RE-2YCYV-fl 2 x 2 x ... ^{2}.

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

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

When a max. cable length of 1000 m is desired, make sure to modify the baud rate accordingly. Refer to page 27 and 28 for more details.

Wiring diagram

See wiring diagrams on pages 3 and 4.

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).
- To protect the switching contacts fuse circuit with T 2.5 A or according to TRD regulations (1.0 A for 72 hrs.).
- If two or more system components are connected in a CAN bus network, the first and last equipment have to be provided with a terminating resistor of 120 Ω. **Fig. 2**
- The CAN bus network must **not** be interrupted while operating.

  Any interruption will result in HIGH/LOW level alarm!

  If the level controller must be replaced, remove terminal strip Ⓐ **Fig. 6**.

  Before removing the CAN-bus line from the terminal strip disconnect all relevant system components.

Note

- Connect screen only to designated terminals.
- 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.
- In spite of 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 pages 25 and 26.

Tool

- Screwdriver for 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 2-40 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. Refer to pages 27 and 28 for more details.

Node ID

Reserved	NRS 2-40(1)	NRS 2-40(2)	NRG 26-40	Reserved	
X - 2	X - 1	X	X + 1	X + 2	
	39	40	41		Factory Setting

Reserved area

First and second control equipment

It is possible to operate the level switch NRS 2-40 together with a **second** level switch NRS 2-40 when **8 instead of only 4 switchpoints** are required.
The second level switch is termed **"second control equipment"** and must be ordered separately.

The NRS 2-40 can also be operated together with the **level controller NRR 2-40** as **"second control equipment".**

The standard equipment NRS 2-40 is termed **"first control equipment 1".**

Be sure to assign different node IDs for NRS 2-40 (first control equipment), additional NRS 2-40 (second control equipment) and NRR 2-40 (controller)!
The name plate of the NRS 2-40 is marked "Control equipment 1" or "Control equipment 2".

Basic Adjustments – continued –

Factory setting

The level switch features the following factory set default values:

- Baud rate: **250 kb/s**
- Control equipment: **1**
- Node ID: **039**
- Control equipment: **2**
- Node ID: **040**
- Switchpoint 1: **80 %**
- Switchpoint 2: **60 %**
- Switchpoint 3: **40 %**
- Switchpoint 4: **20 %**
- Relay with energizing delay switchpoint 1: **1s**
- Relay with energizing delay switchpoint 2: **1s**
- Relay with energizing delay switchpoint 3: **1s**
- Relay with energizing delay switchpoint 4: **1s**
- Relay with de-energizing delay switchpoint 1: **3s**
- Relay with de-energizing delay switchpoint 2: **1s**
- Relay with de-energizing delay switchpoint 3: **1s**
- Relay with de-energizing delay switchpoint 4: **3s**

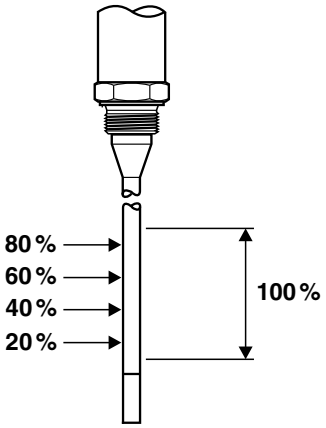


Fig. 7

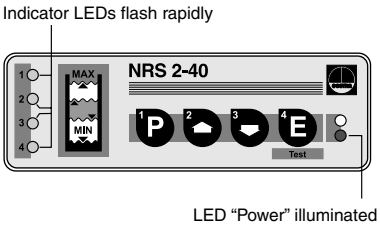
Commissioning

NRS 2-40

Apply power to the unit.

The four indicator LEDs flash rapidly.
The LED “Power” lights up.

The system test cycle takes about 2 sec.



Control Range

❶ Desired control range [mm]

❷ Max. control range

Establish the control range ❶ for your level monitoring application.

