



Level Switch

NRS 1-56

EN
English

Original Installation &
Operating Manual

850142-00

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Content of this Manual

Product:

Level switch
NRS 1-56

First edition:

BAN 850142-00/10-2019cm

You can find the latest Installation & Operating Manuals on our website:
<http://www.gestra.com/documents/brochures.html>

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Scope of delivery/Product package

- 1 x level switch
NRS 1-56
- 1 x Installation & Operating Manual

How to use this Manual

This Installation & Operating Manual describes the correct use of the NRS 1-56 level switch. It applies to persons who integrate this equipment in control systems, install, bring into service, operate, maintain and dispose of this equipment. Anyone carrying out the above-mentioned activities must have read this Installation & Operating Manual and understood its contents.

- Read this Manual in full and follow all instructions.
- Please also read the instructions for use of any accessories.
- The Installation & Operating Manual is part of the product package. Keep it in an easily accessible location.

Availability of this Installation & Operating Manual

- Make sure this Installation & Operating Manual is always available to the operator.
- If you pass on or sell the equipment to a third party, please also hand over the Installation & Operating Manual.

Illustrations and symbols used

1. Action to be taken
- 2.

- Lists
 - ◆ Bullet points in lists

A Keys to illustrations



Additional information



Read the relevant Installation & Operating Manual

Hazard symbols in this Manual



Danger zone/Dangerous situation



Danger of death from electric shock

Types of warning

DANGER

Warning of a dangerous situation that results in death or serious injury.

WARNING

Warning of a dangerous situation that may possibly result in death or serious injury.

CAUTION

Warning of a situation that may result in minor or moderate injury.

ATTENTION

Warning of a situation that results in damage to property or the environment.

Specialist terms/Abbreviations

Here, we explain some abbreviations, specialist terms, etc., which are used in this Manual.

NRG .. / NRS ..

GESTRA equipment and type designations, see page 8.

SELV

Safety Extra Low Voltage

Usage for the intended purpose

The NRS 1-56 level switch can be used in conjunction with various conductive level electrodes as an interval level control system in pressurised steam and hot-water plants and in condensate and feedwater tanks.

The NRS 1-56 level switch also indicates two alarm states, which can be configured as MIN and MAX.

Overview of possible unit combinations

Level switch	Level electrode	Version
NRS 1-56	NRG 1-52	4-rod electrode
NRS 1-56	4 x NRG 16-4	1-rod electrode
NRS 1-56	NRG 16-36	4-rod electrode

Fig. 1

Key to Fig. 1:

NRG = level electrode

NRS = level switch



To ensure the proper use of equipment for all types of use, please also read the Installation & Operating Manuals for the system components used.

- You can find the latest Installation & Operating Manuals for the system components named in **Fig. 1** on our website:
<http://www.gestra.com/documents/brochures.html>
-

Usage for the intended purpose

Applicable directives and standards

The NRS 1-56 level switch has been tested and approved for use in the scope governed by the following directives and standards:

Directives:

- | | |
|------------------------|------------------------------|
| ■ Directive 2014/68/EU | Pressure Equipment Directive |
| ■ Directive 2014/35/EU | Low Voltage Directive |
| ■ Directive 2014/30/EU | EMC Directive |
| ■ Directive 2011/65/EU | RoHS Directive |

Standards:

- | | |
|------------------|--|
| ■ DIN EN 60730-1 | Automatic electrical controls – Part 1:
General requirements |
| ■ EN 61326-1 | Electrical equipment for measurement, control and laboratory use –
EMC requirements |

Standards documents:

- VdTÜV Bulletin BP WASS 0100-RL
Requirements for water level control and limiting equipment

Improper use



There is a danger of death due to explosion if the equipment is used in potentially explosive atmospheres.

Do not use the equipment in potentially explosive atmospheres.

Basic safety notes



There is a risk of electric shock during work on electrical systems.

- Always switch off the voltage to the equipment before performing work on the terminal strips.
- Check that the plant is not carrying live voltage before commencing work.



Faulty equipment jeopardises plant safety.

- If the NRS 1-56 level switch does not behave as described on page 23, it may be faulty.
- Perform failure analysis.
- Only replace faulty equipment with identical equipment from GESTRA AG.

Required personnel qualifications

Activity	Personnel	
Integration in control system	Specialist staff	Plant designer
Installation/electrical connection/ bringing into service	Specialist staff	Electrician/installer
Operation	Boiler service technician	Staff trained by the plant operator
Maintenance work	Specialist staff	Electrician
Setup work	Specialist staff	Plant construction

Fig. 2

Notes on product liability

The manufacturer cannot accept any liability for damages resulting from improper use of the equipment.

