Level switches LLS installation and operating manual

265152120.93067824.РЭ-LLS

10.01.2020

This operation manual is used to describe operation principles, constriction, operation, safe operation of all modifications of LLS level switches (hereinafter - level switch), their installation procedures, maintenance and replacement.

Please consider that the level transmitters can be used under high pressure, temperature, in aggressive, toxic and explosive media. All personnel in charge of installation and maintenance of the level sensors shall read and understand this manual.

Level switches LLS are manufactured as per technical specifications TU 4214 - 003 - 93067824 - 2013.

RivalCom is committed to improvement of properties, design and structure of the level switches and, therefore, reserves the right to make any changes without any notice.

Table of contents

Operation principle of level switch LLS

Level switch LLS can have different construction in depend of design.

The principle of level switch : into case of level switch located bistable reed. Reed switch – an electromechanical device. Which is a pair of ferromagnetic contacts sealed into the hermetic glass bulb. Contacts reed switch closes under the influence of the magnetic field of the float. The flat moves through a guide tube or (LLS-F-T, LLS-F-SA), or together with swing tube (LLS-F-S). This operating principle allows without contact control of reed switch pins.

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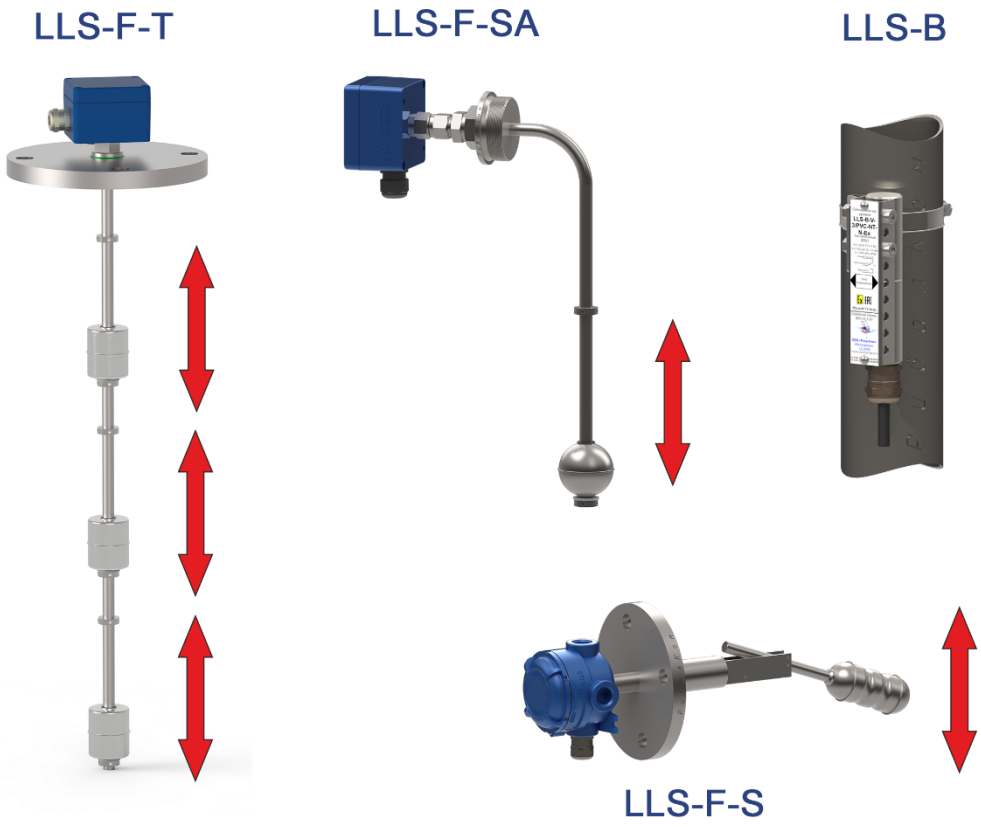

Section 1. Float level switch LLS-F

Float level switch LLS-F – order code:

LLS-F	-	___	-	____	-	____	-	____	-	____	-	___	-	___			-	___	-	___	-	___
		1		**2**		**3**		**4**		**5**		**6**		**7**			-	**8**	-	**9**	-	**10**

1 Variants of process connection

T – vertical mounting
SA – angular design

2 Type of connecting elements / Process connection

A – flange according to ANSI/ASME B16.5
E – flange according to EN1092-1
G – flange according to GOST 12815-80
R – flange according to GOST R 54432-2011 / GOST 33259-2015
| nominal diameter DN
| | nominal pressure PN
| | | the shape of the sealing surface
| | | |
__ __/__/___

MR – Hygienic Union DIN 11851
CP – Flange-clamp DIN 32676
| nominal diameter DN
| | nominal pressure PN
| | | material of seal gasket
| | | |
__ __/__/___

T – Thread connection
F – Sliding compression fitting
| **thread type**
| **M** – metric thread according GOST 24705-81
| **G** – straight thread according DIN EN ISO 228-1 (analogically BSP) (in inches)
| **N** – tapered thread according ANSI/ASME B1.20.1 (in inches)
| | Thread size in millimeters/ inches (for threads M___**x**___ indicates the thread pitch)
| | | **R** – mounting inside of the tank/vessel (optional)
| | | |
__ ___ __/___

X – as agreed with the Customer
N – without connection

3 Guided tube material and connecting elements

V – Stainless steel: 10Cr17Ni13Mo2Ti, 316Ti, 1.4571
L – Stainless steel: 03Cr17Ni14Mo3, 316L, 1.4404, 1.4435
S – Stainless steel: (08)12Cr18Ni10Ti, 321/321H, 1.4541/1.4878
D – Polyvinylidenfluoride PVDF
P – Polypropylene PP
B – Polyvinylchloride PVC
T – Titanium
X – Material on the agreement with the Customer

4 Mounting length

L___ – in mm

Guided tube diameter

/8 8 mm
/12 12 mm
/14 14 mm
/18 18 mm

5 Parameters of alarm points

…. - number of alarm points
/

S SPST, closure at increase level (N.O.)
O SPST, opening at increase level (N.C.)
U SPDT, changeover contact

…. - distance to the alarm point (for horizontal S alarm is not indicated)

* If there are several points of alarm - specify separated by commas

/NR Output signal according **NAMUR DIN EN 60947-5-6**

For example:
1/U200 – 1 alarm point: changeover contact, located on distance 200 mm from base point;
2/S200,O400 – 2 alarm points: S200 – N.O. (closure at increase level) contact, located on distance 200 mm from base point, O400 – N.C. (opening at increase level) contact, located on distance 400 mm from base point
2/S215,O350/NR – 2 alarm points: S215 - N.O. (closure at increase level) contact , located on distance 215 mm from base point, O350 – N.C. (opening at increase level) contact, located on distance 350 mm from base point, Output signal according NAMUR DIN EN 60947-5-6

6 Thermal design (Product temperature)

NT – standard (-60…+150°C)
HT – high-temperature design (-60…+250°C)
HHT – high-temperature design (-60…+450°C)
LT – low-temperature design (-196…+150°C)

7 Electrical connection / Case

Case:
Design of electronic module (see data sheet. 5.3): A…C
| |

| material:
| **A** – aluminum
| **P** – polyester
| **V** – stainless steel
__ __ – Design of electronic module / material

Connection cable:
__/SIL – length of connection cable (in meter) / silicone isolation (-60…+180°C)
__/PVC – length of connection cable (in meter) / PVC isolation (-40…+80°C)
__/X – length of connection cable (in meter) / cable on the agreement with the Customer
__/__/RD – connection cable reinforced with metal hose from stainless steel

Electrical connectors:

HR – connector DIN 43650 (EN 175301-803)
HM – thread connector M12x1
| contact quantity (3…7)
| | connector form (/ S - angled) (Optional)
| | |
| | |
__ __/___

For example:
2/SIL – Silicone connecting cable 2 meters long.
HR4/S – 4-pole angled connector DIN 43650

8 Float

…. - float quantity (indicated in case float number is 2 or more)
/
For switches T or SA design:
F...
constructive construction:
4 – cylindrical with hole
5 – spherical with hole
| material:
| **V** – Stainless steel: 10Cr17Ni13Mo2Ti, 316Ti, 1.4571
| **T** – Titanium
| **D** – Polyvinylidenfluoride PVDF
| **P** – Polypropylene PP
| **B** – Polyvinylchloride PVC
| **F** – PTFE (lining material is listed after of the float material)
| **E** – ECTFE (lining material is listed after of the float material)
| | Outside diameter (in mm)
| | | Hole diameter (in mm)
| | | | Magnetic system
| | | | | Maximum pressure (bar)
| | | | | | | Minimum density of the upper medium (kg/m³), indicated in the case measure of media interface
| | | | | | | | Minimum density of the lower medium (kg/m³), indicated in the case measure of media interface
| | | | | | | | | **B** – balanced on the media interface *

| | | | | | | | |
F _ _ _ _/_/_/_/_/_/

For example:
F4V27/10/A/20 – cylindrical float with hole from 316Ti, outside diameter 27mm and 10 mm hole diameter, Magnetic system A, PN20;
F4T44/15/A/16 – cylindrical float with hole from titanium, outside diameter 44mm and 15 mm hole diameter, Magnetic system A, PN16;

N – without float

9 Approvals and certificates

Ex – Explosion-proof version, Ex-marking GOST R ISO 60079-0-2011**: 0Ex ia IIC T6…T1 Ga**;
Exd – Explosion-proof version, Ex-marking GOST R ISO 60079-0-2011**: 1Ex d IIC T6…T1 Gb.**
NC – Level switch LLS is made of materials that comply with the recommendations of NACE: MR0175 and MR0103, ISO Standard 15156
MD – Level switch LLS for sea and river applications. Type approval of products of the Russian Marine Register of Shipping
HD – Level switch LLS for hygienic application
N – common industrial construction

10 Special design of level switches

BC – design with complete external chamber LGB
FX – flexible construction of level switch
HB – construction with suspension displacer
N – typical design

For example complete order code:
LLS-F-T-G80/16/1-L1500/14-2/U1200,S1430-NT-AA-F5V62/15/A/32-Ex-N;
LLS-F-T-A2’’/150/RF-L260/12-1/S220-NT-CA-F4T44/15/A/16-Exd-N;
LLS-F-T-TG3/8’’/R-L200/12-2/U100,U180-NT-3/SIL-F4V44/15/A/16-N-N;
LLS-F-SA-TG2’’-L1200/14-3/S100,O1050,U1160/NR-NT-AA-F4V44/15/A/16-Ex-N;

1.1 Description of level switch

1.1.1 Construction

Figure 1.1 shows a level switch for installation inside a vessel. It consists of one or more sealed contacts (reed switches) (1) connected to connecting cable (2). To fix the alarm zone, the reed switch and the cable in the guide tube (4) are filled with compound (3).

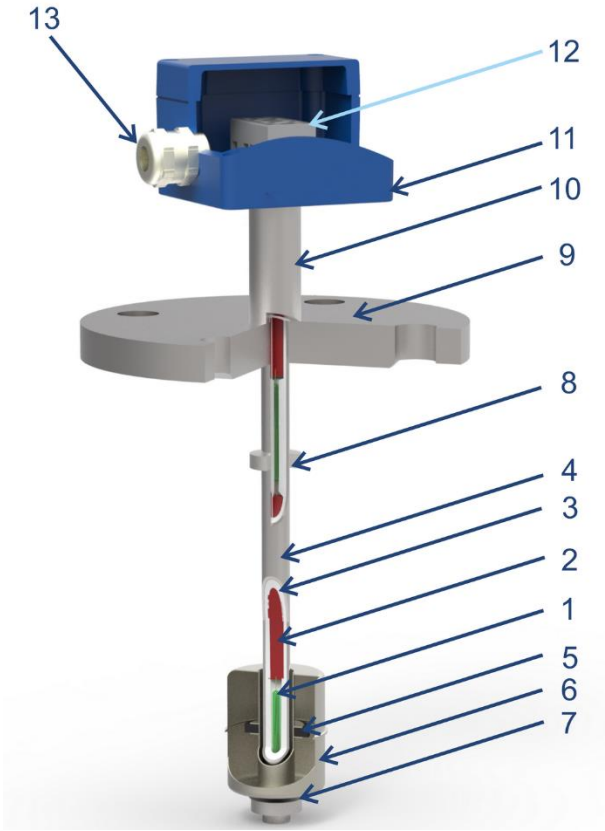

Figure 1.1 Structure of the level switch LLS-F-T

The reed switch contacts are controlled by a permanent magnet (5) installed in the float (6). The float moves from the reed switch to the reed switch along the guide tube along with the measured liquid. Float travel stops (8) are installed on the guide tube to limit the movement of the float and the alarm zone. For longer life and protection of the float on the bottom the limiter is equipped with a PTFE gasket (7).