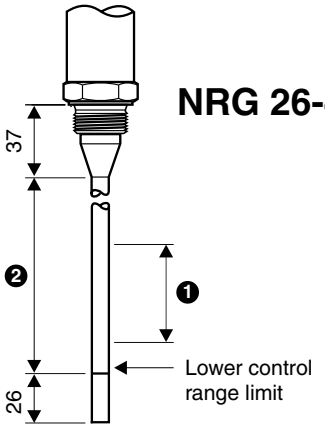


Fig. 8

Commissioning – continued –

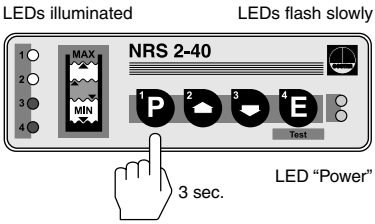
Establish control range

Press button P for 3 sec.

Lower the liquid level in the vessel until the lower limit of the control range ❶ is reached.

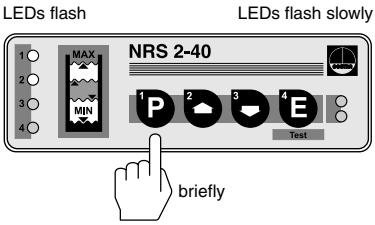
Use button ▲ if you want to establish the upper limit of the desired control range first.

If two control devices are used only one has to be adjusted.



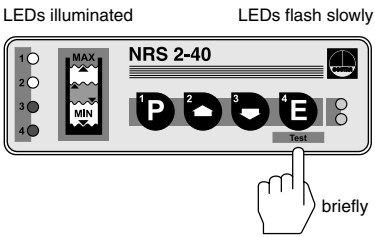
Press button P briefly.

Note:
In the event of a system malfunction, the LED(s) “Bus status” and/or “Power” will be flashing **rapidly** when in program mode. Quit program mode and analyse the system malfunction (see pages 22 – 24).



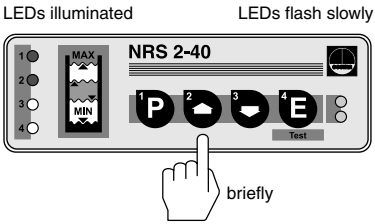
Press button E briefly.

The lower limit of the control range is now saved.

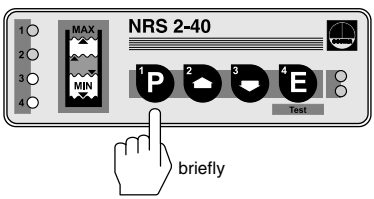


Press button ▲ briefly.

Raise liquid level until the upper limit of the desired control range ❶ is reached.



Press button P briefly.



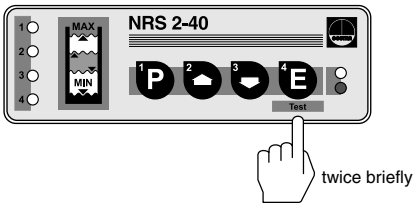
Commissioning – continued –

Establish control range – continued –

Press button E twice briefly.

The upper limit of the desired control range is now saved.

The NRS 2-40 is back in operating mode.



Establish switchpoints within the adjusted control range

❶ Switchpoint 1
❷ Switchpoint 2
❸ Switchpoint 3
❹ Switchpoint 4
❺ Adjusted control range

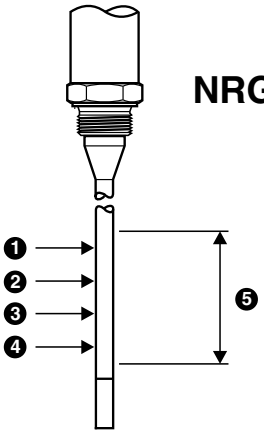


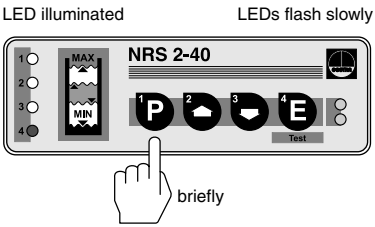
Fig. 9

Establish switchpoints

Press button P briefly.

