# GESTRA Steam Systems

Product Range B

## Water Level Limiter
Level Switch
**NRS 1-50**

## NRS 1-50
## For TWO Electrodes

### Description

The level switch NRS 1-50 is used in conjunction with level electrodes NRG 1...-.. to limit the water level in steam boilers and (pressurised) hot-water plants.

Water level limiters switch off the heating when the water level falls below the set minimum level (low water).

Depending on the directives listed below the level switch NRS 1-50 can be used in combination with the following level electrodes:

| Directive | Level electrode type | |
|---|---|---|
| PED Pressure Equipment Directive 97/23/EC + Functional Safety IEC 61508 SIL 3 | NRG 16-50<br>NRG 17-50<br>NRG 19-50<br>NRG 111-50 | NRG 16-36 |
| VdTÜV Bulletin "Wasserstand 100" (= Water Level 100) | NRG 16-50<br>NRG 17-50<br>NRG 19-50<br>NRG 111-50<br>NRG 16-36 | NRG 16-11<br>NRG 17-11<br>NRG 19-11<br>NRG 111-11<br>NRG 16-36 |
| Marine applications GL/LR Directives | NRG 16-50S<br>NRG 16-11S | NRG 16-38S<br>NRG 16-39S |

### Function

The level switch NRS 1-50 is designed for different electrical conductivities of the boiler water and for connecting one or two level electrodes.

When the water level falls below the low level the level electrodes are exposed and a low level alarm is triggered in the level switch. This switchpoint is determined by the length of the electrode tip.

After the de-energizing delay has elapsed, the two output contacts of the level switch will open the safety circuit for the heating. The switching-off of the heating is interlocked in the safety circuit and can only be deactivated when the level electrode enters the water again.

In addition, two signal outputs for external signalling devices close instantaneously.

An alarm will also be raised if a malfunction occurs in the level electrode and/or the electrical connection.

If the level electrode is installed in a level pot outside the boiler, make sure that the connecting lines are rinsed regularly. During the rinsing process the water level cannot be measured in the level pot for 5 minutes. The level switch therefore bypasses the level electrode and monitors the rinsing and bypass time (standby input, controlled by the logic unit SRL 6-50).

If the connecting lines for steam ≥ 40 mm and water ≥ 100 mm, the installation is considered to be internal. In this case the rinsing processes do not have to be monitored.

An automatic self-testing routine monitors the safety functions in the level switch and the level electrode. In the event of a malfunction the safety circuit opens instantaneously and switches the heating off.

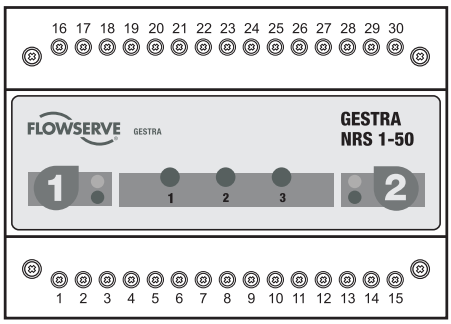
Alarm and errror messages are indicated by LEDs and an alarm can be simulated by pressing the test button.

### Directives and Standards

**Pressure Equipment Directive (PED) 97/23/EC**
Water level limiters are safety accessories as defined in the Pressure Equipment Directive (PED). The level switch NRS 1-50 in conjunction with level electrode NRG 1...-50 and NRG 16-36 is EC type approved according to EN 12952/EN 12953. These Directives state, among other things, the requirements made on limiting systems and equipment for steam boiler plants and (pressurised) hot-water installations.

**Functional Safety acc. to IEC 61508**
The level switch NRS 1-50 is certified acc. to IEC 61508 only if used in combination with level electrode NRG 1...-50 / NRG 16-36. This Directive describes the functional safety of safety-related electrical/electronic/programmable electronic systems.

*P. T. O.*




### Functional Safety acc. to IEC 61508

**Safety characteristics of the subsystem NRG 1...-50 / NRS 1-50**

The equipment combination NRG 1...-50 / NRS 1-50 corresponds to a type B subsystem with Safety Integrity Level (SIL) 3. Type B means that the behaviour under fault conditions of non safety-related components cannot be completely determined. The functional safety of the equipment combination refers to the detection and evaluation of the water level and, as a consequence, the contact position of the output relays.

