Liquid level transmitter LLT-RS installation and operating manual

265152120.93067824.РЭ-LLT-RS

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This operation manual is used to describe operation principles, constriction, operation, safe operation of all modifications of LLT-RS potentiometric level sensors (hereinafter - LLT), 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.

LLT are manufactured as per technical specifications TU 4214 - 001 - 93067824 - 2013.

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

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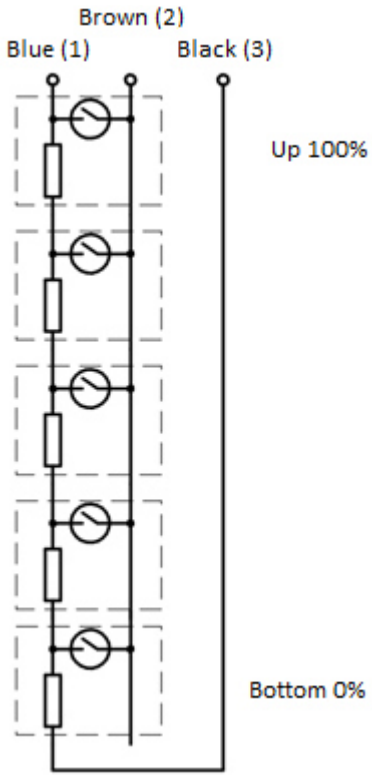
1.Description of level sensor LLT-RS

1.1. Operation principle:

Level sensor LLT-RS can have different construction in depend of design.



Operation principle of level sensors LLT-RS: measuring circuit consist resistive-reed chain (Figure 1) placed inside the protective tube guide (including corrugated), which made of a material resistant to aggressive media. Magnetic field of float affect with reeds and measuring circuit works like 3-wires potentiometer scheme. The voltage measured at the middle contact 2 (brown wire) of the resistive-reed chain, is proportional to the level of measuring media. Depending on the measurement accuracy requirements available different raster (distance between elements): 5 mm; 10 mm or 15 mm

Level sensors have two basic designs:

- for work together with the external camera of the LGB level gauge (using the level gauge float);
- for direct measurement of the liquid level with its own float;

The main advantage of these type level sensors is independence on such destabilizing factors as: the formation of foam or bubbles, the change in current conductivity and permittivity, vibration, pressure and temperature in the below-mentioned limits.

In depended of design level sensor can have junction box, connection cable required length and isolation type, or standard connector, like DIN 43650.

For conversion of output potentiometric signal level sensors is equipped with secondary transmitter different types of output signal types or explosion proof.

Type of output signal depend of using secondary transmitter, for example: PR5350B provide Foundation Fieldbus / ProfiBUS PA output signal in Ex-circuit, but PR5343A provide “current-loop” signal in common industrial design.