Raise or lower the liquid level in the vessel until the desired value is reached.

Use button ▼ if you want to establish a different switchpoint first.



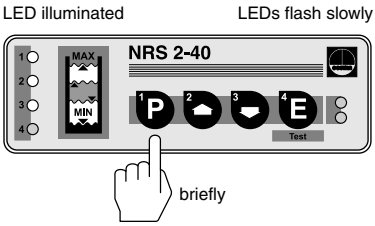
Commissioning – continued –

Establish control range – continued –

Press button P briefly.

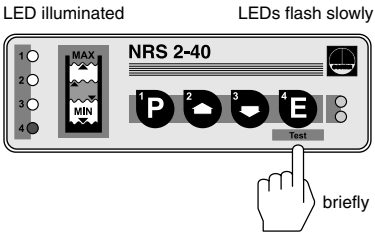
Lower or raise liquid level until switchpoint 4 within the adjusted control range is reached.

Note:
In the event of a system malfunction the LED(s) "Bus status" and/or "Power" will be flashing **rapidly**.



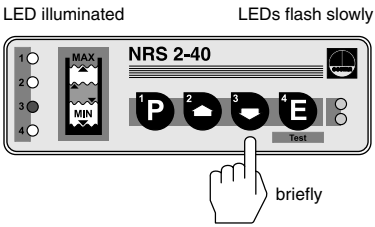
Press button E briefly.

Switchpoint 4 is now saved.



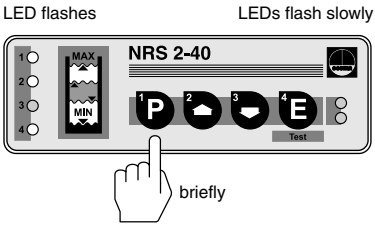
Press button ▼ briefly.

Switchpoint 3 is now active.



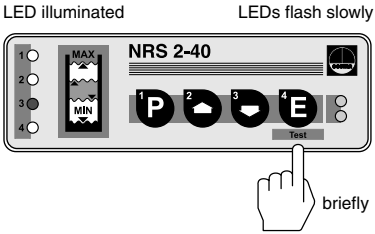
Press button P briefly.

Raise liquid level until switchpoint 3 within the adjusted control range is reached.



Press button E briefly.

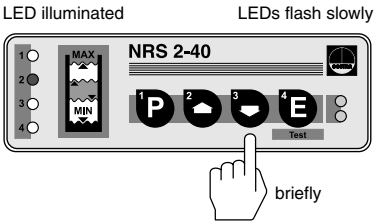
Switchpoint 3 is now saved.



Establish control range – continued –

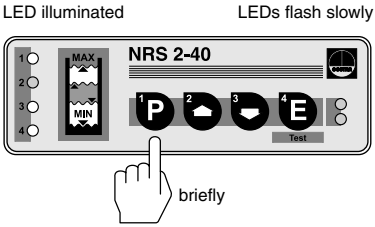
Press button ▼ briefly.

Switchpoint 2 is now active.



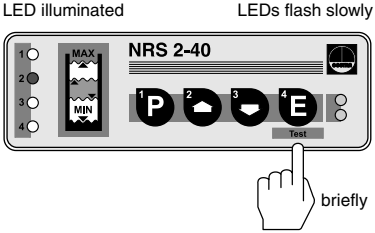
Press button P briefly.

Raise liquid level until switchpoint 2 within the adjusted control range is reached.



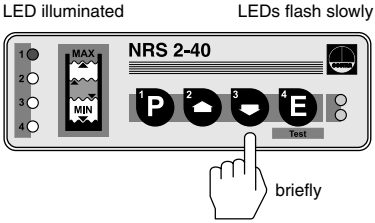
Press button E briefly.