The design of the equipment combination NRG 1...-50 / NRS 1-50 corresponds to the architecture 1oo2 D. This architecture consists of two channels that run automatic self-testing routines to detect and diagnose faults in each other. If the self-testing routine detects a fault, the equipment combination NRG 1...-50 / NRS 1-50 will go to the safe state, which means that the output contacts will open the safety circuit.

| Safety characteristics | SIL | Architecture | Lifetime (a) | Proof Test Interval (a) |
|---|---|---|---|---|
| General | 3 | 1oo2 D | 20 | 20 |
| | **SFF** | **$PFD_{av}$** | **$PFH_{av}$** | **$\lambda_{DU}$** |
| Level switch NRS 1-50 alone | 98.54 % | $1{,}18 \times 10^{-4}$ | $3.73 \times 10^{-8}$ | $7.33 \times 10^{-8}$ /h |
| Level switch NRS 1-50 in conjunction with one level electrode NRG 1...-50, NRG 16-36 | 98.17 % | $1.69 \times 10^{-4}$ | $4.54 \times 10^{-8}$ | $9.33 \times 10^{-8}$ /h |
| Level switch NRS 1-50 in conjunction with two level electrodes NRG 1...-50 | 97.80 % | $1.17 \times 10^{-4}$ | $3.76 \times 10^{-8}$ | $7.38 \times 10^{-8}$ /h |

| Terms / Abbreviations | Description |
|---|---|
| Safety Integrity Level SIL | Classification of the Safety Integrity Level acc. to IEC 61508 |
| Lifetime (a) | Lifetime of equipment combination in years |
| Safe Failure Fraction SFF | Percentage of failures without the potential to put the safety-related system into a dangerous state |
| Probability Failure per Demand (Low Demand) $PFD_{av}$ | Average probability of failure on demand for low demand mode (once a year) |
| Probability Failure per Hour $PFH_{av}$ | Probability of failure per hour |
| $\lambda_{DU}$ | Failure rate for all dangerous undetected failures (per hour) of a channel of a subsystem |

**Determination of the Safety Integrity Level (SIL) for safety-related systems**

Level electrode, level switch and actuators (auxiliary contactors in safety circuit) are subsystems and together constitute a safety-related system that executes a safety function.

The specification of the safety-related characteristics refers to the level electrode and the level switch including the output contacts. The actuator (e. g. an auxiliary contactor in the safety circuit) is installation specific and, according to IEC 61508, must be considered separately for the whole safety-related system.

# Water Level Limiter
Level Switch
**NRS 1-50**

## Directives and Standards – continued –

**VdTÜV Bulletin "Wasserstand 100" (= Water Level 100)**
The level switch NRS 1-50 in conjunction with the level electrodes NRG 1...-50, NRG 1...-11 and NRG 16-36 is type approved according to the VdTÜV Bulletin "Water Level 100".

**Approvals for Marine Applications**
The level switch NRS 1-50 in conjunction with level electrodes NRG 16-50S/NRG 16-11S/NRG 16-38S and NRG 16-39S is approved for marine applications.

**LVD (Low Voltage Directive) and EMC (Electromagnetic Compatibility)**
The level switch NRS 1-50 meets the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC.

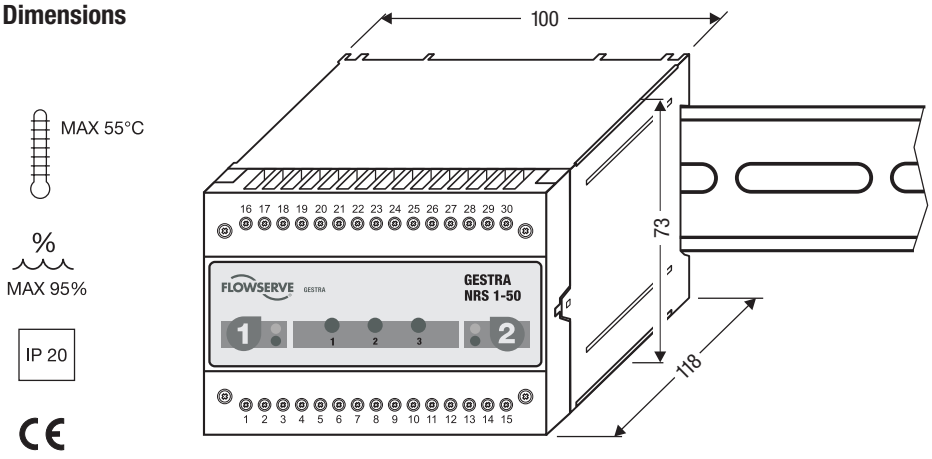
**ATEX (Atmosphère Explosible)**
According to the European Directive 94/9/EC the level switch NRS 1-50 must not be used in potentially explosive areas.