A connecting element (9) is provided on the guide tube for installing the signaling device in the place of operation. This can be a thread, a flange, or a compression fitting. The connecting element can be a stiffening spar (10) is installed, which facilitates the installation of the signaling device and can serve to remove heat from the electronic unit / housing (11).

The housing is used to install the terminal block (12), in which the cable of the level switch LLS and the switching and / or control cable of the process control system are connected. A cable gland (13) is used to enter the cable into the detector housing.

If the level switch is supplied with a connecting cable, the electronic unit, terminal block and cable gland will be missing.

It is possible to manufacture switches with several control points, in this case, as a rule, one float is used for two alarm points, however, this is not a prerequisite.

The contact functions of the switch are always named depending on the increase in the liquid level (float float): Normally open (N.O.) contact - will be open until the level rises to this point, while it changes its function and closes.

1.1.2 Application area:

The level switch is an automation device and does not belong to measuring instruments. It is designed for discrete control of the level of liquid media.

Scope - for use in automatic control systems, process control and regulation of oil refining, food processing, chemical and other industries.

LLS can be used both inside the buildings and outside in the wide range of climate conditions. They are intended for installation at fixed and movable facilities, production and marine conditions, including vibration and other negative conditions. The devices do not require periodic adjustment and require minimum maintenance during operation. These devices do not require periodic adjustments and require minimal maintenance during operation.

The level switches can be used in conventional and explosion-hazard areas in compliance with regulatory documents specifying application of the equipment in explosion hazard zones.

Explosion-proof design of the level switches feature " intrinsically safe" or “flameproof enclosure” type of protection. These designs of the level switches have 0ExiaIIC T6… T1 Ga or 1ExdIIC T6… T1 Gb explosion safety marks. Such level switches include additional construction elements and schematic engineering solutions and require connection to the relevant electrical circuits.

1.1.3 Technical specifications:

The technical specifications of float switches LLS-F-T and LLS-F-SA are shown in table 1.1.

Table 1.1. Technical and electrical specifications of float switches **LLS-F** and angle float switches **LLS-F-SA**

Type switch	LLS-F standart design		LLS-F high-/low-temperature design		LLS-F miniature design	
Product temperature	from -60 to +150 °C (NT)		from -60 to +250 °C (HT) from -60 to +400 °C (HHT) from -196 to +150 °C (LT)		from -60 to +150 °C (NT)	
Ambient temperature	from -60 °C to +85 °C		from -60 °C to +85 °C		from -60 °C to +85 °C	
Product density	≥330…2000 kg/m3		≥330…2000 kg/m3		≥330…2000 kg/m3	
Nominal pressure	from -1 to 200 bar		from -1 to 200 bar		from -1 to 200 bar	
Mounting length [2]	Up 6000 mm		Up 6000 mm		Up 3000 mm	
Ingress protection class, IP:	IP66 (for version case AA, BA, CA, DA), IP67 (version with connecting cable), IP68 (for version case FV);		IP66 (for version case AA, BA, CA, DA), IP67 (version with connecting cable), IP68 (for version case FV);		IP66 (for version case AA, BA, CA, DA), IP67 (version with connecting cable), IP68 (for version case FV);	
Explosion protection	Witout Ex 0Ex ia IIC T6…T1 Ga 1Ex d IIC T6…T1 Gb		Witout Ex 0Ex ia IIC T6…T1 Ga 1Ex d IIC T6…T1 Gb		Witout Ex 0Ex ia IIC T6…T1 Ga 1Ex d IIC T6…T1 Gb	
Type contact	**Load capacity / maximum number of alarm points**		**Load capacity / maximum number of alarm points**		**Load capacity / maximum number of alarm points**	
S / O	AC: 250 V, 100 V*A, 1 A DC: 250 V, 100 W, 1 A	6 pcs.	AC: 36 V, 100 mA DC: 36 V, 100 mA	6 pcs.	AC: 250 V, 10 V*A, 1 A DC: 250 V, 10 W, 1 A	2 pcs.
U	AC: 250 V, 60 V*A, 1 A DC: 250 V, 60 W, 1 A	4 pcs.	AC: 36 V, 100 mA DC: 36 V, 100 mA	4 pcs.	AC: 250 V, 20 V*A, 1 A DC: 250 V, 20 W, 1 A	2 pcs.
/NR	DC: ≤ 8,2 V, 8 mA		DC: ≤ 8,2 V, 8 mA		DC: ≤ 8,2 V, 8 mA	
Ex i	Only for use in Ex-circuit: ≤ 30 V, ≤ 100mA					

Table 1.2. Intrinsically safe circuit parameters

Intrinsically safe circuit parameters	
Maximum input voltage Ui, V	30*
Maximum input current Ii, mA	100
Maximum input power Pi, W	1,0
Maximum internal capacitance Ci, µF	0,08
Maximum internal inductance Li, mH	1

* specific values Ui, Ii are limited by the maximum value of the input power Pi and cannot affect the input of the signaling devices simultaneously

1.1.4 Corrosion resistance:

All level **switches** details contacting with measured media and environment can be made of corrosion resistant and oxidation resistant materials, 316Ti, 316L stainless steels. However, even more resistant materials (Titanium 3.7045, Hastelloy C, Monel) can be used to operate in highly corrosive products, when the corrosion resistance of the aforementioned grades is insufficient. These materials are used to manufacture the parts which shall contact the product or its vapor, and sometimes to manufacture the whole level switch. Sometimes, application of protective coating to the parts of the level switch contacting with the measured medium can be sufficient.

Moreover, it is possible to produce the chamber made of non-conventional materials (09Г2С steel, steel 20, etc.), polymer materials (polyvinylidenfluoride/PVDF, polypropylene/PP, polyethylene/PE, polyvinylchloride/PVC-U/PVC-C and etc.).

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1.2. Operation

1.2.1 Safety precautions:

Failure to comply with maximum values of stated process parameters may result in the damage of the level switch and entail emergency situation and hazard to the health and life of the maintenance personnel, contamination of environment and property damage. Personnel performing works on installation, disassembly, operation and maintenance of the level switch shall read and understand this operation manual and trained on safety.

When LLSs are used for explosion-hazard areas, installation and operation shall be performed by trained specialists duly certified and approved to operate in accordance with regulations and rules acting at the territory of the state and the enterprise. To increase the contact life, it is recommended operation together with an intermediate relay. The electrical connection must correspond to the wiring diagram indicated on the signaling device (the wiring diagram is not indicated on signaling devices with one NC or NO).

Recomendations:

- in case of process changes (new abrasive particles/crystallizing medium/polymerizing medium) during operation of the level switch not intended for use under such new factors, please, consult manufacturer's specialists;
- when installing level switches LLS inside the hazardous area, it is imperative to make sure that the connection to the protected electrical circuits is made correctly.

Prohibited:

- check the functionality of the switches with a magnet. For this operation, a float switch should be used.
- install the level switch at a distance of less than 1 meter from sources of strong electromagnetic fields.
- self-repair of level switch parts and their replacement without notifying the manufacturer.
- use of a level switch with traces of mechanical and chemical damage until the causes that led to their appearance are eliminated.
- try to independently make changes to the design of level switches (including trying to reconfigure the alarm points for submersible level switches).
- the use of submersible level switches in an environment whose neutrality to the materials used in the switch has not been proven.

The manufacturer may not guarantee compliance with the stated data sheet specifications if certain elements of the level switches LLS are replaced by persons other than representatives of the manufacturer.

1.2.2 Installation and disassembly level switch LLS

Attention! Before installation/disassembly of the level switch LLS it is recommended to check the vessel for residues of aggressive and toxic substances, check shut-off fittings for leakages, check temperature of the machine/vessel outer walls to prevent mechanic, thermal burns and other harm to personnel in charge of installation. Personnel shall use special clothes and personal protective equipment during installation/disassembly.

To ensure the safety of the magnetic float (7), it is transported in a fixed position on the protective guiding tube (5). Immediately before installation, the fixing elements must be removed. Alarm points are set at the factory. The working area of the float is calculated taking into account the location of the reed switches inside the protective tube and is fixed using retaining rings (6).

1.2.2.1 Installation

Align the axis of the protective tube guide (5) with the center of the mounting hole. Lower the pipe to the level switch of the installation connection (3). A suitable gasket (4) must be used for sealing. When choosing gaskets, special attention should be paid to the chemical and thermal resistance of the gasket material. For threaded version, screw the switch into the return thread. Tightening torque should be selected in accordance with the regulations for this type of threaded connections. For the flange version, use the appropriate screws / studs and nuts.

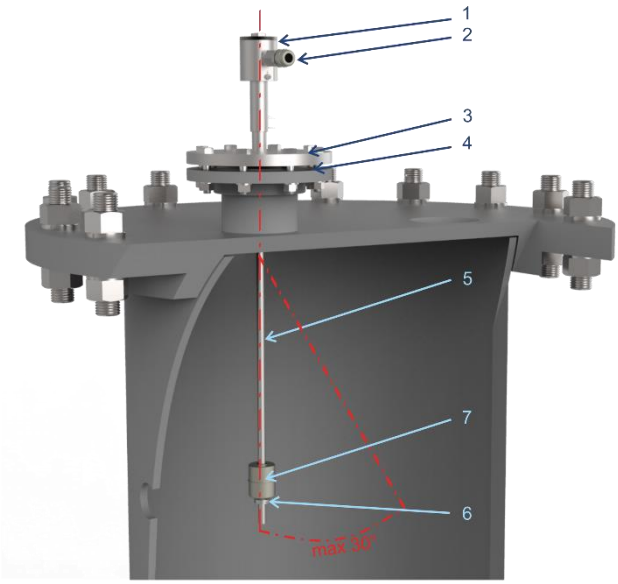


Рисунок 1.1 Монтаж сигнализатора вертикального исполнения

Pay special attention to the correct mounting position of the level switch on the vertical axis *(maximum deviation from the vertical ±30°).*

If the float is larger than the mounting hole in the tank, it should be removed. To do this, unscrew the hex screw on the retaining ring, having previously marked the location of the ring and the top of the float. Then carefully remove the float from the guide tube and put it back on after mounting the alarm. Reinstall the locking element to limit the travel of the float.

1.2.2.2 Disassembly:

Make sure that the container is emptied or the remnants of the medium to be measured do not pose a hazard to the personnel and / or the environment, and the electrical circuits are not energized.

Perform the actions indicated in the item "installation" in the reverse order.

1.2.3 Electrical connection

All level switches are supplied in two versions:

- with connecting cable
- with installed connection terminal box (housing)

In the first case, when connecting, the contacts must be connected in accordance with the required switching function with the existing terminal box / electrical wardrobe. When connecting, pay particular attention to the cable glands used.

When connecting a level switch via a terminal box - it is required to remove the terminal box cover. Then feed the cable through the cable entry in the terminal box. Cut the cable and connect the contacts according to the required switching function. Fasten the routed cable tightly inside the cable gland. Close the terminal box cover tightly. Installation should be carried out with a cable with a cross section of at least 0.75mm2 with the appropriate number of lived.

Operation of magnetic float switches with inductive or capacitive load can destroy the reed switch. This, in turn, can lead to disturbances in the operation of the downstream control unit and to health hazards and material damage. In the case of an inductive load, the signaling devices must be protected by a capacitive-resistive element or an idle diode.