Function

The NRS 1-56 level switch measures using the conductivity principle and makes use of the electrical conductivity of the water to do this.

The level switch is designed for different conductivities and for connection to four electrode rods in total.

The level switch functions as an interval level control system (inlet/discharge/switchable), and also indicates when the water reaches two independent alarm states, which can be configured as MIN or MAX.

The switchpoints for water level control and for the MIN or MAX levels are determined by the length of the respective electrode rods.

For water level control, the level switch recognises whether the electrode rods are immersed or out of the water and, depending on which function is set, it switches the controller output contact, which then turns the feedwater pump on or off, for example. The Pump LED lights up when the level switch has switched the feedwater pump on, for example.

Behaviour in the event of MIN/MAX water level alarms

When the MIN or MAX water level is reached, the level switch recognises that the corresponding electrode rod is immersed or no longer immersed. When the off delay has elapsed, the relevant Alarm 1/2 output contact is switched. The alarm 1/2 LED simultaneously lights up red.

Alarm simulation

A button is pressed to begin a test sequence. During the test sequence, the MIN or MAX alarm is simulated, see table on page 26.

Behaviour in the event of error messages

If faults occur in the level electrode and/or the electrical connection, the integrated relays are de-energised.

Alarm and fault indications are displayed by LEDs, see page 28.

Technical data

Supply voltage

- 24 V DC +/-20 %

Power consumption

- Max. 2 VA

Current input

- Max. 0.2 A

Required external fuse

- 0.5 A M

Inputs for connecting level electrodes

- 4 x inputs for level electrodes: NRG 10-52, NRG 16-52; NRG 16-36, NRG 16-4, four-pin with shield

Electrode voltage

- 5 Vss

Sensitivity (water conductivity at 25 °C)

Switchable

- > 0.5 $\mu\text{S/cm}$ < 1000 $\mu\text{S/cm}$
or
- > 10 $\mu\text{S/cm}$ < 10,000 $\mu\text{S/cm}$

Alarm 1/Alarm 2 outputs

- 2 x volt-free relay contacts, contact material AgNi0.15, AgSnO2
- Maximum switching current - 8 A at 250 V AC / 30 V DC - $\cos \varphi = 1$
- Inductive loads must have interference suppression (RC combination) as specified by the manufacturer

Off delay of Alarm 1/2 outputs

- 3 seconds, factory set.

Pump output

- 1 x volt-free relay contact, contact material AgNi0.15, AgSnO2
- Maximum switching current - 8 A at 250 V AC / 30 V DC - $\cos \varphi = 1$
- Inductive loads must have interference suppression (RC combination) as specified by the manufacturer

Required external fuse for output contacts

- T2.5A

Technical data

Indicators and controls

- 1 x button for initiating the test function
- 1 x multicolour “ON” LED (green/red) - for indicating the operating state and internal errors
 - ◆ green = running
 - ◆ red = power up, malfunction or internal error
- 1 x red “Alarm 1” LED for indicating a MIN/MAX alarm
- 1 x red “Alarm 2” LED for indicating a MIN/MAX alarm
- 1 x green “Pump” LED for indicating the ON/OFF pump status
- 1 x 4-pole code switch for setting the function and sensitivity

Protection class

- III Safety Extra Low Voltage

IP rating to EN 60529

- Housing: IP 40
- Terminal strips: IP 20

Electrical safety

- Degree of contamination 2 for installation in control cabinet with protection rating IP 54, fully insulated

Admissible ambient conditions

- Service temperature 0 °C – 55 °C (0 °C – 55 °C at power-on)
- Storage temperature - 20 °C – 70 °C *
- Transport temperature - 20 °C – 80 °C (< 100 hours) *
- Air humidity max. 95 %, non-condensing
* *Only switch on after a 24-hour defrosting period*

Housing

- Housing material: Lower section of black polycarbonate (glass-fibre reinforced), front of grey polycarbonate
- 2 x 8-pole terminal strips, removable separately
- Max. cross-section per screw terminal:
 - ◆ 1 x 4.0 mm² solid, or
 - ◆ 1 x 2.5 mm² stranded with sleeve, or
 - ◆ 2 x 1.5 mm² stranded with sleeve
- Housing attachment: Mounting clip on support rail TH 35 (to EN 60715)