Switchpoint 2 is saved.



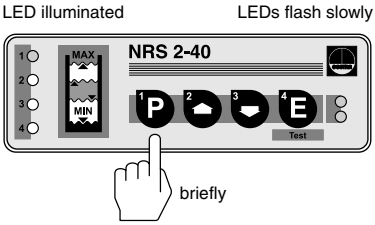
Press button ▼ briefly.

Switchpoint 1 is now active.



Press button P briefly.

Raise liquid level until switchpoint 1 within the adjusted control range is reached.



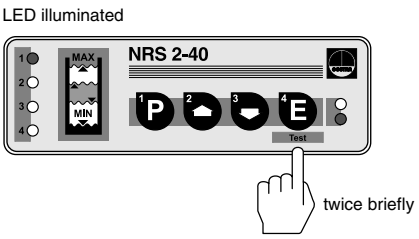
Commissioning – continued –

Establish control range – continued –

Press button E twice briefly.

Switchpoint 1 is saved.

The NRS 2-40 is again in operating mode.



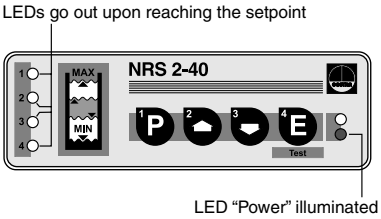
Operation

Normal operation

Normal operation – switching controller is working.

All LEDs go out as soon as the setpoint is reached.

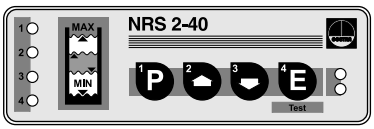
The LED “Power” is illuminated.



Alarm

There are two alarm conditions:

- **High-level alarm**
- **Low-level alarm**

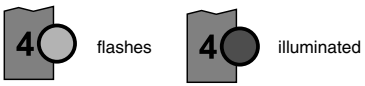


High-level alarm

LED 1 changes after the de-energizing delay from rapid flashing to lighting.

Low-level alarm

LED 4 changes after the de-energizing delay from rapid flashing to lighting.

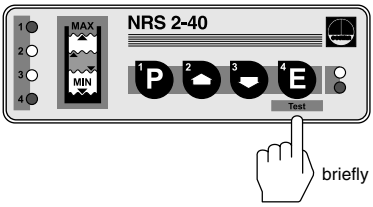


Relay test high/low level alarm (MIN/MAX)

Press button E briefly.

The test mode is active for 5 seconds.

LEDs illuminated

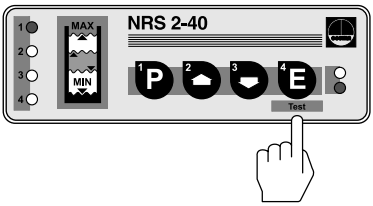


Hold down button E.

LED 4 goes out.

A low-level alarm is simulated for switchpoint 4.

LED 4 goes out

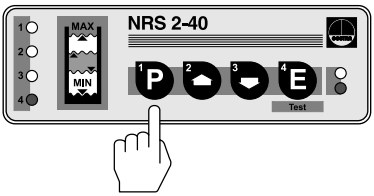


Hold down button P.

LED 1 goes out.

A high-level alarm is simulated for switchpoint 1.