Меры по защите контактов сигнализаторов

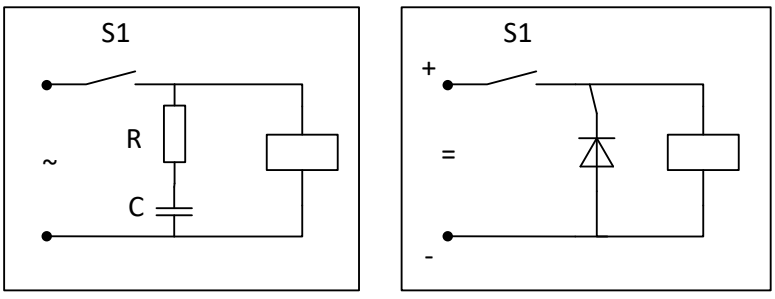


Figure 1.3 Methods of protection of alarm contacts

In the case of a capacitive load, with a cable length of more than 50 m or when connected to a process control system with a capacitive input, connect the protective resistor in series 22 Ω and respectively 47 Ω (for 10 VA contacts) to limit peak currents (Figure 1.4.)

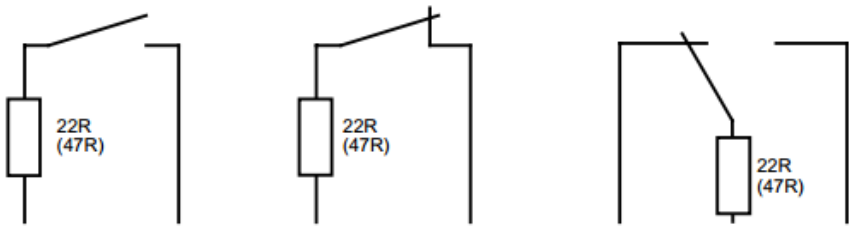
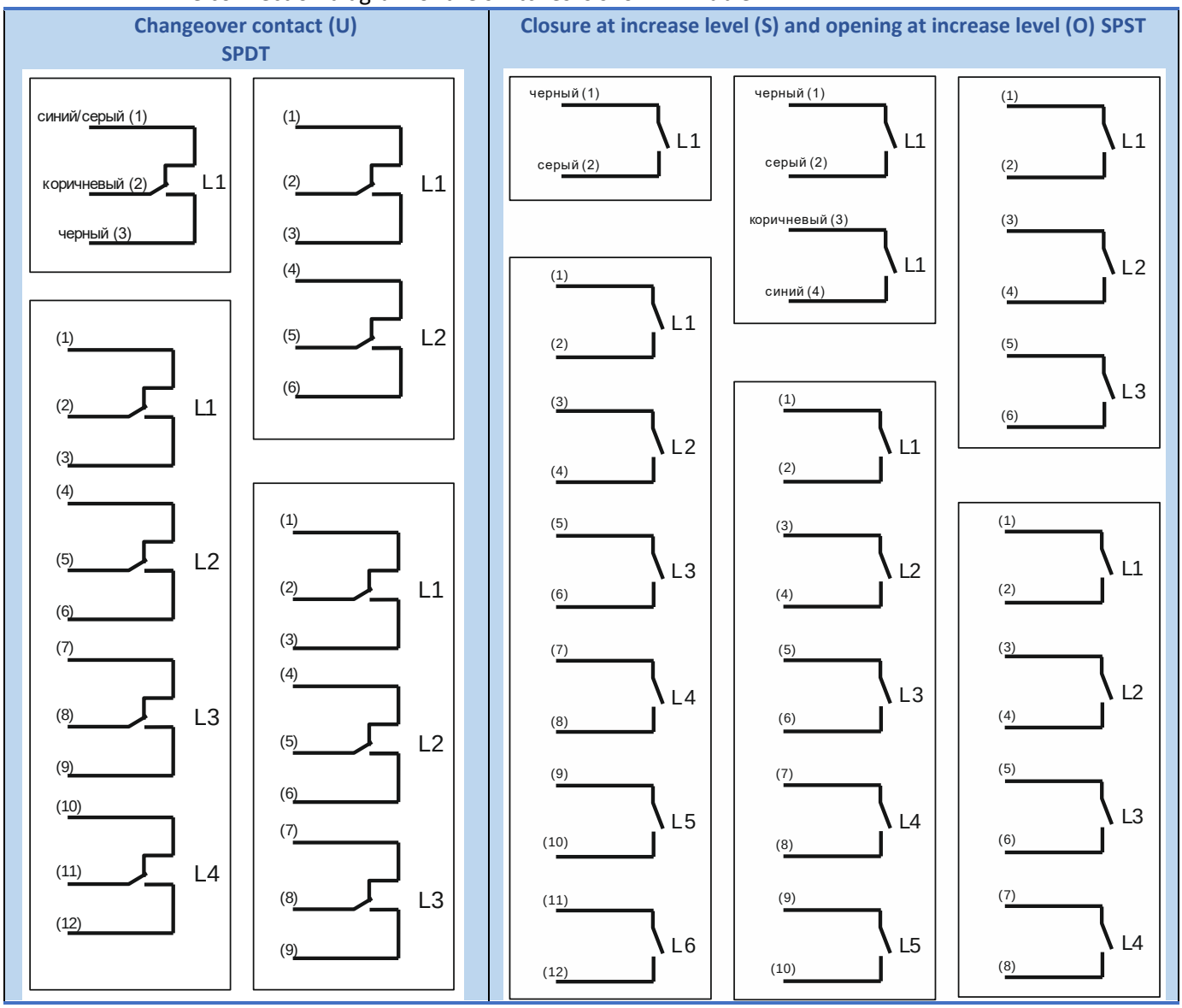


Figure 1.4 Connection of protective resistances

Overloading the alarm can destroy the built-in reed switch. It is imperative that the maximum switching power specified in this manual is observed.

The connection diagram of the switches is shown in Table 1.2.



1.2.4 Maintenance

The level switches LLS operate for a long time without any wear under regular operation.

Visually inspect the float, guided tube and other structural elements for signs of corrosion, oxidation during inspections and planned maintenance of the vessel/tank. If necessary, clean the structural elements of the level switches. To remove and assemble the float, please, follow instructions of section 2.2 "Installation and Disassembly" of this manual.

1.3. Troubleshooting

The main element of the level switches LLS device is a magnetically controlled contact with a high service life (the number of operations is at least 10^5), therefore the average service life of the signaling device is 10 years.

The malfunction or inoperability of the LLS level switch device can be expressed in the inability of the latter to switch contacts or several successive switchings with one required. This can be caused by mechanical damage to the signaling device (reed switch), cable damage, incorrect installation of an alarm, incorrect installation of the float, stuck float, loose contact of terminals, exposure to strong disturbing magnetic fields, etc.

Below is an algorithm by which you can carry out operational diagnostics and subsequent elimination of the cause of the malfunction.

1. Make sure that there are no external mechanical damages on the housing, guide tube, float of the signaling device (traces of impact, falling, etc.).

   If available, consult the manufacturer.

2. Check the possibility of free movement of the float along the guide pipe (no bends or non-linearities in the pipe, overlaps / build-up on the float and the guide pipe).

   If there are adhesions / deposits - clean them, if there are irregularities on the pipe that impede the movement of the float - consult the manufacturer.

3. Check the correct installation of the retaining rings: to do this, move the float to the retaining ring and measure the length along the guide tube from the sealing surface of the connecting element (reference point) to the middle of the float. Check the obtained result with the data on the alarm points from the passport.

   If not, move the circlip to the corresponding point.

4. Check the tightness of the connection cable on the terminal block.

   If contact is loose, tighten tighten.

5. Check the reed switch function with a multimeter by moving the float along the guide tube.

If the reed switches do not operate, contact the manufacturer.

Section 2. Level switch LLS-B for use with level gauge

Level switch LLS-B – order code:

LLS-B - ___ - ____ - ____ - ____ - ____ - ___
1 2 3 4 5 6

1 Construction / Variants of process connection

B – for mounting on level gauge LGB (outside)

2 Case material

S – stainless steel
A – aluminum

3 Electrical connection / Case

Case:

Design of electronic module (see data sheet 5.1.2) A
| material:
| **A** – aluminum
A A – Design of electronic module / material

Connection cable (see data sheet 5.1.1):

__/SIL – length of connection cable (in meter) / silicone isolation (-60…+180°C)
__/PVC – length of connection cable (in meter) / PVC isolation (-40…+80°C)
__/X – length of connection cable (in meter) / cable on the agreement with the Customer
__/__/RD – connection cable reinforced with metal hose from stainless steel

For example:
2/SIL – Silicone connecting cable 2 meters long
1/PVC – PVC connecting cable 1 meters long reinforced with metal hose

4 Thermal design (Product temperature)

NT – standard (-60…+150°C)
HT – high-temperature design (-60…+400°C) (only construction with aluminum case)
LT – low-temperature design (-100…+125°C) (only construction with aluminum case)

5 Output signal according NAMUR DIN EN 60947-5-6

NR – yes
N – no

6 Approvals and certificates

Ex – Explosion-proof version, Ex-marking
GOST R ISO 60079-0-2011**: 0Ex ia IIC T6…T1 Ga**;
Exd – Explosion-proof version, Ex-marking
GOST R ISO 60079-0-2011**: 1Ex d IIC T6…T1 Gb.**
N – common industrial construction

For example complete order code:
LLS-B-S-2/SIL-NT-N-Ex;
LLS-B-S-4/PVC-NT-N-Exd;
LLS-B-A-AA-HT-NR-Ex.

2.1 Description of level switch

2.1.1 Construction

Figure 2.1 shows a level switch for operation with an LLS-B level indicator.

It consists of one sealed contact (reed switch) (1), connected to the connecting cable (2). To protect against shocks and ensure safety, the reed switch in the housing (4) is filled with a compound (3). The connecting cable is fixed with a seal in the cable gland (5). The signaling point (switching of the reed switch contact) is marked on the body (triangular groove 0.5-1 mm) and a mark on the nameplate (6) of the device.

The reed switch contacts are controlled by a permanent magnet installed in the level indicator float.

The level indicator float moves along the level indicator chamber (9) with the measured liquid. When moving along the signaling device, the position of the reed switch contacts is switched and they are fixed in this position. To fix the contacts of the reed switch, a magnet mounted on the reed switch is used. When the float is moved in the opposite direction, the contacts return reed switch to its original position.

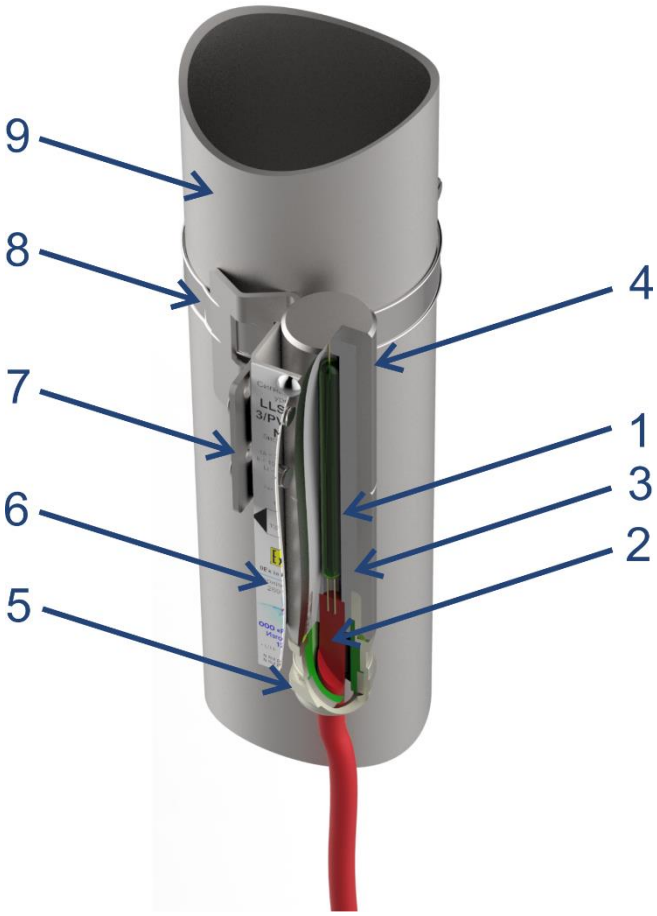


Figure 2.1 LLS-B level switch device

The indicator is mounted on the level indicator chamber using a multi-position bracket (7) and a clamp (8). The multi-position bracket allows precise adjustment of the position of the indicator on the level indicator chamber.