Weight

- Approx. 0.2 kg

Name plate/Identification NRS 1-56

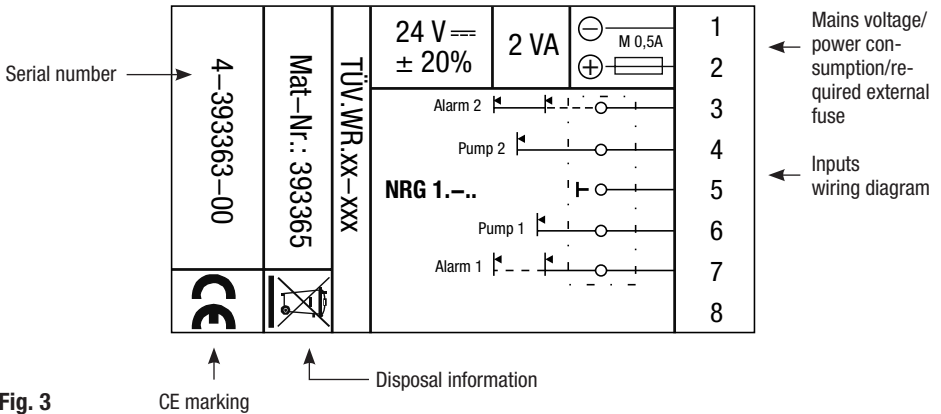
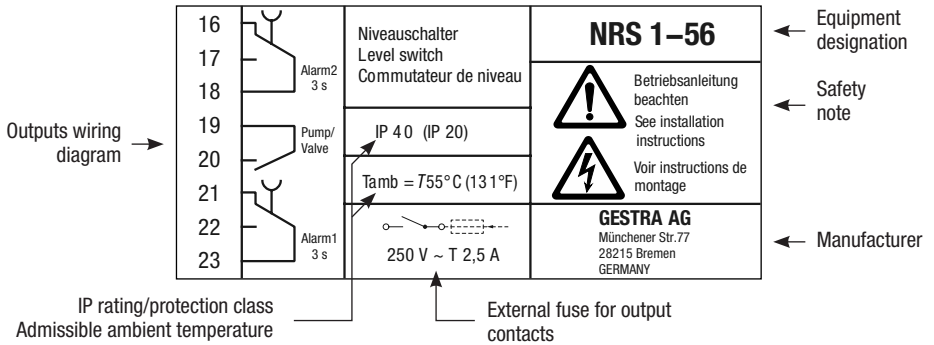


Fig. 3

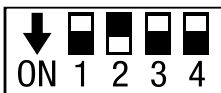


The date of production is printed on the side of the equipment.

Factory settings

The NRS 1-56 level switch is delivered with the following factory default settings:

- Function: Inlet control
- Sensitivity: > 10 μ S/cm at 25 °C
- Code switch setting: Sliding switch, white (1 = OFF, 2 = ON, 3 = OFF, 4 = OFF)



Configuring the function and sensitivity, see page 22, Fig. 13.

