GESTRA®

Level Switch

NRS 1-56

EN (USA)
English

Original Installation &
Operating Manual
850697-00-00

Contents

Contents

Content of this Manual

Product:

Level Switch NRS 1-56

First edition:

IOM 850697-00/08-2021cm

You can find the latest Installation & Operating Manuals on our website:
http://www.gestra.com

Scope of supply, 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

Ⓐ 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 on/off level control system in steam boilers and hot water installations and in condensate and feedwater tanks. The NRS 1-56 is classified as operating control in accordance with UL 60730-1.

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

Overview of possible equipment combinations

Level switch	Level electrode	Version
NRS 1-56	NRG 1.-52	4-rod electrode

To ensure proper use in all applications, please also read the Installation & Operating Manuals for the system components used.

- You will find the latest Installation & Operating Manuals for the system components listed in the table above on our website:
  http://www.gestra.com

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:

Standards:

- UL 60730-1 and CAN/CSA E60730-1
  General Requirements for Automatic Electrical Controls
- UL 60730-2-15 and CAN/CSA E60730-2-15
  Requirements for Automatic Electrical Water Level Sensing Controls

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.

Do not bring any equipment into service that does not have its own specific rating plate.

The rating plate indicates the technical features of the equipment.

Basic safety information

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 is a danger to 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

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 uses the conductivity of the water to measure the level.

The level switch is designed for different conductivities and for connection to a four tipped probe.

The level switch functions as an on/off level control system (fill/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 recognizes whether the electrode rods are immersed or exposed 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.

Behavior in the event of MIN/MAX water level alarms

When the MIN or MAX water level is reached, the level switch recognizes that the corresponding electrode rod is immersed or exposed. When the off delay has elapsed, the relevant Alarm 1/Alarm 2 output contact is switched. The Alarm 1/Alarm 2 LED simultaneously lights up red.

Alarm simulation

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

Behavior in the event of fault indications

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

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

Technical data

Supply voltage

- 24 V DC +/-20 %; SELV / PELV / CLASS2

Power consumption

- Max. 2 W

Current input

- Max. 0.2 A

Required external fuse

- M0.5A (medium time-lag)

Inputs for connecting level electrodes

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

Electrode voltage

- 5 Vss

Response sensitivity [electrical conductivity of water at 77 °F (25 °C)]

- > 5 ppm (10 µS/cm) < 5000 ppm (10,000 µS/cm)

Alarm 1/Alarm 2 outputs

- 2 x volt-free relay contacts, (changeover relays), contact material AgNi0.15, AgSnO2
- Maximum switching current - 8 A at 250 V AC / 30 V DC - cos φ = 1
- Inductive loads must have interference suppression (RC combination) in accordance with the manufacturer's specification

Off delay of Alarm 1/Alarm 2 outputs

- Factory default setting 3 seconds.

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 φ = 1
- Inductive loads must have interference suppression (RC combination) in accordance with the manufacturer's specification

Required external fuse for output contacts

- T2.5A (slow blow)

Technical data

Indicators and controls

- 1 x button for initiating the test function
- 1 x multicolor “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 pump status ON/OFF
- 1 x 4-pole code switch for setting function and sensitivity

Protection

- Terminal box: IP 40 according to EN 60529
- Terminal strips: IP 20 according to EN 60529
- As a UL open type, the level switch must be installed in a control cabinet.

Electrical safety

- Pollution degree 2, overvoltage category II according to UL 60730-1

Admissible ambient conditions

- Service temperature: 32 ° - 131 °F (0 ° - 55 °C)
  [at power-on 32 ° - 131 °F (0 ° - 55 °C)]
- Storage temperature: -4 ° - 158 °F (-20 ° - 70 °C) *
- Transport temperature: -4 ° - 176 °F (-20 ° - 80 °C) (< 100 hours) *
- Air humidity: max. 95 %, non-condensing