If there are several alarms on one level gauge, it is recommended to mount it on the level gauge of the terminal box. This allows to reduce the number of signal cables going from the signaling devices to the control cabinet to one.

2.1.2 Application area:

The level switch is an automation device and does not belong to measuring instruments. It is designed for discrete control of the level of liquid media.

Scope - for use in automatic control systems, process control and regulation of oil refining, food processing, chemical and other industries.

LLS can be used both inside the buildings and outside in the wide range of climate conditions. They are intended for installation at fixed and movable facilities, production and marine conditions, including vibration and other negative conditions. The devices do not require periodic adjustment and require minimum maintenance during operation. These devices do not require periodic adjustments and require minimal maintenance during operation.

The level switches can be used in conventional and explosion-hazard areas in compliance with regulatory documents specifying application of the equipment in explosion hazard zones.

Explosion-proof design of the level switches feature " intrinsically safe" or “flameproof enclosure” type of protection. These designs of the level switches have 0ExiaIIC T6… T1 Ga or 1ExdIIC T6… T1 Gb explosion safety marks. Such level switches include additional construction elements and schematic engineering solutions and require connection to the relevant electrical circuits.

2.1.3 Technical specifications:

The technical specifications of level switches LLS-B for use with level gauge are shown in table 2.1 and 2.2.

Table 2.1. Technical and electrical specifications of switches LLS-B for use with level gauge LGB

Type switch	**LLS-B-S-…-N**	**LLS-B-S-…-Ex**	**LLS-B-S-…-Exd**	**LLS-B-S-…-NR-…**
Case permissible temperature	from -60 to +150 °C (NT)	from -60 to +150 °C (NT)	from -60 to +150 °C (NT)	from -60 to +150 °C (NT)
Ambient temperature	from -60 °C to +85 °C	from -60 °C to +85 °C	from -60 °C to +85 °C	from -60 °C to +85 °C
Type cable	/SIL – 4x0,75mm^2 in silicone isolation (-60…+180°C) /PVC – 4x0,75mm^2 in PVC isolation (-40…+80°C)			
Product density	work is carried out from the float of the level indicator LGB: the density of the measured medium and the maximum pressure are regulated by the parameters of the level indicator			
Nominal pressure				
Ingress protection class, IP:	68	68	68	68
Explosion protection:	Witout Ex	0Ex ia IIC T6…T1 Ga	1Ex d IIC T6…T1 Gb	NAMUR DIN EN 60947-5-6
Тип контакта	one changeover contact (SPDT)			
Load capacity	250 V =, 60 W, 1A 250 V ~, 60 V·A, 1 A	Only for use in Ex-circuit : ≤ 30 V, ≤ 100mA	250 V =, 60 W, 1A 250 V ~, 60 V·A, 1 A	Only for use in citrcuit according NAMUR DIN EN 60947-5-6

Table 2.2. Technical and electrical specifications **LLS-B** for use with level gauge LGB in version with extended temperature range

Product temperature	**HT** – high-temperature design (-60…+400 °C) **LT** – low-temperature design (-100…+125 °C)
Ambient temperature	from -60 °C to +85 °C
Product density	work is carried out from the float of the level indicator LGB: the density of the measured medium and the maximum pressure are regulated by the parameters of the level indicator
Nominal pressure	
Case	aluminum
Ingress protection class, IP:	66
Explosion protection	Witout Ex / 0Ex ia IIC T6…T1 Ga / NAMUR DIN EN 60947-5-6
Type contact	one changeover contact (SPDT
Load capacity	AC: 250 V, 100 V*A, 1 A
	DC: 250 V, 100 W, 1 A

Table 2.3. Intrinsically safe circuit parameters

Intrinsically safe circuit parameters	
Maximum input voltage Ui, V	30*
Maximum input current Ii, mA	100
Maximum input power Pi, W	1,0
Maximum internal capacitance Ci, µF	0,08
Maximum internal inductance Li, mH	1

* specific values Ui, Ii are limited by the maximum value of the input power Pi and cannot affect the input of the signaling devices simultaneously

2.1.4 Corrosion resistance:

Since the level switch in this version is installed outside the chamber, it does not come into contact with the measured medium and is not subjected to overpressure and corrosive media loads. Only vapors of the measured medium (if any) and atmospheric phenomena can be affected. To protect against these negative factors, the body is made of corrosion-resistant materials.

2.2. Operation

2.2.1 Safety precautions:

Failure to comply with maximum values of stated process parameters may result in the damage of the level switch and entail emergency situation and hazard to the health and life of the maintenance personnel, contamination of environment and property damage. Personnel performing works on installation, disassembly, operation and maintenance of the level switch shall read and understand this operation manual and trained on safety.

When LLSs are used for explosion-hazard areas, installation and operation shall be performed by trained specialists duly certified and approved to operate in accordance with regulations and rules acting at the territory of the state and the enterprise. To increase the contact life, it is recommended operation together with an intermediate relay. The electrical connection must correspond to the wiring diagram indicated on the signaling device (the wiring diagram is not indicated on signaling devices with one NC or NO).

Recomendations:

- in case of process changes (new abrasive particles/crystallizing medium/polymerizing medium) during operation of the level switch not intended for use under such new factors, please, consult manufacturer's specialists;
- when installing level switches LLS inside the hazardous area, it is imperative to make sure that the connection to the protected electrical circuits is made correctly.

Prohibited:

- Bring strong magnets (including neodymium) to the switch at a distance closer than 30 cm.
- install the level switch at a distance of less than 1 meter from sources of strong electromagnetic fields.
- self-repair of level switch parts and their replacement without notifying the manufacturer.
- use of a level switch with traces of mechanical and chemical damage until the causes that led to their appearance are eliminated.
- try to independently make changes to the design of level switches

The manufacturer may not guarantee compliance with the stated data sheet specifications if certain elements of the level switches LLS are replaced by persons other than representatives of the manufacturer.

2.2.2 Installation and disassembly level switch LLS

Attention! Before installation/disassembly of the level switch LLS it is recommended to check the vessel for residues of aggressive and toxic substances, check shut-off fittings for leakages, check temperature of the machine/vessel outer walls to prevent mechanic, thermal burns and other harm to personnel in charge of installation. Personnel shall use special clothes and personal protective equipment during installation/disassembly.

Since the switch can be installed outside the remote chamber of the level indicator in operation, installation should be carried out only when the switches are disconnected from the electrical circuits.

2.2.2.1 Installation

In this version, the level switches are supplied already mounted on the LGB level indicator using a multi-position bracket (2). The bracket itself is mounted on the level indicator chamber using a clamping strap (1). The switch is mounted on the bracket using screws (3) and nuts (4) inserted into the special holes of the indicator mounting plate (5).

During installation, it is necessary to use the nuts, washers, bolts and gaskets recommended by the regulatory documents.

Alarm points are freely adjustable by moving the switch the chamber together with the multi-position bracket by unscrewing the clamping band.

The multi-position bracket allows you to move the switch both in the longitudinal (change of the signaling point depending on the level) and in the transverse (moving away / approaching the switch to the camera) direction.

For more accurate placement of switches on the camera or installation of several switches at one point, it is permissible to move the switch body along the multi-position bracket by installing screws in another pair of holes in the mounting plate (5).

The multi-position bracket allows moving away / approaching the switch to the float of the level indicator, this can adversely affect the operation of the switch, therefore, it is recommended to mark the initial position of the switch before changing the position.

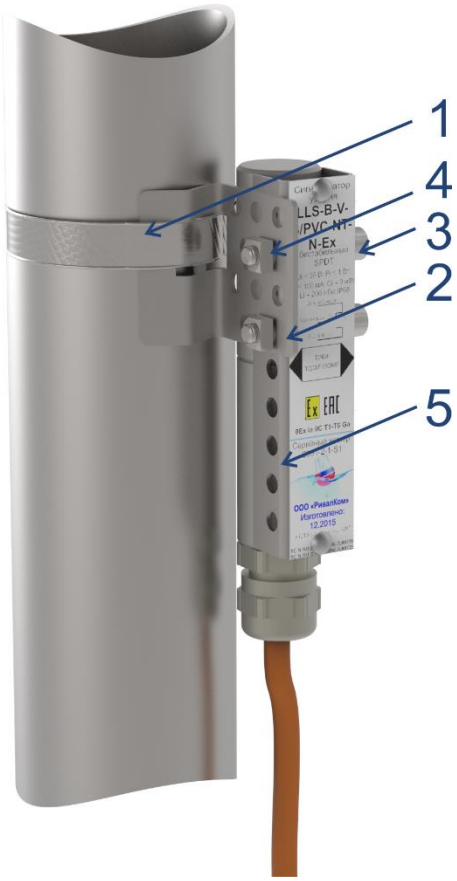


Figure 2.2 Mounting the switch on the camera level indicator

2.2.2.2 Disassembly:

Make sure that the container is emptied or the remnants of the medium to be measured do not pose a hazard to the personnel and / or the environment, and the electrical circuits are not energized.

Perform the actions indicated in the item "installation" in the reverse order.

2.2.3 Electrical connection

All level switches are supplied in two versions:

- with connecting cable
- with installed connection terminal box (housing)

In the first case, when connecting, the contacts must be connected in accordance with the required switching function with the existing terminal box / electrical wardrobe. When connecting, pay particular attention to the cable glands used.

When the switches are delivered with a terminal box mounted on the level indicator, the switch cables are inserted into the box and connected to the terminal block at the factory.

Installation should be carried out with a cable with a cross section of at least 0.75mm2 with the appropriate number of lived.

Operation of magnetic float switches with inductive or capacitive load can destroy the reed switch. This, in turn, can lead to disturbances in the operation of the downstream control unit and to health hazards and material damage. In the case of an inductive load, the signaling devices must be protected by a capacitive-resistive element or an idle diode.

Меры по защите контактов сигнализаторов

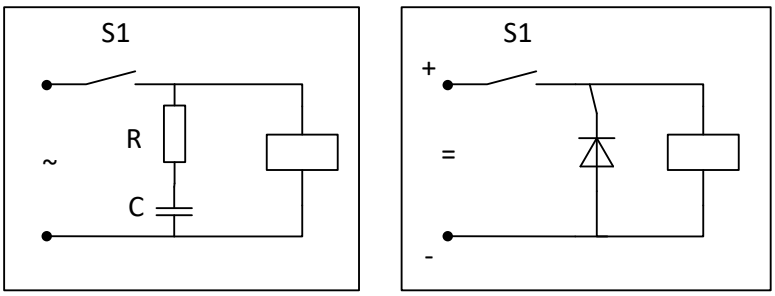


Figure 2.3 Methods of protection of alarm contacts

In the case of a capacitive load, with a cable length of more than 50 m or when connected to a process control system with a capacitive input, connect the protective resistor in series 22 Ω and respectively 47 Ω (for 10 VA contacts) to limit peak currents (Figure 2.4.)