Functional elements and dimensions

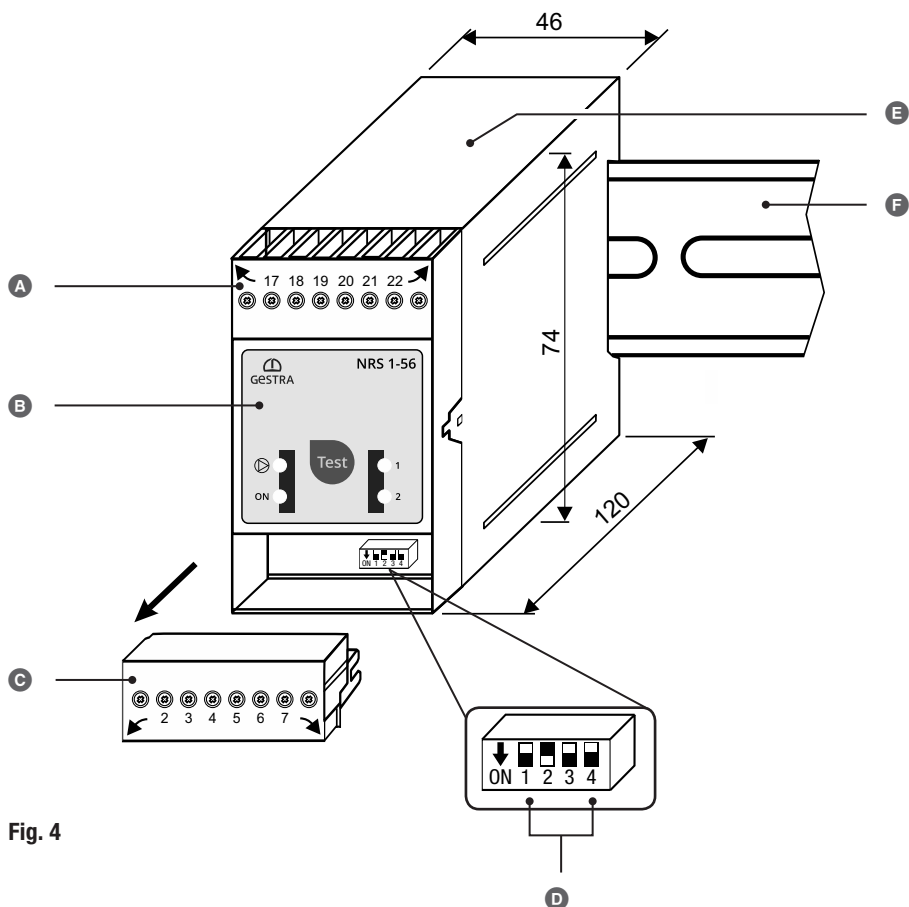


Fig. 4

- A** Upper terminal strip
- B** Front membrane with LED, see page 23
- C** Lower terminal strip
- D** 4-pole code switch, for setting the function and sensitivity
- E** Housing
- F** Support rail TH 35



The code switch can be accessed by removing the lower terminal strip.

Equipment settings, see page 22.

Installing the NRS 1-56 level switch

The NRS 1-56 level switch snaps onto a TH 35 support rail in a control cabinet.

DANGER



There is a risk of electric shock during work on electrical systems.

- Switch off the voltage to the plant before you install the equipment.
- Check that the plant is not carrying live voltage before commencing work.

1. Switch off the voltage to the plant and secure the surrounding equipment in the control cabinet, if live, so it cannot be touched.
2. Carefully press the unit onto the support rail until the holder clips into place.

Electrical connection safety notes

DANGER



Incorrectly connecting the level switch or any associated components is a danger to plant safety.

- Connect the level switch and all associated components as shown in the wiring diagram in **Fig. 5** of this Manual.
- Do not use unused terminals as jumpers or support terminals.