** Only switch on after a 24-hour defrosting period*

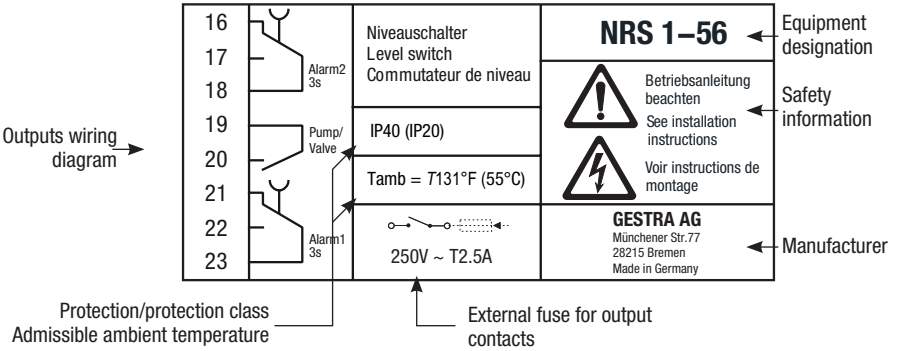
Terminal box

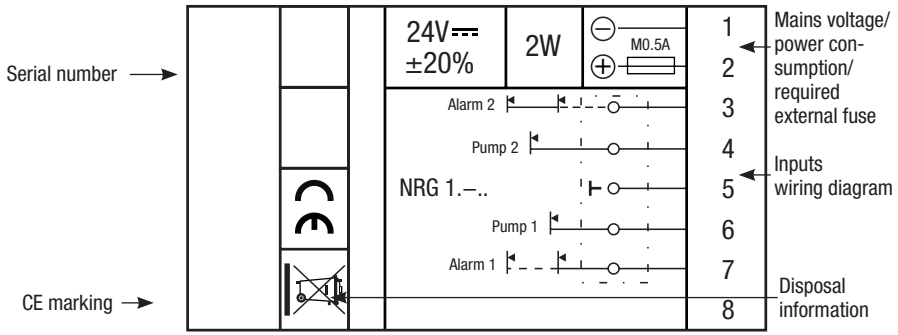
- Terminal box material: Lower section of black polycarbonate (glass-fiber reinforced), front of gray polycarbonate
- 2 x 8-pole terminal strips, removable separately
- Max. wire size per screw terminal:
  - 1 x AWG12 (4.0 mm^2) solid, or
  - 1 x AWG14 (2.5 mm^2) stranded with sleeve, or
  - 2 x AWG16 (1.5 mm^2) stranded with sleeve
- Terminal box attachment: Mounting clip on support rail TH 35 (according to EN 60715)

Weight

- Approx. 0.44 lb (0.2 kg)

Rating plate, identification NRS 1-56





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

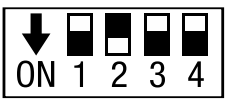
c UL us OPERATING CONTROL E513189	Input rating: 24VDC, 2W
	Output rating : Pilot duty B300 / R300
	Ambient temperature: 32–131°F (0–55°C)
	Wiring: Use Copper Conductors Only, Use 60/75°C Conductors, Use No.18-16 AWG Wire Size Only, Tightening: Torque 0.79Nm or 7lb in.
	Use with accessory: NRG 10–52, NRG 16–52

Fig. 1

Default factory settings

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

- Function: Fill control
- Sensitivity: > 5 ppm (10µS/cm) at 77 °F (25 °C)
- Code switch setting: Sliding switch, white (1 = OFF / 2 = ON / 3 = OFF / 4 = OFF)



Configuring function and sensitivity
see page 22, **Fig. 9**.