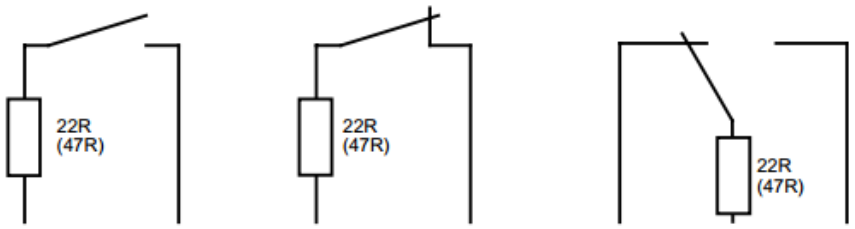
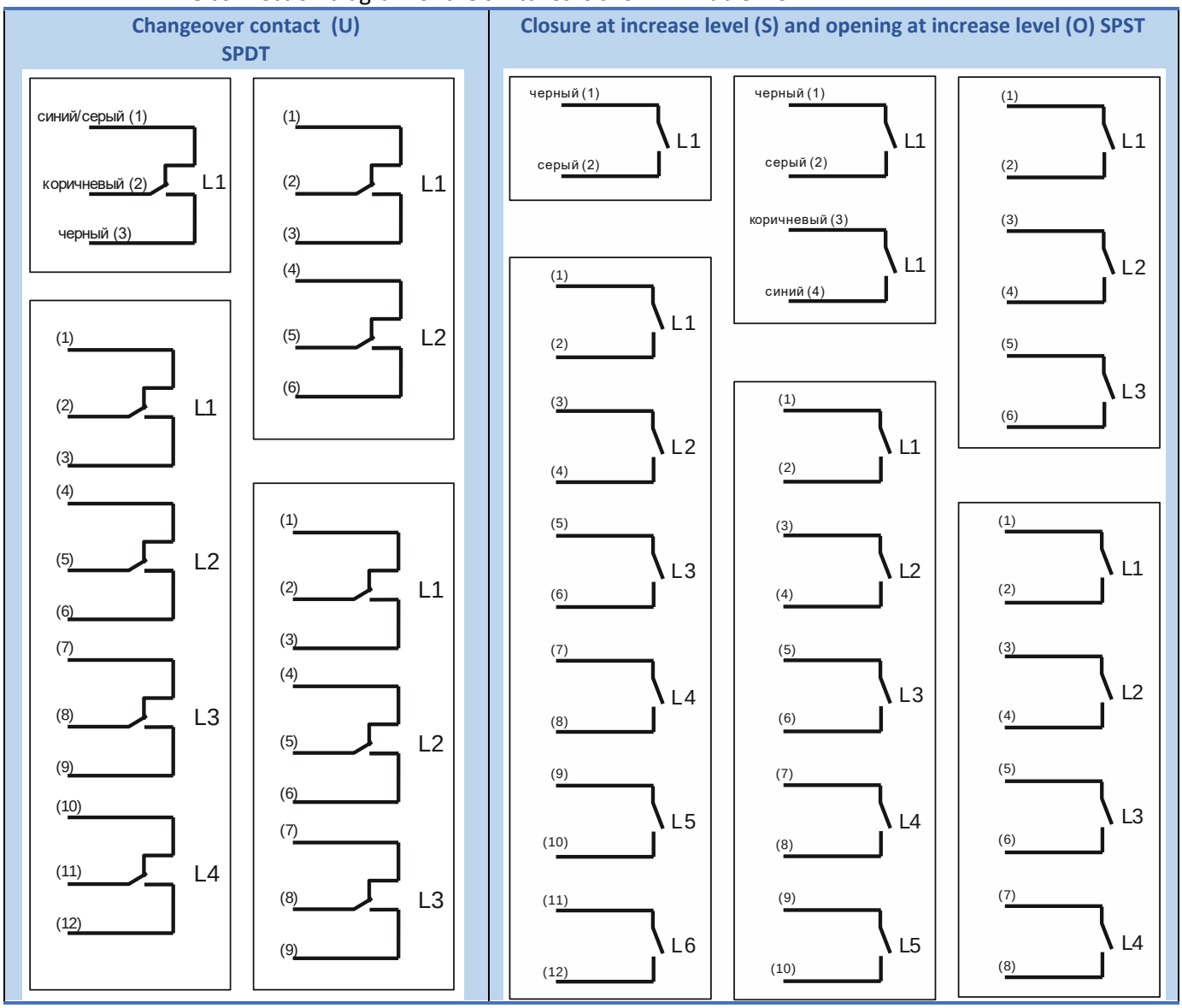


Figure 2.4 Connection of protective resistances

Overloading the alarm can destroy the built-in reed switch. It is imperative that the maximum switching power specified in this manual is observed.

The connection diagram of the switches is shown in Table 2.3.



The serial numbers (position) of the switches increase with the increasing scale of the level indicator (from bottom to top).

2.2.4 Maintenance

Level switches LLS, when properly used, function for a long period of time without mechanical wear.

It is recommended to subject the signaling device cable to a visual inspection for damage during the audit and PPR. If necessary, tighten the terminals to which the signaling device cable is connected.

For maintenance of level gauges LGB, refer to the appropriate operating instructions.

2.3. Troubleshooting

The main element of the level switches LLS device is a magnetically controlled contact with a high service life (the number of operations is at least 10^5), therefore the average service life of the signaling device is 10 years.

The malfunction or inoperability of the LLS level switch device can be expressed in the inability of the latter to switch contacts or several successive switchings with one required. This can be caused by mechanical damage to the signaling device (reed switch), cable damage, incorrect installation of an alarm, incorrect installation of the float, stuck float, loose contact of terminals, exposure to strong disturbing magnetic fields, etc.

Below is an algorithm by which you can carry out operational diagnostics and subsequent elimination of the cause of the malfunction.

1. Make sure that the trigger point of the signaling device is within the range of the float (the indicator rollers at the installation point freely turn over when the float passes).
   If necessary, temporarily move the indicator to a point guaranteed passage of the float to check the reaction to the movement of the float.
2. Make sure that there are no external mechanical damages on the casing of the signaling devices (traces of impact, falling, etc.)
3. Check the functionality of the signaling device itself. To do this, you can use a permanent magnet or a level indicator float: you need to drag the magnet along the body at a distance of ~ 1-2 cm up and down. With correct operation, the contacts of the signaling device should switch, this can be determined by sound (the reed switch switches are heard) or using a multimeter in the resistance test mode: the resistance on the pair from core No. 2 (changeover) and either of the two remaining ones should tend to zero. Attention: If the magnet is very powerful (for example, a large or neodymium magnet), you must not bring it close to the signaling device body - this can lead to the signaling device failure.
   If there is no reaction to the movement of the magnet
4. Check the integrity of the signaling device connecting cable
5. Check the reliability of the contact at the connecting terminals to which the indicator is connected.

If the cause of the malfunction was not found, it is required to send the indicator for diagnostics to the manufacturer.

Section 3. Horizontal float level switch LLS-F-S

Horizontal float level switch LLS-F-S– order code:

LLS-F - ___ - ____ - ____ - ____ - ____ - ___ - ___ - ___ - ___ - ___

1 2 3 4 5 6 7 - 8 - 9 - 10

1 Variants of process connection

S – horizontal design (swing tube)

2 Type of connecting elements / Process connection

A – flange according to ANSI/ASME B16.5
E – flange according to EN1092-1
G – flange according to GOST 12815-80
R – flange according to GOST R 54432-2011 / GOST 33259-2015
| nominal diameter DN
| | nominal pressure PN
| | | the shape of the sealing surface
| | | |
__ __/__/___

MR – Hygienic Union DIN 11851
CP – Flange-clamp DIN 32676
| nominal diameter DN
| | nominal pressure PN
| | | material of seal gasket
| | | |
__ __/__/___

T – Thread connection
| **thread type**
| **M** – metric thread according GOST 24705-81
| **G** – straight thread according DIN EN ISO 228-1 (analogically BSP) (in inches)
| **N** – tapered thread according ANSI/ASME B1.20.1 (in inches)
| | Thread size in millimeters/ inches (for threads M___**x**___ indicates the thread pitch)
| | | **R** – mounting inside of the tank/vessel (optional)
| | | |
__ ___ __/___

X – as agreed with the Customer

3 Guided tube material and connecting elements

V – Stainless steel: 10Cr17Ni13Mo2Ti, 316Ti, 1.4571
L – Stainless steel: 03Cr17Ni14Mo3, 316L, 1.4404, 1.4435
S – Stainless steel: (08)12Cr18Ni10Ti, 321/321H, 1.4541/1.4878
D – Polyvinylidenfluoride PVDF

P – Polypropylene PP
B – Polyvinylchloride PVC
T – Titanium
X – Material on the agreement with the Customer

4 Mounting length

L___ – in mm
Guided tube diameter

/33 33,7 mm

5 Parameters of alarm points

1 - number of alarm points
/
S SPST, closure at increase level (N.O.)
O SPST, opening at increase level (N.C.)
U SPDT, changeover contact

For example:
1/U – 1 alarm point: changeover contact;
1/U/NR – 1 alarm points: changeover contact; Output signal according NAMUR DIN EN 60947-5-6

6 Thermal design (Product temperature)

NT – standard (-60…+150°C)
HT – high-temperature design (-60…+250°C)
HHT – high-temperature design (-60…+450°C)
LT – low-temperature design (-196…+150°C)

7 Electrical connection / Case

Case:
Design of electronic module: A…C
| **|**
| material:
| **A** – aluminum
| **P** – polyester
| **V** – stainless steel
__ **__** – Design of electronic module / material

Connection cable:

__/SIL – length of connection cable (in meter) / silicone isolation (-60…+180°C)
__/PVC – length of connection cable (in meter) / PVC isolation (-40…+80°C)
__/X – length of connection cable (in meter) / cable on the agreement with the Customer
__/__/RD – connection cable reinforced with metal hose from stainless steel

Electrical connectors:

HR – connector DIN 43650 (EN 175301-803)
HM – thread connector M12x1
| contact quantity (3…7)
| | connector form (/ S - angled) (Optional)

```
|   |   |
|   |   |
__  __/___
```

For example:
2/SIL – Silicone connecting cable 2 meters long.
HR4/S – 4-pole angled connector DIN 43650

8 Float

F...
constructive construction:
1 – cylindrical corrugated
2 – cylindrical
3 – spherical
| материал:
| **V** – Stainless steel: 10Cr17Ni13Mo2Ti, 316Ti, 1.4571
| **T** – Titanium
| **D** – Polyvinylidenfluoride PVDF
| **P** – Polypropylene PP
| **B** – Polyvinylchloride PVC
| **F** – PTFE (lining material is listed after of the float material)
| **E** – ECTFE (lining material is listed after of the float material)
| | outside diameter (in mm)
| | | length (in mm)
| | | | maximum pressure (bar)
| | | | |
| | | | |
F _ _ _/_/_

For example:
F1V42/100/16 – cylindrical corrugated float from 316Ti, outside diameter 42mm, without magnetic system, PN16;

N – without float

9 Approvals and certificates

Ex – Explosion-proof version, Ex-marking GOST R ISO 60079-0-2011**: 0Ex ia IIC T6…T1 Ga**;
Exd – Explosion-proof version, Ex-marking GOST R ISO 60079-0-2011**: 1Ex d IIC T6…T1 Gb.**
NC – Level switch LLS is made of materials that comply with the recommendations of NACE: MR0175 and MR0103, ISO Standard 15156
MD – Level switch LLS for sea and river applications. Type approval of products of the Russian Marine Register of Shipping
HD – Level switch LLS for hygienic application
N – common industrial construction

10 Special design of level switches

N – typical design

Пример полного кода заказа:
LLS-F-S-E50/16/B1-L150/33-1/U-NT-AA-F1V42/100/16-N-N;

3.1 Description of level switch

3.1.1 Construction

Figure 3.1 shows a horizontal level switch for installation inside a vessel.