Wiring diagram for the NRS 1-56 level switch

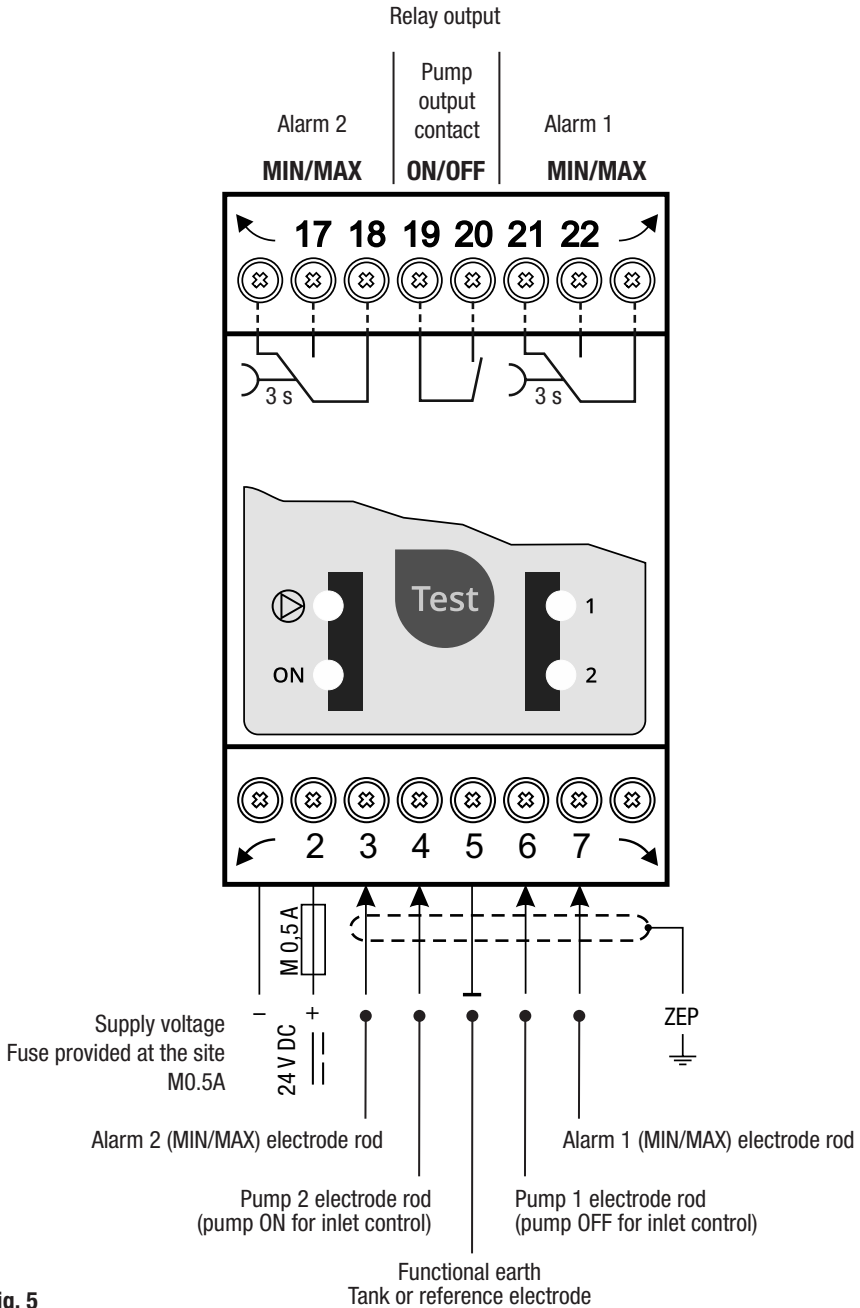


Fig. 5

Electrical connection

Connecting the 24 V DC power supply

- The NRS 1-56 level switch is supplied with 24 V DC.
- A safety power supply unit that delivers a Safety Extra Low Voltage (SELV) must be used to supply the equipment with 24 V DC.
- Use an M0.5A fuse as an external fuse.

Connecting the output contacts

- Connect the outputs as shown in the wiring diagrams in Fig. 5.
- Only use the terminals specified in the wiring diagrams.
- Use a T2.5A fuse to protect the switching contacts.

Connecting the level electrodes

- Use a shielded, multi-core control cable with a minimum conductor size of 0.5 mm², e.g. LIYCY 5 x 0.5 mm².
- Maximum cable length = 100 m.
- Route connecting cables separately from power cables.

Connection examples

Inlet control - various level electrodes connected

Function	Code switch setting
----------	---------------------

MIN/MAX alarm and pump (ON/OFF) / sensitivity ($> 10 \mu\text{S/cm}$)

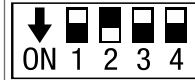
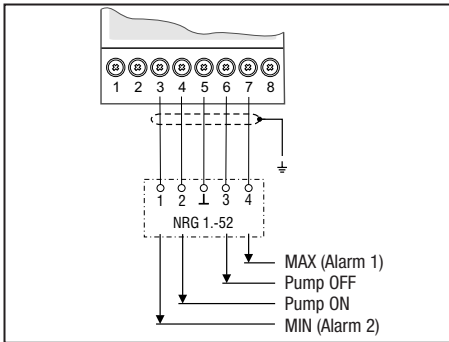


Fig. 6

MIN1/MIN2 alarm and pump (ON/OFF) / sensitivity ($> 10 \mu\text{S/cm}$)

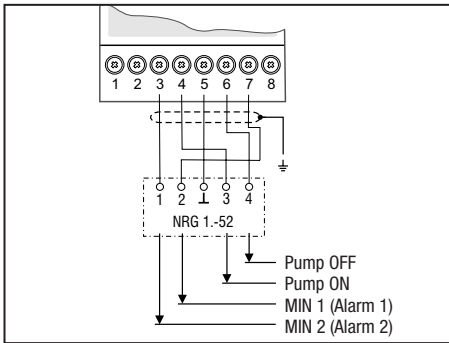


Fig. 7

MIN/MAX alarm and pump (ON/OFF) / sensitivity ($> 10 \mu\text{S/cm}$) with 4 x NRG 16-4

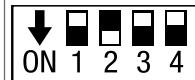
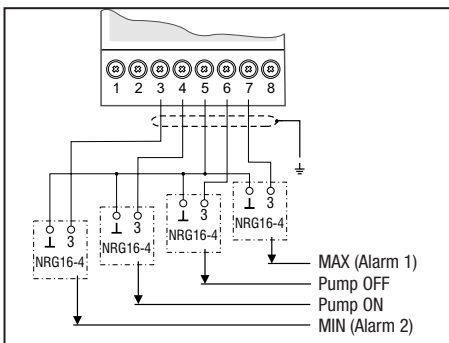


Fig. 8

Connection examples

Discharge control - various level electrodes connected

Function

Code switch setting

MIN/MAX alarm and pump (ON/OFF) / sensitivity ($> 10 \mu\text{S/cm}$)

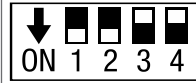
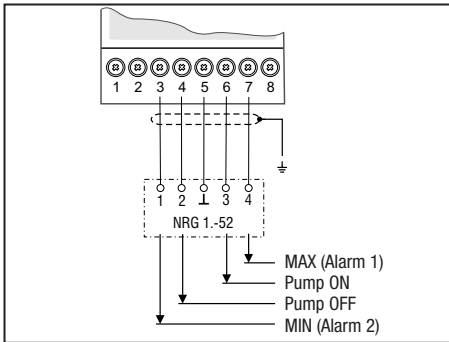