Functional elements and dimensions

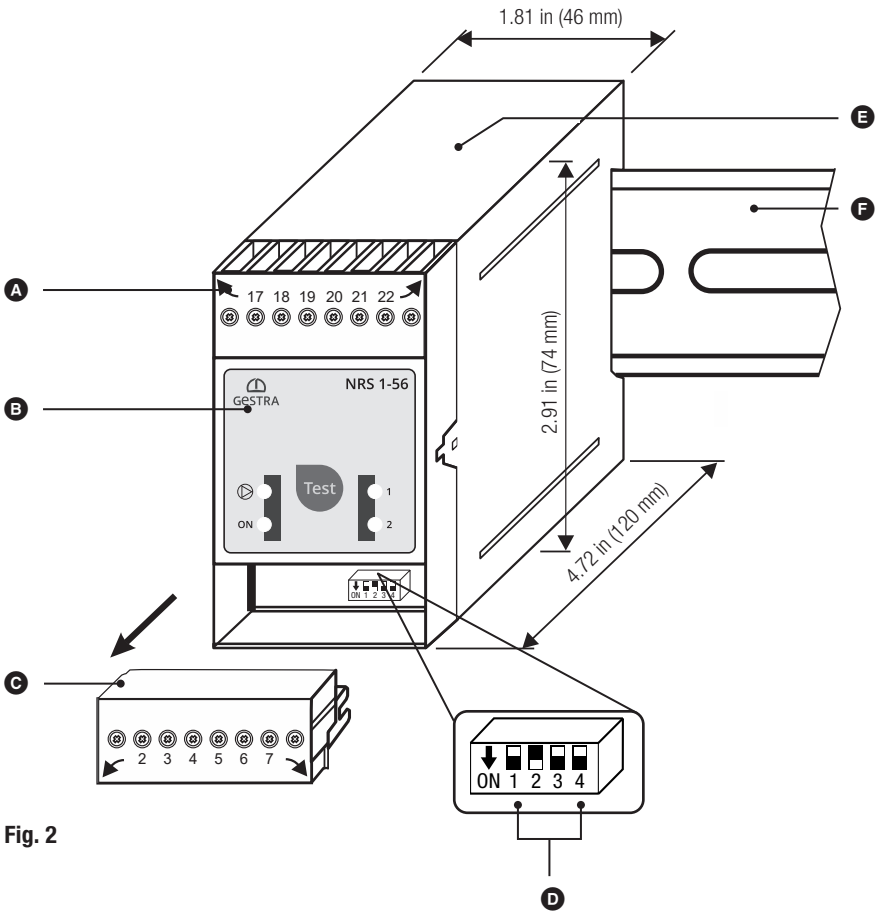


Fig. 2

- **A** Upper terminal strip
- **B** Front membrane with LED, see page 23
- **C** Lower terminal strip
- **D** 4-pole code switch, for setting function and sensitivity
- **E** Terminal box
- **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 any surrounding equipment in the control cabinet that is live, so it cannot be touched.
2. Carefully press the unit onto the support rail until the holder clips into place.

Safety information on the electrical connection

⚠ 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. 3** of this Manual.
- Do not use unused terminals as jumpers or support terminals.