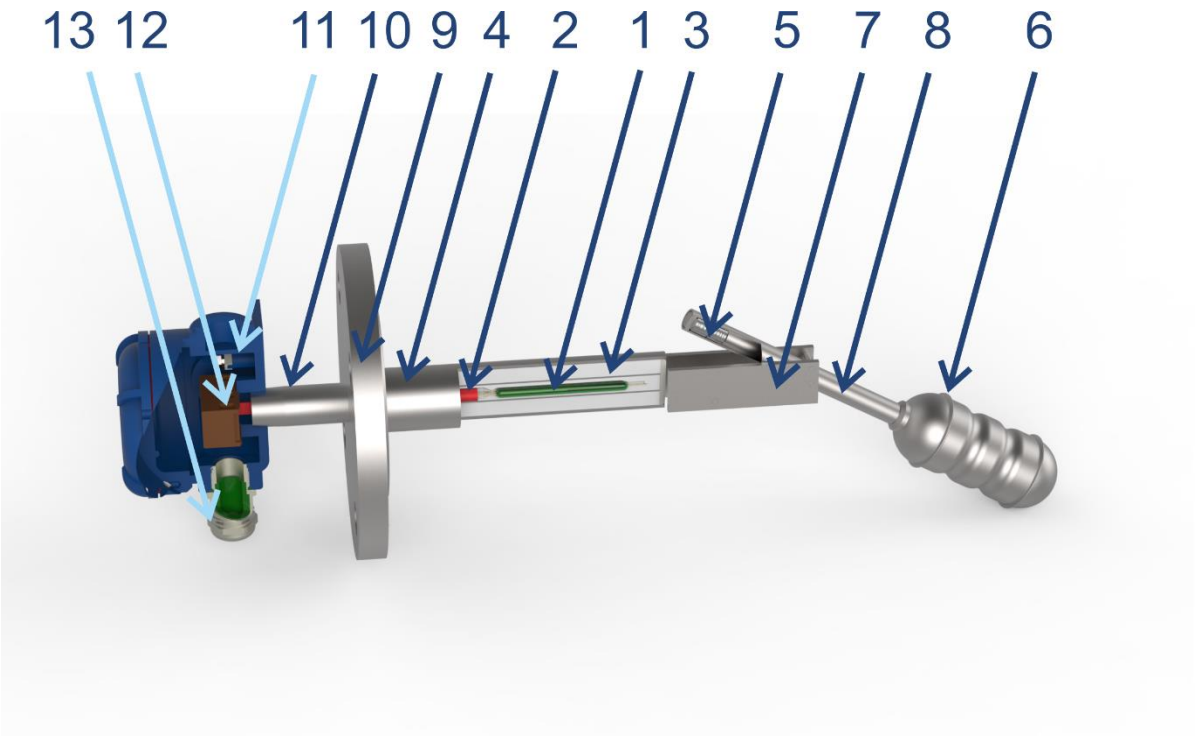


Figure 3.1 LLS-F-S level switch device

It consists of one sealed contact (reed switch) (1) connected to a connecting cable (2). To fix the alarm zone, the reed switch and the cable in the guide tube (4) are filled with compound (3).

The reed switch contacts are controlled by a permanent magnet (5) installed in a tube called a "rocker" (8) to which a float (6) is attached. The rocker arm is fixed on the axis of rotation between the guide plates (7). A stopper is also installed between the guide plates to limit the movement of the rocker arm and float.

A connecting element (9) is provided on the guide tube for installing the signaling device in the place of operation. This can be a thread, a flange, or a compression fitting. A stiffener spar (10) can be installed on the connecting element, which facilitates the installation of the indicator and can serve to remove heat from the electronic unit / housing (11).

The housing is used to install the terminal block (12), in which the cable of the LLS indicator and the switching and / or control cable of the process control system are connected. A cable gland (13) is used to enter the cable into the detector housing.

If the level switch is supplied with a connecting cable, the electronic unit, terminal block and cable gland will be missing.

The contact function of the alarm always depends on an increase in the liquid level (floating of the float).

The horizontal design can use a three-pole so-called "changeover" contact consisting of one NO and one NC contact (SPDT). Thus, using this or that contact, it is possible to control both from raising and lowering the level.

3.1.2 Application area:

The level switch is an automation device and does not belong to measuring instruments. It is designed for discrete control of the level of liquid media.

Scope - for use in automatic control systems, process control and regulation of oil refining, food processing, chemical and other industries.

LLS can be used both inside the buildings and outside in the wide range of climate conditions. They are intended for installation at fixed and movable facilities, production and marine conditions, including vibration and other negative conditions. The devices do not require periodic adjustment and require minimum maintenance during operation. These devices do not require periodic adjustments and require minimal maintenance during operation.

The level switches can be used in conventional and explosion-hazard areas in compliance with regulatory documents specifying application of the equipment in explosion hazard zones.

Explosion-proof design of the level switches feature " intrinsically safe" or “flameproof enclosure” type of protection. These designs of the level switches have 0ExiaIIC T6… T1 Ga or 1ExdIIC T6… T1 Gb explosion safety marks. Such level switches include additional construction elements and schematic engineering solutions and require connection to the relevant electrical circuits.

3.1.3 Technical specifications:

The technical specifications of horizontal float level switch LLS-F-S are shown in table 3.1.

Table 3.1. Technical and electrical specifications of horizontal float level switch **LLS-F-S**

Product temperature	from -60 to +150 °C (NT) from -196 to +150 °C (LT) from -60 to +250 °C (HT) from -60 to +450 °C (HHT)	
Ambient temperature	from -60 °C to +85 °C	
Product density	≥330 kg/m3	
Nominal pressure	from -1 to 400 bar	
Guided tube diameter	standard 33,7 mm	
Mounting length	standard to 1000 mm	
Ingress protection class, IP:	IP66 (for version case AA, BA, CA, DA), IP68 (for version case FV)	
Explosion protection	Witout Ex 0Ex ia IIC T6…T1 Ga / 1Ex d IIC T6…T1 Gb	
Type contact	**Load capacity / maximum number of alarm points**	
S / O	AC: 250 V, 100 V*A, 1 A DC: 250 V, 100 W, 1 A	1 pcs.
U	AC: 250 V, 60 V*A, 1 A DC: 250 V, 60 W, 1 A	1 pcs.
/NR	DC: ≤ 8,2 V, 8 mA	
Ex i	Only for use in Ex-circuit: ≤ 30 V, ≤ 100mA	

Таблица 3.2. Intrinsically safe circuit parameters

Intrinsically safe circuit parameters	
Maximum input voltage Ui, V	30*
Maximum input current Ii, mA	100
Maximum input power Pi, W	1,0
Maximum internal capacitance Ci, µF	0,08
Maximum internal inductance Li, mH	1

* specific values Ui, Ii are limited by the maximum value of the input power Pi and cannot affect the input of the signaling devices simultaneously

3.1.4 Corrosion resistance:

All level switches details contacting with measured media and environment can be made of corrosion resistant and oxidation resistant materials, 316Ti, 316L stainless steels. However, even more resistant materials (Titanium 3.7045, Hastelloy C, Monel) can be used to operate in highly corrosive products, when the corrosion resistance of the aforementioned grades is insufficient. These materials are used to manufacture the parts which shall contact the product or its vapor, and sometimes to manufacture the whole level switch. Sometimes, application of protective coating to the parts of the level switch contacting with the measured medium can be sufficient.

Moreover, it is possible to produce the chamber made of non-conventional materials (09Г2С steel, steel 20, etc.), polymer materials (polyvinylidenfluoride/PVDF, polypropylene/PP, polyethylene/PE, polyvinylchloride/PVC-U/PVC-C and etc.).

3.2. Operation

3.2.1 Safety precautions:

Failure to comply with maximum values of stated process parameters may result in the damage of the level switch and entail emergency situation and hazard to the health and life of the maintenance personnel, contamination of environment and property damage. Personnel performing works on installation, disassembly, operation and maintenance of the level switch shall read and understand this operation manual and trained on safety.

When LLSs are used for explosion-hazard areas, installation and operation shall be performed by trained specialists duly certified and approved to operate in accordance with regulations and rules acting at the territory of the state and the enterprise. To increase the contact life, it is recommended operation together with an intermediate relay. The electrical connection must correspond to the wiring diagram indicated on the signaling device (the wiring diagram is not indicated on signaling devices with one NC or NO).

Recomendations:

- in case of process changes (new abrasive particles/crystallizing medium/polymerizing medium) during operation of the level switch not intended for use under such new factors, please, consult manufacturer's specialists;
- when installing level switches LLS inside the hazardous area, it is imperative to make sure that the connection to the protected electrical circuits is made correctly.

Prohibited:

- check the functionality of the signaling devices with a magnet. For this operation, use the float and the indicator rocker.
- install the level switch at a distance of less than 1 meter from sources of strong electromagnetic fields.
- self-repair of level switch parts and their replacement without notifying the manufacturer.
- use of a level switch with traces of mechanical and chemical damage until the causes that led to their appearance are eliminated.
- try to independently make changes to the design of level switches
- use of submersible level switches in the environment, the neutrality of which to the materials used in the switch has not been proven.

The manufacturer may not guarantee compliance with the stated data sheet specifications if certain elements of the level switches LLS are replaced by persons other than representatives of the manufacturer.

3.2.2 Installation and disassembly level switch LLS

Attention! Before installation/disassembly of the level switch LLS it is recommended to check the vessel for residues of aggressive and toxic substances, check shut-off fittings for leakages, check temperature of the machine/vessel outer walls to prevent mechanic, thermal burns and other harm to personnel in charge of installation. Personnel shall use special clothes and personal protective equipment during installation/disassembly.

3.2.2.1 Installation:

Align the axis of the guide tube (5) with the center of the mounting sleeve. Insert the signaling device into the mounting socket, holding the float (7) from damage.

Pay attention to correct installation position (float must be folded down when not activated). In the case of installation in nozzles, make sure that the float swings freely.

A suitable gasket (4) must be used for sealing. When choosing gaskets, special attention should be paid to the chemical and thermal resistance of the gasket material. For the version with threaded connection, screw the indicator into the thread. Select the tightening torque in accordance with the standards for this type of screw connection. For flanged versions, use appropriate screws and nuts.

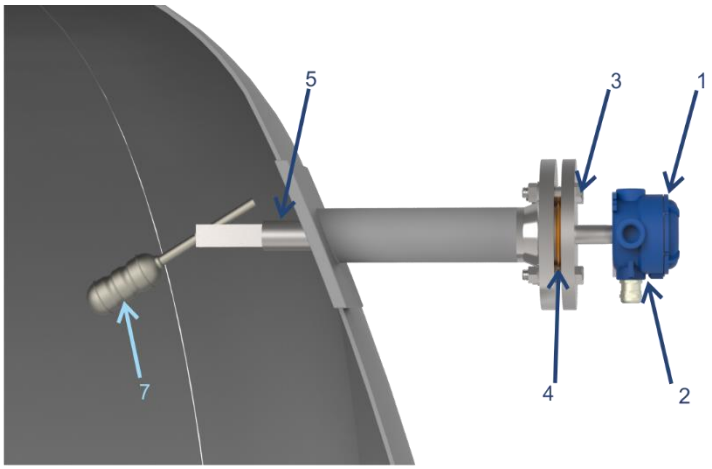


Figure 3.2 Installation of a horizontal signaling device.

1.2.2.2 Disassembly:

Make sure that the container is emptied or the remnants of the medium to be measured do not pose a hazard to the personnel and / or the environment, and the electrical circuits are not energized.

Perform the actions indicated in the item "installation" in the reverse order.

3.2.3 Electrical connection

All level switches are supplied with an installed junction box (housing).

When connecting a level switch via a terminal box - it is required to remove the terminal box cover. Then feed the cable through the cable entry in the terminal box. Cut the cable and connect the contacts according to the required switching function. Fasten the routed cable tightly inside the cable gland. Close the terminal box cover tightly. Installation should be carried out with a cable with a cross

section of at least 0.75mm2 with an appropriate number of cores. When connecting, pay particular attention to the cable glands used.

Operation of magnetic float switches with inductive or capacitive load can destroy the reed switch. This, in turn, can lead to disturbances in the operation of the downstream control unit and to health hazards and material damage. In the case of inductive load, the signaling devices must be protected by a capacitive-resistive link or an idle diode.