Fig. 9

MAX1/MAX2 alarm and pump (ON/OFF) / sensitivity ($> 10 \mu\text{S/cm}$)

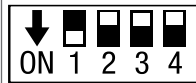
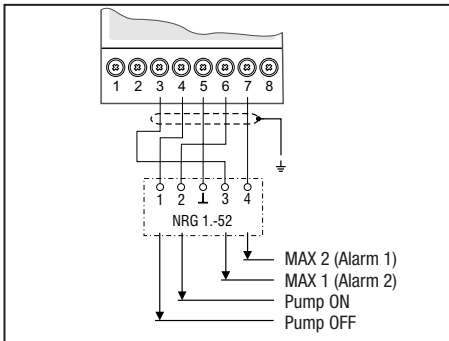


Fig. 10

MAX alarm and pump (ON/OFF) / sensitivity ($> 10 \mu\text{S/cm}$) with NRG 16-36

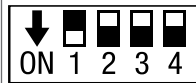
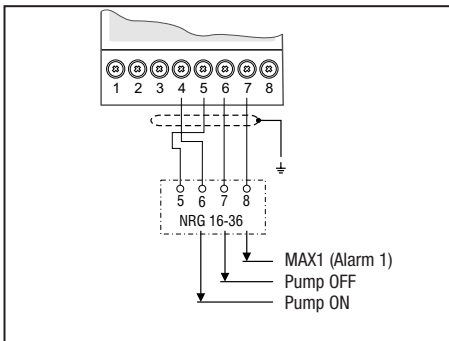


Fig. 11

Changing the equipment settings


DANGER



Danger of death from electric shock if live connections on terminal strips are touched.

- Always switch off the voltage to the equipment before performing work on the terminal strips.
- Check that the plant is not carrying live voltage before commencing work.

Changing the sensitivity and function

The sensitivity and function are determined by the code switch  (see Fig. 4) . To make changes, you can access the code switch as follows:




Make changes before installing the level switch, when access is easier.

You will need the following tools:

- Slotted screwdriver, size 2.5, fully insulated

Proceed as follows:

1. Switch off the supply voltage to the equipment or plant.
2. Carefully unscrew the lower terminal strip with a screwdriver, then remove, see Fig. 12.
3. Set code switch  (see Fig. 4) as desired.
For coding, see page 22, Fig. 13.
4. When your settings are complete:
 - Plug the lower terminal strip back in.
 - Switch the mains voltage back on. The equipment restarts.

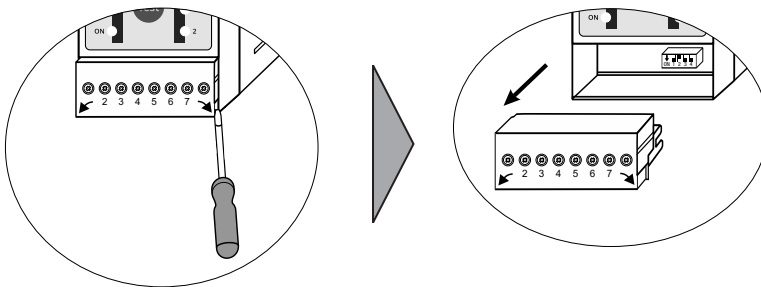
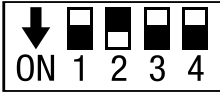


Fig. 12

Changing the equipment settings

Code switch **Ⓢ** - sliding switch, white

Configuring the function and sensitivity



Level switch NRS 1-56

Function	Code switch Ⓢ			
	S1	S2	S3	S4
Inlet control (factory setting)	OFF			
Discharge control	ON			
Alarm 2 = MIN / Alarm 1 = MIN		ON	ON	
Alarm 2 = MAX / Alarm 1 = MIN		OFF	ON	
Alarm 2 = MIN / Alarm 1 = MAX (factory setting)		ON	OFF	
Alarm 2 = MAX / Alarm 1 = MAX		OFF	OFF	
Sensitivity > 10 μ S/cm (factory setting)				OFF
Sensitivity > 0.5 μ S/cm				ON

Fig. 13

Bringing into service - starting, switchpoints and function test

The operating panel and signal LEDs

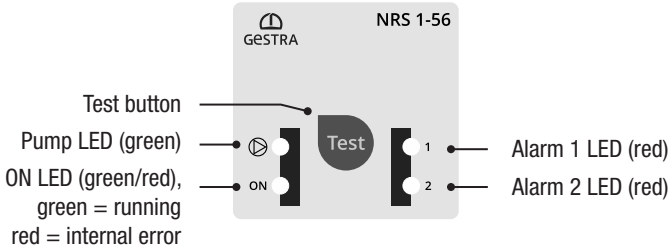


Fig. 14

- Before bringing into service, check that the level switch and level electrode are correctly connected.
- Next, switch on the supply voltage.