Wiring diagram for the NRS 1-56 level switch

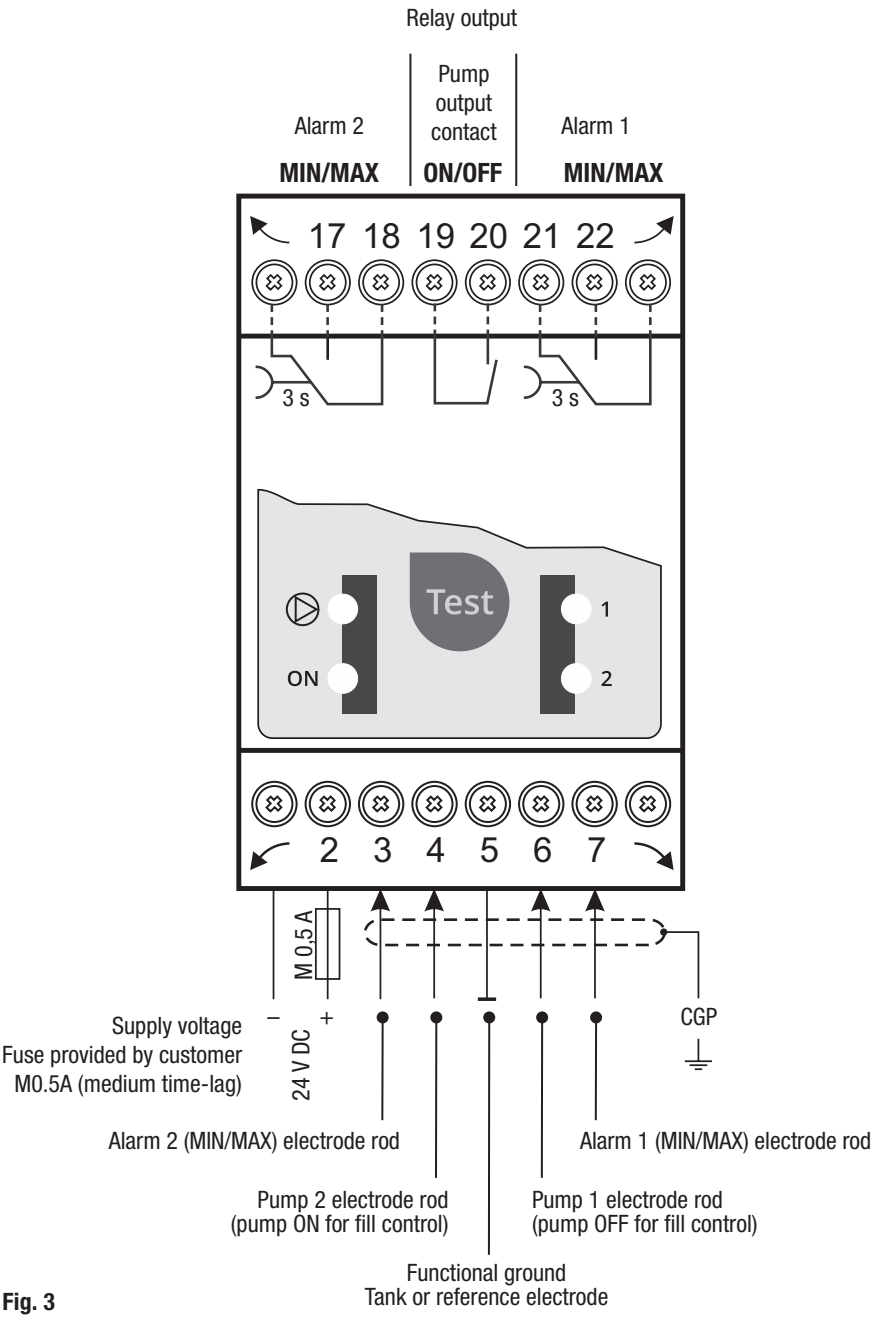


Fig. 3

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 / PELV / CLASS2) must be used to supply the equipment with 24 V DC.
- Use a 0.5A medium time-lag fuse as an external fuse.

Connecting the output contacts

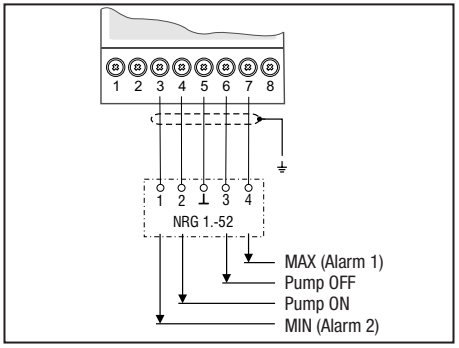
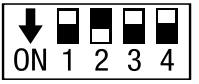
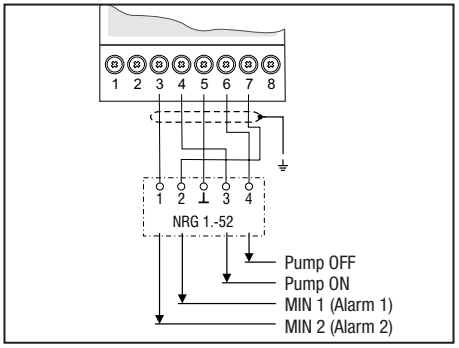
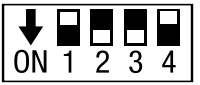
- Connect the outputs as shown in the wiring diagrams in **Fig. 3.**
- Only use the terminals specified in the wiring diagrams.
- Use a 2.5A slow blow fuse to protect the switching contacts.