Меры по защите контактов сигнализаторов

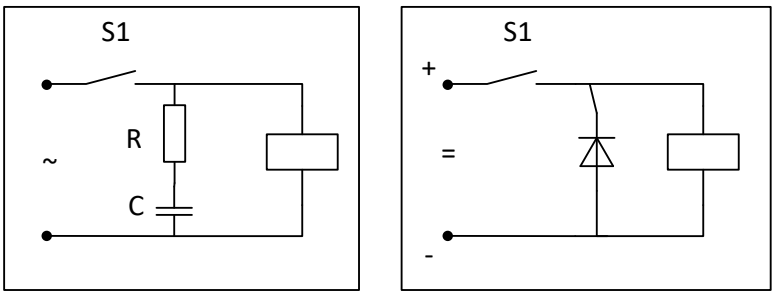


Рисунок 3.3 Methods of protection of alarm contacts

In the case of a capacitive load, with a cable length of more than 50 m or when connected to a process control system with a capacitive input, connect the protective resistor in series 22 Ω and

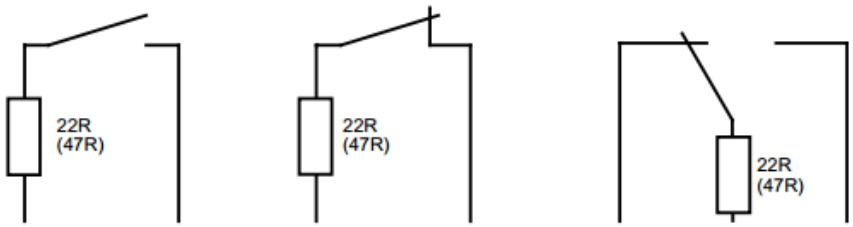
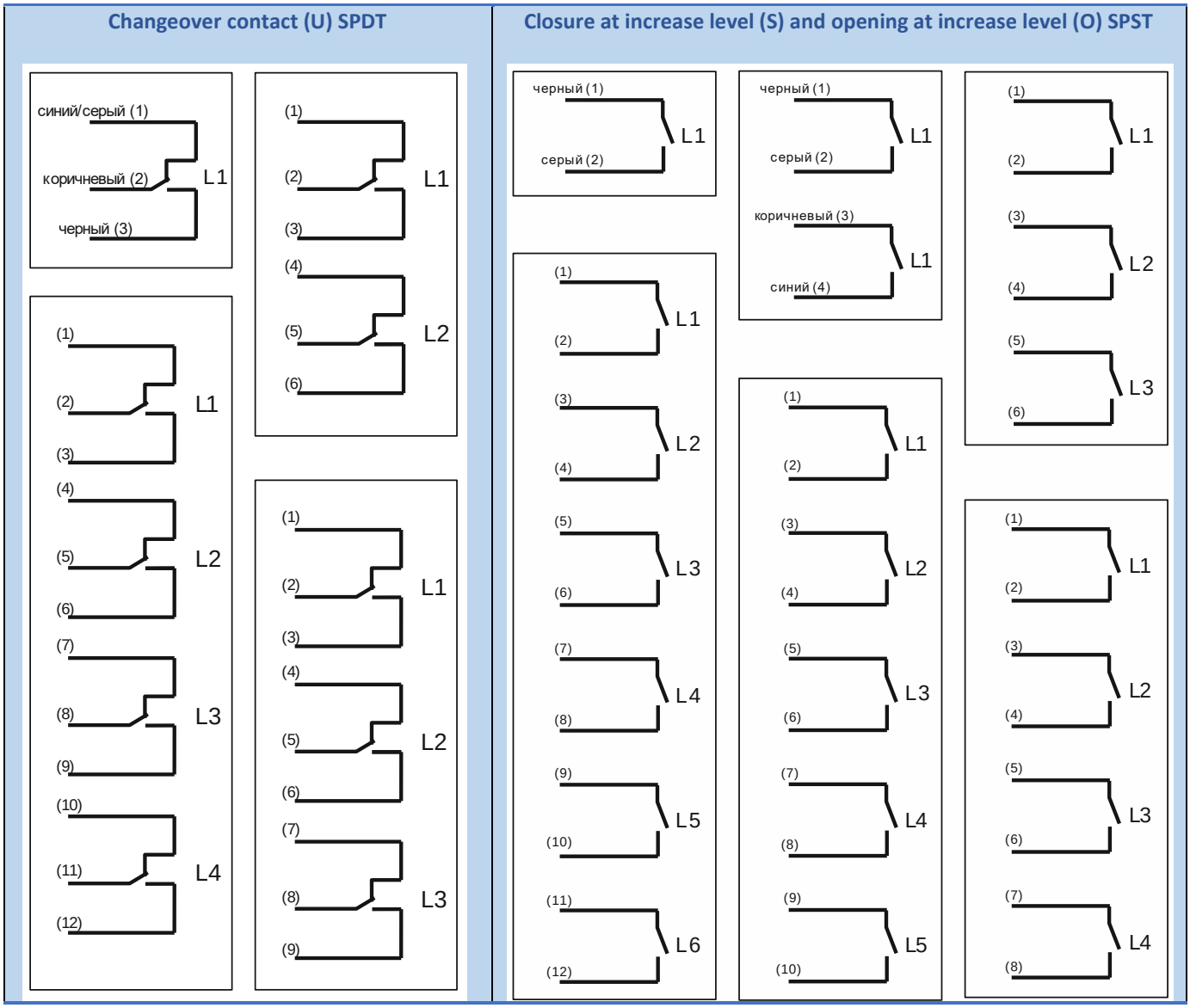


Рисунок 3.4 Connection of protective resistances

respectively 47 Ω (for 10 VA contacts) to limit peak currents (Figure 3.4.)

Overloading the alarm can destroy the built-in reed switch. It is imperative that the maximum switching power specified in this manual is observed.

The connection diagram of the switches is shown in Table 3.2.



3.2.4 Maintenance

The level switches LLS operate for a long time without any wear under regular operation.

Visually inspect the float, guided tube and other structural elements for signs of corrosion, oxidation during inspections and planned maintenance of the vessel/tank. If necessary, clean the structural elements of the level switches. To remove and assemble the float, please, follow instructions of section 2.2 "Installation and Disassembly" of this manual.

3.3. Troubleshooting

The main element of the level switches LLS device is a magnetically controlled contact with a high service life (the number of operations is at least 10^5), therefore the average service life of the signaling device is 12 years.

The malfunction or inoperability of the LLS level switch device can be expressed in the inability of the latter to switch contacts or several successive switchings with one required. This can be caused by

mechanical damage to the signaling device (reed switch), cable damage, incorrect installation of an alarm, incorrect installation of the float, stuck float, loose contact of terminals, exposure to strong disturbing magnetic fields, etc.

Below is an algorithm by which you can carry out operational diagnostics and subsequent elimination of the cause of the malfunction.

1. Make sure that there are no external mechanical damages on the housing, guide tube, float of the signaling device (traces of impact, falling, etc.).
   If available, consult the manufacturer.
2. Check the possibility of free movement of the float along the guide pipe (no bends or non-linearities in the pipe, overlaps / build-up on the float and the guide pipe).
   If there are adhesions / deposits - clean them, if there are irregularities on the pipe that impede the movement of the float - consult the manufacturer.
3. Using a tape measure, measure the length of the branch pipe into which the signaling device is installed - this length, together with the thickness of the tank walls, should be less than the length from the sealing surface to the end of the signaling device guide pipe.
   If the length of the branch pipe is longer than the length of the guide pipe, make sure that the indicator is able to lower the float to the lowest point inside the branch pipe. If the size of the branch pipe does not allow it, it should be shortened.
4. Check the tightness of the connection cable on the terminal block.
   If contact is loose, tighten tighten.
5. Check the reed switch function with a multimeter by moving the float along the guide tube.
   If the reed switches do not operate, contact the manufacturer.

If the cause of the malfunction was not found, it is required to send the indicator for diagnostics to the manufacturer.

Section 4. Pontoon level switch LLS-P

Pontoon level switch LLS-P – order code:

LLS-P - ___ - ____ - ____ - ____ - ____ - ___ - ___ - ___ - ___ - ___

1 2 3 4 5 6 7 - 8 - 9 - 10

1 Type of connecting elements / Process connection

A – flange according to ANSI/ASME B16.5
E – flange according to EN1092-1
G – flange according to GOST 12815-80
R – flange according to GOST R 54432-2011 / GOST 33259-2015

```
|  nominal diameter DN
|  |  nominal pressure PN
|  |  |  the shape of the sealing surface
|  |  |  |
__ __/__/___
```

MR – Hygienic Union DIN 11851
CP – Flange-clamp DIN 32676

```
|  nominal diameter DN
|  | nominal pressure PN
|  |  |  material of seal gasket
|  |  |  |
__ __/__/___
```

T – Thread connection
F – Sliding compression fitting

```
|  thread type
|  M – metric thread according GOST 24705-81
|  G – straight thread according DIN EN ISO 228-1 (analogically BSP) (in inches)
|  N – tapered thread according ANSI/ASME B1.20.1 (in inches)
|  |  Thread size in millimeters/ inches (for threads M___x___ indicates the thread pitch)
|  |  |  R – mounting inside of the tank/vessel (optional)
|  |  |  |
__ ___ __/___
```

X – as agreed with the Customer
N – without connection

2 Rope and connecting elements material

V	–	Stainless steel: 10Cr17Ni13Mo2Ti, 316Ti, 1.4571
L	–	Stainless steel: 03Cr17Ni14Mo3, 316L, 1.4404, 1.4435
S	–	Stainless steel
X	–	Material on the agreement with the Customer

3 Mounting length

L___ – in mm

4 Parameters of alarm points

U SPDT, changeover contact
/NR Output signal according **NAMUR DIN EN 60947-5-6**

5 Thermal design

NT – standard (-60…+80°C)
HT – high-temperature design (-60…+200 °C)
LT – low-temperature design (-100…+400 °C)

6 Electrical connection / Case

Case:
Design of electronic module (see data sheet. 5.4): A…F
| material:
| **A** – aluminum
| **P** – polyester
| **V** – stainless steel
__ __ – Design of electronic module / material

7 Load (counterweight)

C...
constructive construction:
6 – cylindrical
7 – spherical
| материал:
| **V** – Stainless steel: 10Cr17Ni13Mo2Ti, 316Ti, 1.4571
| **L** – Stainless steel: 03Cr17Ni14Mo3, 316L, 1.4404, 14435
| **S** – Stainless steel
| **T** – Titanium
| **X** – Material on the agreement with the Customer
| | diameter (in mm)
| | | load length (mm)
C _ _ _/__
For example:
C6S40/70 – cylindrical load from stainless steel, diameter 40mm,lenght 70mm
F4V27/10/A/20 – cylindrical float with hole from 316Ti, outside diameter 27mm and 10 mm hole diameter, Magnetic system A, PN20;
F4T44/15/A/16 – cylindrical float with hole from titanium, outside diameter 44mm and 15 mm hole diameter, Magnetic system A, PN16;

8 Approvals and certificates

Ex – Explosion-proof version, Ex-marking GOST R ISO 60079-0-2011**: 0Ex ia IIC T6…T1 Ga**;
Exd – Explosion-proof version, Ex-marking GOST R ISO 60079-0-2011**: 1Ex d IIC T6…T1 Gb.**
MD – Level switch LLS for sea and river applications. Type approval of products of the Russian Marine Register of Shipping
N – common industrial construction

9 Special design of level switches

N – typical design
LI – светодиодная индикация
For example complete order code: LLS-P-E100/40/E-L3000-U/NR-NT-EA-C6S40/70-Exd-N

4.1 Description of level switch

4.1.1 Construction

Figure 4.1 shows the level switch.

It consists of one sealed contact (reed switch) (1) connected to a connecting cable (2).

The reed switch contacts are controlled by a magnetic system (3) installed in the tube (4). To the magnetic system of which a cable (5) is attached, on which a load (6) is suspended.

A connecting element (7) is provided for installing the indicator at the place of operation. It can be a thread, a flange, a compression fitting.

The housing is used to install the terminal block (8), which connects the LLS signal cable and the switching and / or control cable of the process control system. A cable gland (9) is used to enter the cable into the detector housing.

If the level switch is supplied with a connecting cable, the electronic unit, terminal block and cable gland will be missing.

The contact function of the alarm always depends on an increase in the liquid level (floating of the float).

Figure 4.1 LLS-P level switch construction

The horizontal design can use a three-pole so-called "changeover" contact consisting of one NO and one NC contact (SPDT). Thus, using this or that contact, it is possible to control both from raising and lowering the level.

4.1.2 Application area:

The level switch is an automation device and does not belong to measuring instruments. It is designed for discrete control of the level of liquid media.

Scope - for use in automatic control systems, process control and regulation of oil refining, food processing, chemical and other industries.