LED 1 goes out



System Malfunctions

There are four types of system malfunctions that might occur in the level electrode and the level switch:

- Max. admissible temperature in electrode terminal box exceeded
- No or faulty communication between switching controller and electrode
- Fault in CAN bus
- Failure of 24 V power supply unit built in level controller NRS 2-40

Danger

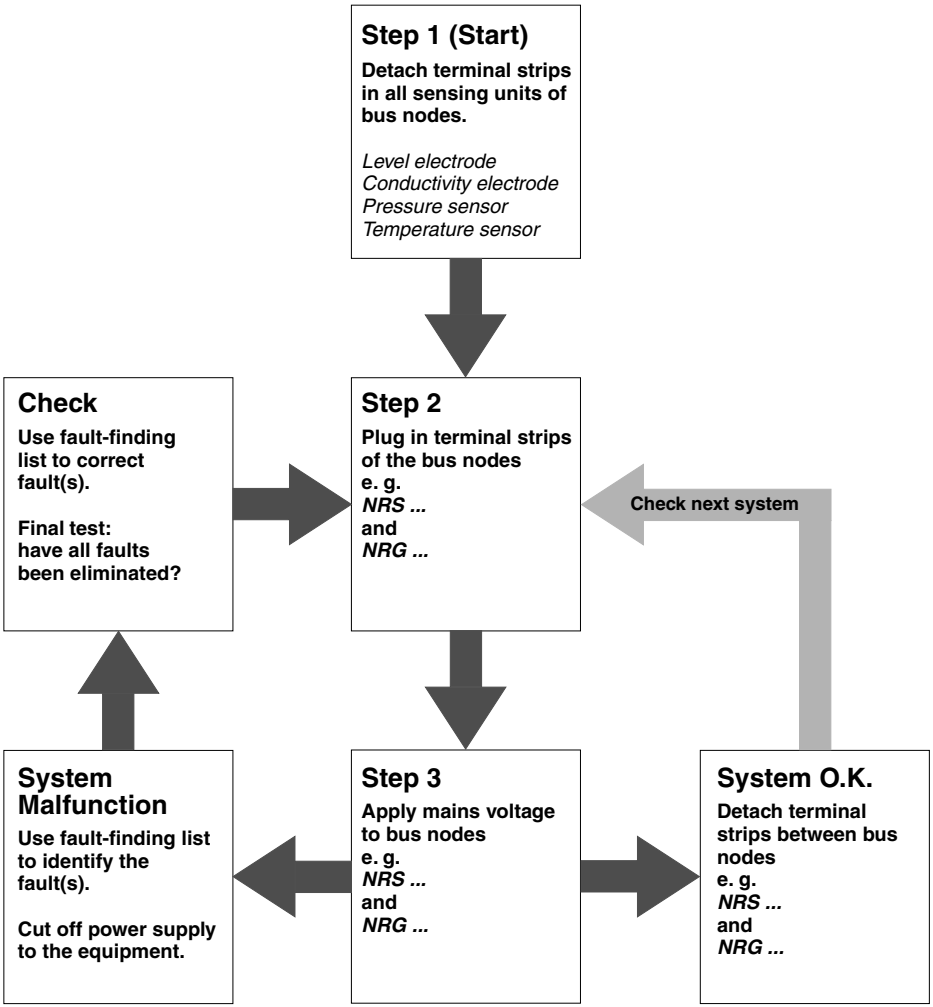
The terminal strip of the NRS 2-40 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting or removing the equipment.

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.

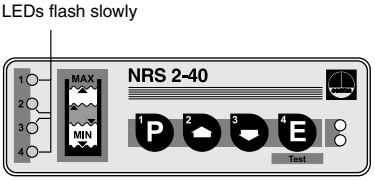
We recommend the following systematic fault finding procedure:



System Malfunctions – continued –

System malfunction 1

The four indicator LEDs flash slowly.
High/low-level alarm

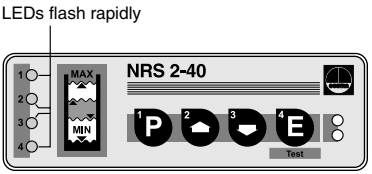


Fault: The max. admissible temperature in the electrode terminal box is exceeded.
Remedy: Insulate electrode flange to protect the equipment against heat radiation.

As soon as the temperature drops below the max. admissible limit the equipment automatically returns to normal operation.