Connecting the level electrodes

- Use a shielded, multi-core TC-ER control cable with minimum wire size AWG 18, e.g., OELFLEX CONTROL TM CY 5G1.
- Maximum cable length = 328.1 ft (100 m).
- Route connecting cables separately from power cables.

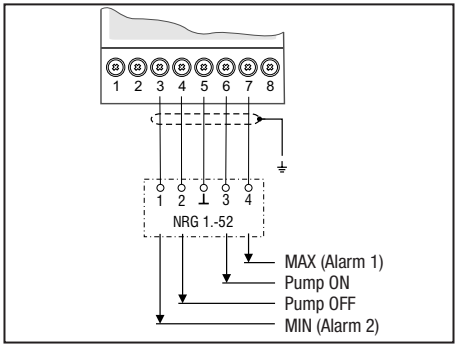
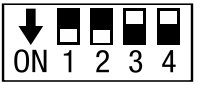
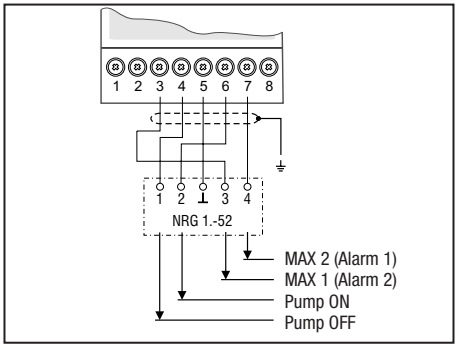
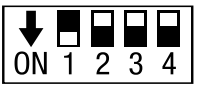
Connection examples

Fill control - connection of various level electrodes

Function	Code switch setting
MIN/MAX alarm and pump (ON/OFF) / sensitivity [> 5 ppm(10 µS/cm)]	
 **Fig. 4**	
MIN1/MIN2 alarm and pump (ON/OFF) / sensitivity [> 5 ppm(10 µS/cm)]	
 **Fig. 5**	

Connection examples

Discharge control - connection of various level electrodes

Function	Code switch setting
MIN/MAX alarm and pump (ON/OFF) / sensitivity [> 5 ppm(10 µS/cm)]	
 **Fig. 6**	
MAX1/MAX2 alarm and pump (ON/OFF) / sensitivity [> 5 ppm(10 µS/cm)]	
 **Fig. 7**	

Changing the equipment settings

⚠ DANGER

Danger of death from electric shock! Do not touch live connections on terminal strips.

- 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 code switch Ⓓ (see **Fig. 2**) . 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:

- Flat blade screwdriver, size 3/32 inch (2.4 mm), 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. 8**.
3. Set code switch Ⓓ (see **Fig. 2**) as desired.
   For codes, see page 22, **Fig. 9**.
4. When your settings are complete:
   - Re-insert the lower terminal strip.
   - Switch the mains voltage back on. The equipment restarts.

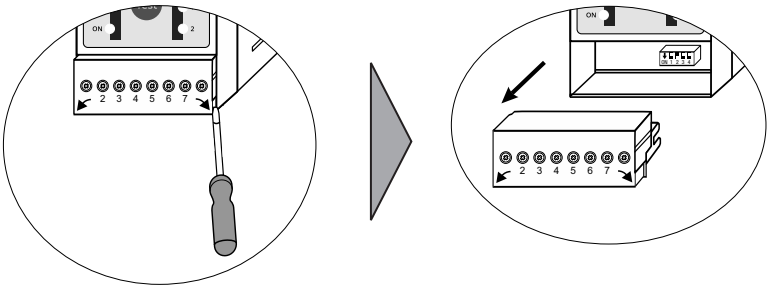
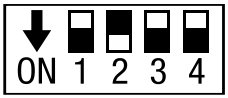


Fig. 8

Changing the equipment settings

Code switch Ⓓ - sliding switch, white

Configuring function and sensitivity



Level switch NRS 1-56

	Code switch Ⓓ			
Function	**S1**	**S2**	**S3**	**S4**
Fill 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 > 5 ppm (10 µS/cm) (factory setting)				OFF