Starting		
Switch on supply voltage	All LEDs light up briefly (self-test) The ON LED lights up red The Alarm 1/2 LEDs light up red The Pump LED lights up green	The system is started and tested.

Normal operation		
The system is working within the desired parameters	The ON LED lights up green Depending on the water level, the Alarm 1/2 LEDs and Pump LED light up	Status display during normal operation

Checking the switchpoint and function (inlet control)		
Reduce the water level until it is below the "Pump ON" level. The "Pump ON" electrode rod is no longer immersed.	The Pump LED lights up green	The pump relay is energised. Contacts 19/20 are closed.
Fill the tank until the water is above the "Pump OFF" level. The "Pump OFF" electrode rod is immersed.	The Pump LED does not light up	The pump relay is de-energised. Contacts 19/20 are open.

Bringing into service - starting, switchpoints and function test

Checking the switchpoint and function (discharge control)

Fill the tank until the water is above the "Pump ON" level. The "Pump ON" electrode rod is immersed.	The Pump LED lights up green	The pump relay is energised. Contacts 19/20 are closed.
Reduce the water level until it is below the "Pump OFF" level. The "Pump OFF" electrode rod is no longer immersed.	The Pump LED does not light up	The pump relay is de-energised. Contacts 19/20 are open.

Checking the switchpoint and function (MAX alarm)

Fill the tank until the water is above the MAX level. The MAX electrode rod is immersed.	LED 1 or 2 flashes red, depending on the configuration	The off delay is in progress.
	LED 1 or 2 lights up red, depending on the configuration	The delay time has elapsed. The MAX relay is de-energised. MAX output contacts* 21/23 are closed, 22/23 are open. * Factory setting of output contacts Alarm 1 = MAX

Checking the switchpoint and function (MIN alarm)

Reduce the water level until it is below the MIN level. The MIN electrode rod is no longer immersed.	LED 1 or 2 flashes red, depending on the configuration	The off delay is in progress.
	LED 1 or 2 lights up red, depending on the configuration	The delay time has elapsed. The MIN relay is de-energised. MIN output contacts* 16/18 are closed, 17/18 are open. * Factory setting of output contacts Alarm 2 = MIN

Bringing into service - operation, testing

Inlet control		
The water has dropped below the "Pump ON" water level switchpoint.	The Pump LED lights up green	The pump relay is energised. Contacts 19/20 are closed.
The water has risen above the "Pump OFF" water level switchpoint.	The Pump LED does not light up	The pump relay is de-energised. Contacts 19/20 are open.

Discharge control		
The water has risen above the "Pump ON" water level switchpoint.	The Pump LED lights up green	The pump relay is energised. Contacts 19/20 are closed.
The water has dropped below the "Pump OFF" water level switchpoint.	The Pump LED does not light up	The pump relay is de-energised. Contacts 19/20 are open.

Behaviour on the occurrence of a MAX alarm		
The water is above the "MAX level" switchpoint.	LED 1 or 2 flashes red, depending on the configuration	The off delay is in progress.
	LED 1 or 2 lights up red, depending on the configuration	The delay time has elapsed. The MAX relay is de-energised. MAX output contacts* 21/23 are closed, 22/23 are open. * Factory setting of output contacts Alarm 1 = MAX

Behaviour on the occurrence of a MIN alarm		
The water has dropped below the "MIN level" switchpoint.	LED 1 or 2 flashes red, depending on the configuration	The off delay is in progress.
	LED 1 or 2 lights up red, depending on the configuration	The delay time has elapsed. The MIN relay is de-energised. MIN output contacts* 16/18 are closed, 17/18 are open. * Factory setting of output contacts Alarm 2 = MIN



Plausibility check

If the electrode rods were installed the wrong way round when the equipment was brought into service, both alarm LEDs flash to alert the user.

If Alarm 1 and 2 are both configured as MIN or MAX alarms, there is **no plausibility check** of the two electrode rods.

Bringing into service - operation, testing

Test					
Perform a function test by simulating the alarms					
Initiate the test sequence by pressing and holding the "Test" button					
Step	Alarm 1 LED	Output contact Alarm 1	Alarm 2 LED	Output contact Alarm 2	Runtime
1	flashes	energised	OFF	energised	3 s
2	lights up	de-energised	OFF	energised	3 s
3	OFF	energised	OFF	energised	1 s
4	OFF	energised	flashes	energised	3 s
5	OFF	energised	lights up	de-energised	3 s
6	OFF	energised	OFF	energised	3 s

- To end the test, release the "Test" button.
- To continuously repeat the test, press and hold the "Test" button.
- If a genuine alarm occurs, this will not be tested during the test sequence.