System malfunction 2

The four indicator LEDs flash rapidly.
High/low-level alarm



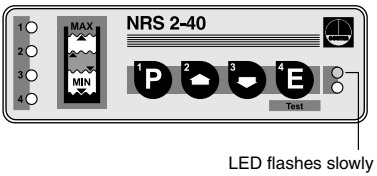
Fault: The CAN bus line between the nodes is interrupted.
Remedy: Check wiring and terminals. Restart system

Fault: Incorrect node ID(s).
Remedy: Set correct nodes ID(s), referring to section “Basic Adjustments” or “Annex”. Disconnect the system from its power supply. After 5 sec. apply power and restart system.

System Malfunctions – continued –

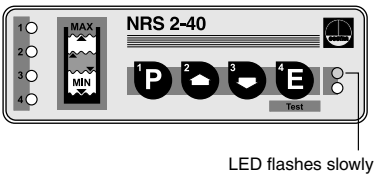
System malfunction 3

LED “Bus status” flashes slowly.



Fault: Malfunction in CAN bus.
Remedy: Restart system.

LED “Bus status” flashes slowly.
High/low-level alarm



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, referring to the wiring diagram.
Disconnect the system from its power supply. After 5 sec. apply power and restart system.

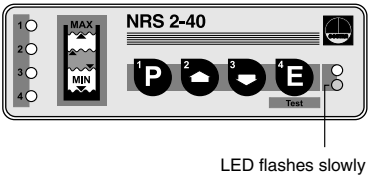
Fault: The baud rate of one or more nodes is not set correctly.
Remedy: Check baud rate settings of all bus nodes. The baud rates **must be identical.** Refer to section “Annex” for more details.
Disconnect the system from its power supply. After 5 sec. apply power and restart system.

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 the indications specified in “Annex”.
Disconnect the system from its power supply. After 5 sec. apply power and restart system.

System Malfunctions – continued –

System malfunction 4

LED “Power” flashes slowly.



Fault: The power supply unit (PSU) is overloaded and 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.
Disconnect the system from its power supply. After 5 sec. apply power and restart system.

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

Malfunctions

Danger

The terminal strip of the NRS 2-40 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting or removing the equipment.

Fault-finding list for troubleshooting

Device fails to work – indication of 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 intererence 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 system after installation.

Device fails to work – no function

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

Device does not work properly

Fault: Incorrect function at analogue output. The following actual value indicator shows incorrect values.
Remedy: Correct the switchpoint settings and the control range settings of the electrode.

Fault: Switchpoints and actual value indication drift continuously towards 100 %.
Remedy: Deposits have accumulated on the electrode rod. Remove the level electrode and clean the electrode rod.

Fault: A high-level alarm is raised although the liquid level is below high level.
Remedy: Deposits have accumulated on the electrode rod.
Clean the electrode rod.
Defective electrode insulation. Replace level electrode.

Fault: Liquid level below switchpoint “LOW LEVEL”, device fails to switch.
Remedy: Check installation of level electrode and vent hole in the protection tube.
If an external measuring pot is used make sure to open the isolating valves.

Malfunctions – continued –

Fault-finding list for troubleshooting– continued –

***Fault*:** "HIGH-LEVEL" switchpoint exceeded – no indication.
Remedy: Level switch defective. Replace equipment.

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 2-40 is live during operation.
This presents the danger of electric shock.
Cut off power supply before mounting or removing the equipment.

Factory set default node IDs

Switching controller	Level electrode
NRS 1-40 ID:001	NRG 16-40 ID:002
	NRG 16-40 ID:003
NRS 1-41 ID:006	NRG 16-41 ID:007
NRS 1-42 ID:020	NRG 16-42 ID:021
NRS 2-40 ID:039	NRG 26-40 ID:041
NRR 2-40 ID:040	
LRR 1-40 ID:050	LRG 16-40 ID:051

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 ❽.