Fig. 9

Bringing into service - starting, checking switchpoints and function

Operating panel and signal LEDs

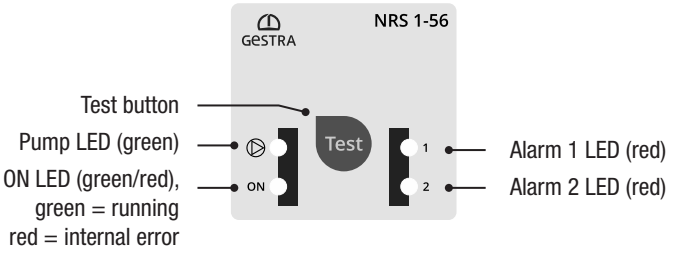


Fig. 10

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

Starting		
Switch on the supply voltage	All LEDs light up briefly (self-test) The ON LED lights up red The Alarm 1/Alarm 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	Status display during normal operation
	The Alarm 1/Alarm 2 LEDs and Pump LED light up based on the water level	

Checking the switchpoint and function (fill control)		
Reduce the water level until it is below the “Pump ON” level. The “Pump ON” electrode rod is exposed.	The Pump LED lights up green	The pump relay is energized. 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-energized. Contacts 19/20 are open.

Bringing into service - starting, checking switchpoints and function

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 energized. Contacts 19/20 are closed.
Reduce the water level until it is below the “Pump OFF” level. The “Pump OFF” electrode rod is exposed.	The Pump LED does not light up	The pump relay is de-energized. 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-energized. 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 exposed.	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-energized. MIN output contacts* 16/18 are closed, 17/18 are open. *** Factory setting of output contacts Alarm 2 = MIN**

Bringing into service - operation, testing

Fill control		
The water has fallen below the “Pump ON” water level switchpoint.	The Pump LED lights up green	The pump relay is energized. 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-energized. 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 energized. Contacts 19/20 are closed.
The water has fallen below the “Pump OFF” water level switchpoint.	The Pump LED does not light up	The pump relay is de-energized. Contacts 19/20 are open.

Behavior 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-energized. MAX output contacts* 21/23 are closed, 22/23 are open. * **Factory setting of output contacts Alarm 1 = MAX**

Behavior on the occurrence of a MIN alarm		
The water has fallen 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-energized. 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**	energized	OFF	energized	3 s
2	**lights up**	**de-energized**	OFF	energized	3 s
3	OFF	energized	OFF	energized	1 s
4	OFF	energized	**flashes**	energized	3 s
5	OFF	energized	**lights up**	**de-energized**	3 s
6	OFF	energized	OFF	energized	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 is a danger to 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, removal).
- Disconnect all poles of the supply cable from the mains and secure so it cannot be switched back on.
- Check that the plant is not carrying live voltage before commencing work.

System malfunctions

Indication of system malfunctions

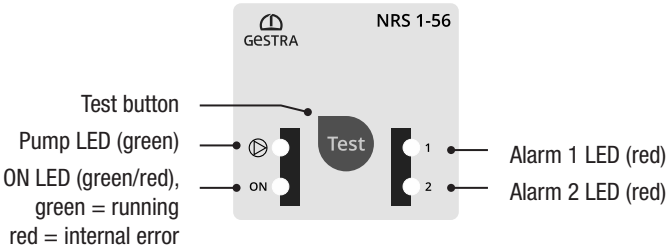


Fig. 11

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

Fig. 12

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 connection of the shield to the central grounding point (CGP) 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 errors that cannot be corrected with the aid of this Installation & Operating Manual, please contact our service center or authorized 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 carrying voltage.
3. Unscrew and pull off the upper and lower terminal strips, see **Fig. 2** Ⓐ; Ⓒ
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.

UL components

Level switch NRS 1-56 level electrode is registered under XACN.E513189.

For your notes

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You can find our authorized agents around the world at: **www.gestra.com**

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