Faulty equipment jeopardises plant safety.

- If the NRS 1-56 level switch does not behave as described in this section, it may be faulty.
- Perform failure analysis.
- Only replace faulty equipment with identical equipment from GESTRA AG.

System malfunctions

Causes

System malfunctions occur if components have been incorrectly installed or configured, if the equipment has overheated, if there is interference in the supply network or electronic components are faulty.

Check the installation and configuration before systematic troubleshooting:

Installation:

- Check that the installation location complies with the admissible ambient conditions in terms of temperature, vibration, interference sources, etc.

Wiring:

- Does the wiring conform to the wiring diagrams?

Level switch configuration:

- Are the function and sensitivity correctly set on code switch **Ⓧ**?

Length of electrodes:

- Do the electrodes have the correct length, and are they correctly assigned on the level switch?

DANGER



There is a risk of electric shock during work on electrical systems.

- Always switch off the voltage to the equipment before working on the terminal strips (installation, electrical connection, disassembly).
- Disconnect all poles of the supply cable from the mains and secure so they cannot be switched back on.
- Check that the plant is not carrying live voltage before commencing work.

System malfunctions

Indication of system malfunctions

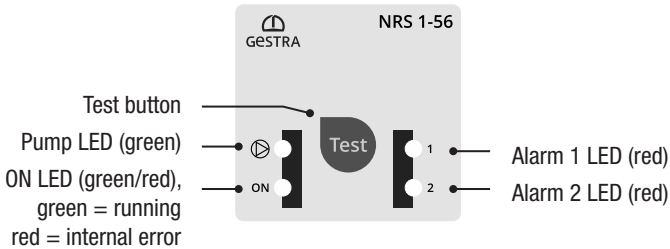


Fig. 15

Type of fault/malfunction	Relay			LEDs			
	Alarm 1	Pump	Alarm 2	ON	Pump	1	2
Interruption to power supply	de-energised	de-energised	de-energised	off	off	off	off
The electrode rods are connected the wrong way round	de-energised	de-energised	de-energised	green	off	flashes red	flashes red
Internal error	de-energised	de-energised	de-energised	red	off	flashes red	flashes red

Fig. 16

Action against high-frequency interference

High-frequency interference can be caused by out-of-phase switching operations. If such interference occurs and results in sporadic failure, we recommend taking the following action to suppress interference:

- Provide inductive loads with RC combinations as specified by the manufacturer.
- Increase the distance from sources of interference.
- Check the shield connection to the central earthing point (CEP) in the control cabinet.
- Suppress HF interference using hinged-shell ferrite rings.
- Route the connecting cables to the level electrodes separately from power lines.

What to do in the event of system malfunctions



In the event of malfunctions or faults that cannot be remedied with the aid of this Installation & Operating Manual, please contact our service centre or authorised agent in your country.

Taking out of service

1. Switch off the supply voltage and switch off the voltage to the equipment.
2. Check that the equipment is not live.
3. Unscrew and pull off the upper and lower terminal strips, see **Fig. 4 A; C**
4. Release the slider holder on the base of the equipment, and detach the NRS 1-56 level switch from the support rail.

Disposal

Dispose of the level switch in accordance with statutory waste disposal regulations.

Returning decontaminated equipment

If products have come into contact with media that are hazardous to health, they must be drained and decontaminated before being returned to GESTRA AG.

Such media include solid, liquid or gaseous substances, mixtures of these, or radiation.

GESTRA AG can accept returned products only if accompanied by a completed and signed return note and also a completed and signed declaration of decontamination.



The return confirmation and declaration of decontamination must be attached to the outside of the return package, as processing will otherwise be impossible and the products will be returned to the sender at their expense.

Please proceed as follows:

1. Let GESTRA AG know about the return beforehand by e-mail or phone.
2. Wait until you have received the return confirmation from GESTRA.
3. Fill out the return confirmation (and declaration of decontamination) and send it with the products to GESTRA AG.

EU Declaration of Conformity

We hereby declare that the NRS 1-56 level switch conforms to the following European Directives:

- Directive 2014/35/EU Low Voltage Directive
- Directive 2014/30/EU EMC Directive
- Directive 2011/65/EU RoHS Directive

Please see our Declaration of Conformity for details on the conformity of our equipment with European Directives.

The current Declaration of Conformity can be found online at www.gestra.com or can be requested from us.

For your notes



You can find our authorised agents around the world at:

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