Attention

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

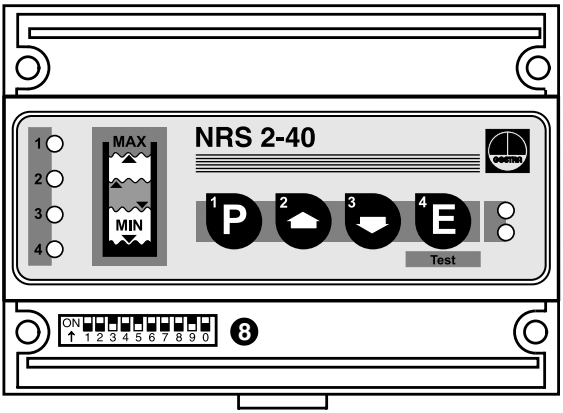
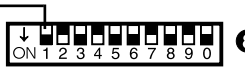


Fig. 10

		Node ID	39
S1	***ON***	1	
S2	***ON***	2	
S3	***ON***	4	
S4	OFF	8	
S5	OFF	16	
S6	***ON***	32	
S7	OFF	64	

Fig. 11 (Factory setting)



		Node ID	74
S1	OFF	1	
S2	***ON***	2	
S3	OFF	4	
S4	***ON***	8	
S5	OFF	16	
S6	OFF	32	
S7	***ON***	64	

Fig. 12 (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. 13 (Factory setting 250 kBit/s)

Annex – continued –

Declaration of conformity CE

We hereby declare that the equipment **NRS 2-40** conforms to the following European guidelines:

- LV guideline 73/23/eec version 93/68/eec
- 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 61 000-6-2

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

Bremen, 23rd July 2002
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

Ⓒ Supporting rail 35 x 15 to DIN EN 50022

Example of Installation

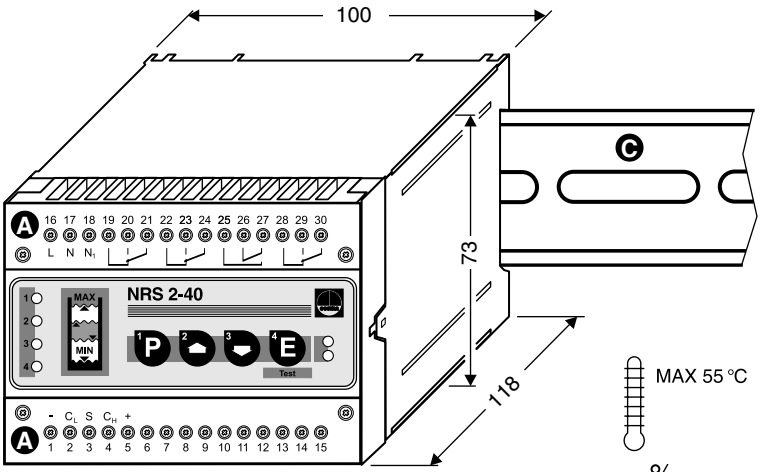


Fig. 14

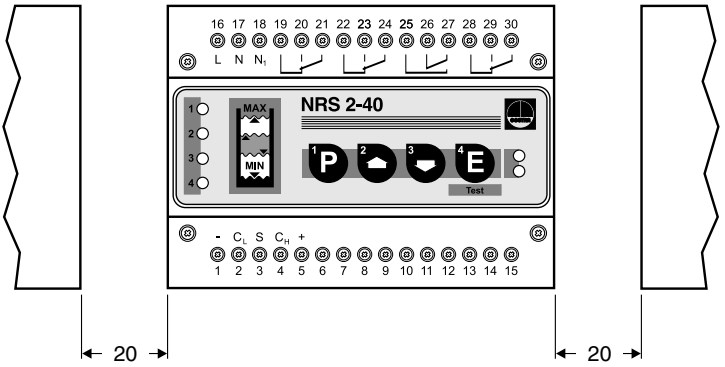


Fig. 15

For your notes

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