LLS can be used both inside the buildings and outside in the wide range of climate conditions. They are intended for installation at fixed and movable facilities, production and marine conditions, including vibration and other negative conditions. The devices do not require periodic adjustment and require minimum maintenance during operation. These devices do not require periodic adjustments and require minimal maintenance during operation.

The level switches can be used in conventional and explosion-hazard areas in compliance with regulatory documents specifying application of the equipment in explosion hazard zones.

Explosion-proof design of the level switches feature " intrinsically safe" or “flameproof enclosure” type of protection. These designs of the level switches have 0ExiaIIC T6… T1 Ga or 1ExdIIC T6… T1 Gb explosion safety marks. Such level switches include additional construction elements and schematic engineering solutions and require connection to the relevant electrical circuits.

4.1.3 Technical specifications:

The technical specifications of pontoon level switch LLS-P are shown in table 4.1.

Table 4.1. Technical and electrical specifications of pontoon level switches **LLS-P**

Product temperature	from -60 to +80 °C (NT) from -100 to +400 °C (LT) from -60 to +200 °C (HT)	
Ambient temperature	from -60 °C to +85 °C	
Product density	≥330 kg/m3	
Nominal pressure	from -1 to 400 bar	
Mounting length	standard to 3000 mm	
Ingress protection class, IP:	IP66 (for version case DA)	
Explosion protection:	Witout Ex 0Ex ia IIC T6…T1 Ga / 1Ex d IIC T6…T1 Gb	
Type contact	**Load capacity / maximum number of alarm points**	
U	AC: 250 V, 60 V*A, 1 A	1pcs.
	DC: 250 V, 60 W, 1 A	1 pcs.
U /NR	DC: ≤ 8,2 V, 8 mA Only for use in Ex-circuit: ≤ 30 V, ≤ 100mA	1 pcs.
Ex i	Only for use in Ex-circuit: ≤ 30 V, ≤ 100mA	

Таблица 4.2. Intrinsically safe circuit parameters

Intrinsically safe circuit parameters	
Maximum input voltage Ui, V	30*
Maximum input current Ii, mA	100
Maximum input power Pi, W	1,0
Maximum internal capacitance Ci, µF	0,08
Maximum internal inductance Li, mH	1

* specific values Ui, Ii are limited by the maximum value of the input power Pi and cannot affect the input of the signaling devices simultaneously

4.1.4 Corrosion resistance::

All level switches details contacting with measured media and environment can be made of corrosion resistant and oxidation resistant materials, 316Ti, 316L stainless steels. However, even more resistant materials (Titanium 3.7045, Hastelloy C, Monel) can be used to operate in highly corrosive products, when the corrosion resistance of the aforementioned grades is insufficient. These materials are

used to manufacture the parts which shall contact the product or its vapor, and sometimes to manufacture the whole level switch. Sometimes, application of protective coating to the parts of the level switch contacting with the measured medium can be sufficient.

Moreover, it is possible to produce the chamber made of non-conventional materials (09Г2С steel, steel 20, etc.), polymer materials (polyvinylidenfluoride/PVDF, polypropylene/PP, polyethylene/PE, polyvinylchloride/PVC-U/PVC-C and etc.).

4.2. Operation

4.2.1 Safety precautions

Failure to comply with maximum values of stated process parameters may result in the damage of the level switch and entail emergency situation and hazard to the health and life of the maintenance personnel, contamination of environment and property damage. Personnel performing works on installation, disassembly, operation and maintenance of the level switch shall read and understand this operation manual and trained on safety.

When LLSs are used for explosion-hazard areas, installation and operation shall be performed by trained specialists duly certified and approved to operate in accordance with regulations and rules acting at the territory of the state and the enterprise. To increase the contact life, it is recommended operation together with an intermediate relay. The electrical connection must correspond to the wiring diagram indicated on the signaling device (the wiring diagram is not indicated on signaling devices with one NC or NO).

Recomendations:

- in case of process changes (new abrasive particles/crystallizing medium/polymerizing medium) during operation of the level switch not intended for use under such new factors, please, consult manufacturer's specialists;
- when installing level switches LLS inside the hazardous area, it is imperative to make sure that the connection to the protected electrical circuits is made correctly.

Prohibited:

- check the functionality of the switches with a magnet. For this operation, a float switch should be used.
- install the level switch at a distance of less than 1 meter from sources of strong electromagnetic fields.
- self-repair of level switch parts and their replacement without notifying the manufacturer.
- use of a level switch with traces of mechanical and chemical damage until the causes that led to their appearance are eliminated.
- try to independently make changes to the design of level switches.
- the use of submersible level switches in an environment whose neutrality to the materials used in the switch has not been proven.

The manufacturer may not guarantee compliance with the stated data sheet specifications if certain elements of the level switches LLS are replaced by persons other than representatives of the manufacturer.

4.2.2 Installation and disassembly level switch LLS

Attention! Before installation/disassembly of the level switch LLS it is recommended to check the vessel for residues of aggressive and toxic substances, check shut-off fittings for leakages, check temperature of the machine/vessel outer walls to prevent mechanic, thermal burns and other harm to personnel in charge of installation. Personnel shall use special clothes and personal protective equipment during installation/disassembly.

4.2.2.1 Installation:

Installation, operation, adjustment should be carried out by trained specialists, certified and admitted to work in the prescribed manner in accordance with the rules and regulations in force in the territory of the Russian Federation and this enterprise.

A suitable gasket must be used for sealing. When choosing gaskets, special attention should be paid to the chemical and thermal resistance of the gasket material. For the version with threaded connection, screw the indicator into the thread. Select the tightening torque in accordance with the standards for this type of screw connection. For flanged versions, use appropriate screws and nuts.

Pay particular attention to the correct installation position *(maximum deviation from vertical ± 30 °).*

4.2.2.2 Disassembly:

Make sure that the container is emptied or the remnants of the medium to be measured do not pose a hazard to the personnel and / or the environment, and the electrical circuits are not energized.

Perform the actions indicated in the item "installation" in the reverse order.

4.2.3 Electrical connection

All level switches are supplied with an installed junction box (housing)

When connecting a level switch via a terminal box - it is required to remove the terminal box cover. Then feed the cable through the cable entry in the terminal box. Cut the cable and connect the contacts according to the required switching function. Fasten the routed cable tightly inside the cable gland. Close the terminal box cover tightly. Installation should be carried out with a cable with a cross section of at least 0.75mm2 with the appropriate number of lived.

Operation of magnetic float switches with inductive or capacitive load can destroy the reed switch. This, in turn, can lead to disturbances in the operation of the downstream control unit and to health hazards and material damage. In the case of an inductive load, the signaling devices must be protected by a capacitive-resistive element or an idle diode.

Меры по защите контактов сигнализаторов

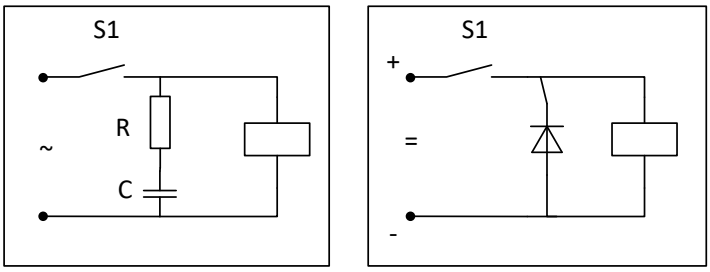


Рисунок 4.3 Methods of protection of alarm contacts

In the case of a capacitive load, with a cable length of more than 50 m or when connected to a process control system with a capacitive input, connect the protective resistor in series 22 Ω and

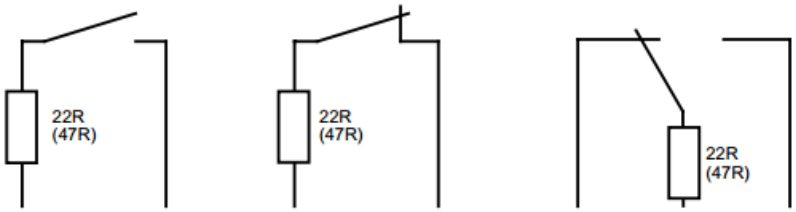
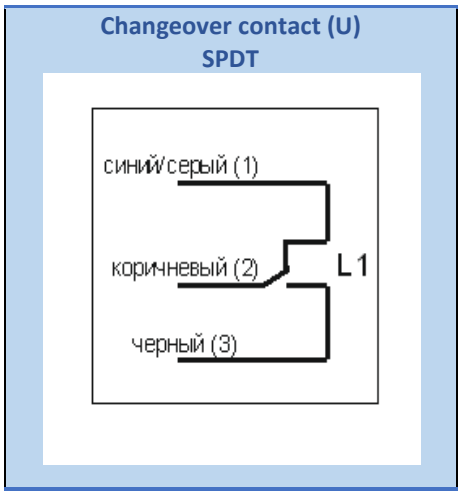


Рисунок 4.4 Подключение защитных сопротивлений

respectively 47 Ω (for 10 VA contacts) to limit peak currents (Figure 4.4.)

Overloading the alarm can destroy the built-in reed switch. It is imperative that the maximum switching power specified in this manual is observed.

The connection diagram of the switches is shown in Table 4.2.



4.2.4 Maintenance

The level switches LLS operate for a long time without any wear under regular operation.

Visually inspect the float, guided tube and other structural elements for signs of corrosion, oxidation during inspections and planned maintenance of the vessel/tank. If necessary, clean the

structural elements of the level switches. To remove and assemble the float, please, follow instructions of section 4.2 "Installation and Disassembly" of this manual.

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4.3. Troubleshooting

The main element of the level switches LLS device is a magnetically controlled contact with a high service life (the number of operations is at least 10^5), therefore the average service life of the signaling device is 12 years.

The malfunction or inoperability of the LLS level switch device can be expressed in the inability of the latter to switch contacts or several successive switchings with one required. This can be caused by mechanical damage to the signaling device (reed switch), cable damage, incorrect installation of an alarm, incorrect installation of the float, stuck float, loose contact of terminals, exposure to strong disturbing magnetic fields, etc.

Below is an algorithm by which you can carry out operational diagnostics and subsequent elimination of the cause of the malfunction.

4. Make sure that there are no external mechanical damages on the housing, cable, moving part of the signaling device (traces of impact, falling, etc.).

If available, consult the manufacturer.

5. Check the possibility of free movement of the load with the magnetic system (absence, overlapping / sticking on the cable).

If there are build-ups / deposits, clean them off.

6. Using a tape measure, measure the length of the branch pipe into which the signaling device is installed - this length, together with the thickness of the container walls, should be less than the length from the sealing surface to the end of the signaling device weight.

If the length of the branch pipe is greater than the length of the guide pipe, make sure that the signaling device can lower the weight to the lowest point inside the branch pipe. If the dimensions of the branch pipe do not allow this, the length of the cable must be increased or the branch pipe must be shortened.

7. Check the tightness of the connection cable on the terminal block.

If contact is loose, tighten tighten.

8. Check the reed switch function with a multimeter. When the load is lifted, the function of the reed switch contacts must be switched.

If the reed switches fail to operate, contact the manufacturer.

If the cause of the malfunction was not found, it is required to send the indicator for diagnostics to the manufacturer.

Appendix 1. Certificates and approval documentation

Certificate of Conformity TR CU 012/2011, № ЕАЭС RU C-RU.НА65.В.00756/20, серия RU № 0249391. Valid until 24.09.2025г.

Declaration of conformity TR CU 004/2011, № ЕАЭС N RU Д-RU.ПХ01.В.17330/20. Valid until 20.05.2025г.

Declaration of conformity TR CU 020/2011, № ЕАЭС N RU Д-RU.ПХ01.В.16762/20. Valid until 14.05.2025г.

Declaration of conformity TR CU 010/2011: ЕАЭС N RU Д-RU.АЖ49.В.10785/20. Valid until 27.07.2025г.

Certificate of Conformity GOST R № РОСС RU.НВ61.Н06800. Valid until 19.05.2023г.

Certificate of Conformity GOST R № РОСС RU.АД07.Н01048. Valid until 13.10.2022г.

Certificate of Conformity № РОСС 31885.04РУК0/СМК000048-18. Valid until 13.11.2021г.