## Technical Data

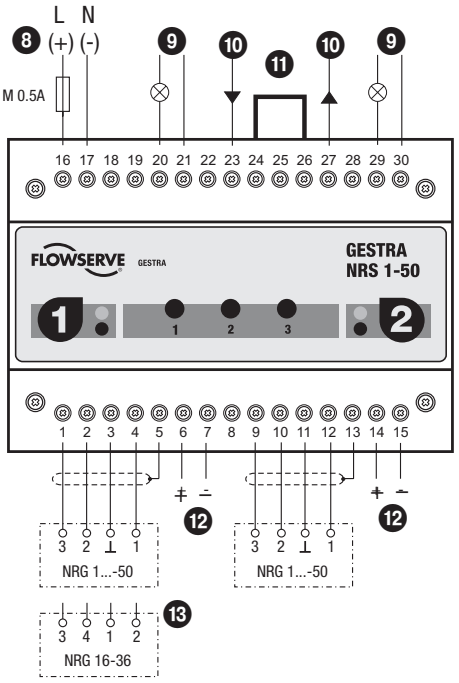
**Mains voltage**
24 VDC +/– 20 %, 0.3 A or 100 – 240 VAC + 10/– 15 %, 47 – 63 Hz, 0.2 A
**External fuse**
M 0.5 A (semi-delay)
**Power consumption**
7 VA
**Response sensitvity**
(Electrical conductivity of water at 25 °C)
> 0.5 ... < 1000 µS/cm or
> 10 ... < 1000 µS/cm
**Inputs:**
**Electrical connection of level electrode**
2 inputs for level electrode NRG 1...-50, NRG 1...-11, NRG 16-36, screened control cable with four poles, minimum conductor size 0.5 mm², e. g. LiYCY 4 x 0.5 mm².
Max. length 100 m with a conductivity > 10 µS/cm at 25 °C.
Max. length 30 m with a conductivity < 10 µS/cm at 25 °C.
**Stand-by input**
2 volt-free inputs, 24 V DC, for monitoring the purging and bypass time. Max. bypass time: 5 minutes.
Wiring: control cable 2 x 0.5 mm².
**Outputs:**
**Safety circuit**
2 volt-free make contacts, 24 V DC – 250 V AC, max. 6 A (resistive/inductive), contact material AgNi.
Delay of response: 3 seconds, 15 sec. for marine applications.
Provide inductive loads with RC combinations according to manufacturer's specification to ensure interference suppression.
**Signal output**
2 volt-free outputs for instantaneous external signalling, 24 – 230 V AC/DC, max. 100 mA.
Wiring: control cable 2 x 0.5 mm².
**Indicators and adjustors**
2 buttons for test and diagnosis, 4 red/green LEDs for indicating the operating mode and alarm.
6 red LEDs for fault diagnosis, 2 two-pole code switches for setting the number of electrodes.
**Housing**
Housing material: base: polycarbonte, black; front: polycarbonate, grey. Terminal strips separately detachable
Fixing of housing: Mounting clip on supporting rail TH 35, EN 60715.

Supply in accordance with our general terms of business.

## Dimensions




## Wiring diagram




### Key

8 Mains supply
9 Signal output 1 / 2 for external alarm 24-230 V AC/DC 100 mA
10 Safety circuit, input and output, external fuse: 2 A (anti-surge) or 1 A (anti-surge), TRD 604, 72 hours
11 Wire link, on site, when used as water level limiter acc. to TRD, EN 12952 / EN 12953
12 Stand-by input 1 / 2, 24 V DC, for connecting the logic unit SRL 6-50
13 Level electrode NRG 1...-50, NRG 1...-11, NRG 16-36

**Electrical safety**
Degree of contamination: 2, overvoltage category III to EN 61010-01.
**Protection**
Housing: IP 40 to EN 60529, Terminal strip: IP 20 to EN 60529
**Weight**
approx. 0.5 kg
**Further conditions:**
**Ambient temperature**
when system is switched on: 0 ° ... 55 °C,
during operation: -10 ... 55 °C
**Transport temperature**
-20 ... +80 °C (<100 hours), defrosting time of the de-energized equipment before it can be put into operation: 24 hours.
**Storage temperature**
-20 ... +70 °C, defrosting time of the de-energized equipment before it can be put into operation: 24 hours.
**Relative humidity**
max. 95 %, no moisture condensation
**Site altitude**
max. 2000 m

## Interlock

In the event of an alarm the level switch NRS 1-50 does not interlock automatically. If an interlocking function in the installation is required, the follow-up circuit (safety circuit) must be equipped with an interlock. The circuitry must meet the requirements of the EN 50156.

## Power Supply, Stand-by Input and Signal Output

Use a safety power supply unit (SELV) to feed the level switch NRS 1-50 with 24 V DC. Only devices with protection by electrical separation or with low voltage may be connected to the stand-by inputs.

## Order & Enquiry Specification

GESTRA Level switch NRS 1-50 as water level limiter acc. to TRD, EN 12952/EN 12953

Mains supply .....

Sensitivity ..... µS/cm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