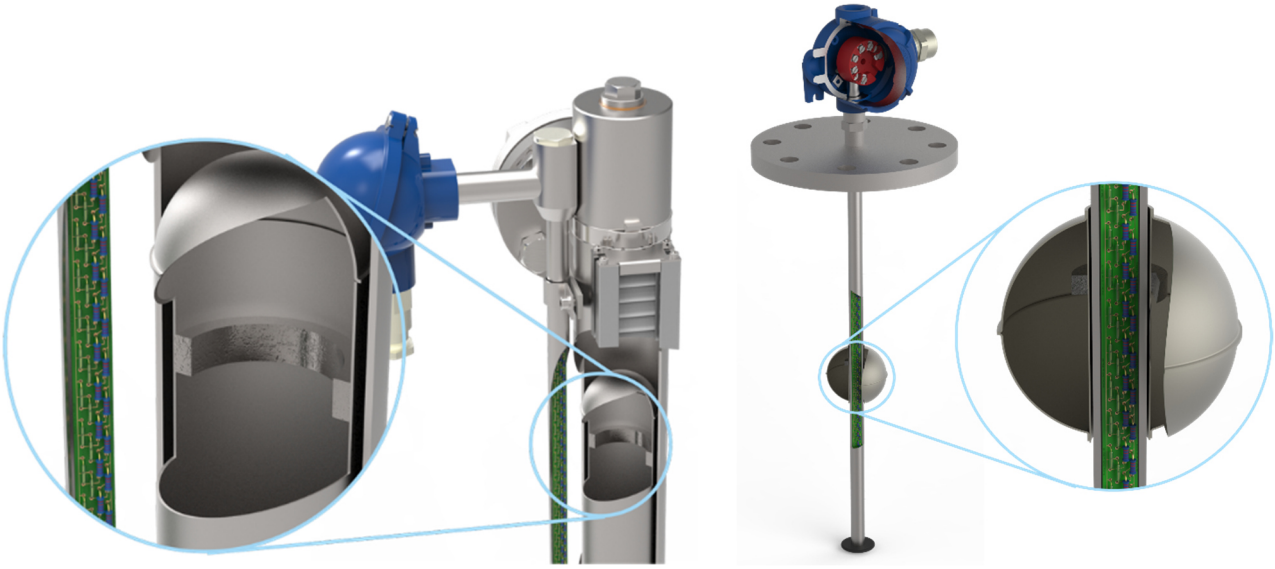


Figure 2. Outward and structure

Figure 2. shows outward and structure of level sensors LLT-RS.

Guided tube with mounted PCB connecting with junction box. In guided tube placed mounting element: flange, thread/ sliding fitting; In design for work together with the external camera of the LGB level gauge mounting element on guided tube is absent: its function is performed by the bracket on external chamber.

Float of level sensors can be different construction in depend of characteristic of measuring media: temperature, pressure, density, corrosion activity and etc.

Bottom end of guided tube equipped limiting ring with damping gasket from PTFE for exclusion of dropping out of float. The gasket is designed to prevent sparks and mechanical wear of the float. Limiting ring can have additional centration element if necessary.

Junction box have unmounting cap and threated hole for cable gland, selected in depended of ambient conditions. Terminal block or secondary transmitter can be mounted in junction box if necessary.

1.2 Application area:

The level sensors is designed for measurements of the upper level or interface of liquid media, including food and explosive.

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

LLT-RS 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.

The level sensors 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 sensors feature " intrinsically safe" or “flameproof enclosure” type of protection. These designs of the level gauges have 0 Exia IIC T6…T2 Ga, 1 Exd IIC T6…T2 Gb, 0Ex d ia IIC T6…T2 Gb explosion safety marks. Such level sensors include additional construction elements and schematic engineering solutions providing possibility of operation in hazardous areas, and require connection to the relevant electrical circuits.

1.3 Technical specifications:

Operating medium density: 320...2000 kg/m3;(1)

Temperature range of the measured medium: - 196…+250 °C; (2)

Ambient temperature range: -60…+85 °C ;(3)

Operating gauge pressure: -0,1…42 MPa;(4)

Frequency of reeds installation: 4.5 / 9 / 13 mm;

Ingress protection: IP66 - IP68;

Supply voltage: 8…36 V;

Output signal: signal depend of using secondary transmitter: “current loop”, HART, ModBUS, ProfiBUS PA, Foundation Fieldbus and etc.);

Cable gland thread: ISO M16x1,5 / M20x1,5 / NPT ½” / PG13,5 and etc.;

Dimensions of the electronic block, not more than, mm: 125x150x150;

Type of explosion proof (optional): 0ExiaIIC T6…T2 Ga / 1ExdIIC T6…T2 Gb / 0ExdiaIIC T6...T2 Gb;

Weight, not more than, kg: 50.

Table 1 - Accuracy of measurements of the LLT-RS.

	with solid probe			with flexible probe		
Frequency of reeds installation (5)	5	10	15	5	10	15
Absolute accuracy, mm	±5	±10	±15	±5	±10	±15
Ambient temperature effect per 10 °C, % of span	±0,3	±0,5	±0,8	±0,3	±0,5	±0,8
Accuracy of output signal “Current loop”, % of Span	±0,3	±0,5	±0,8	±0,3	±0,5	±0,8

Notes:

(1)Bypass mounting level sensor LLT-RS working from magnetic field of float of level gauge LGB (see p.1.3.3 of this instruction);

(2) (3) (4) Depending from design;

(5) Frequency of reeds installation depending from order and established during production.

1.3.1 Corrosion resistance:

All level **sensors** 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 gauge. Sometimes, application of protective coating to the parts of the level gauge 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.).

1.3.2 Electrical characteristic

The LLT level sensors is allowed to be used both in explosive zones and in general industrial conditions.

If the transmitter is used in potentially explosive areas, it must be connected to power supplies / transmitters / measuring devices that have built-in or external intrinsically safe barriers.

Intrinsically safe barriers must supply the following electrical parameters:

Ui ≤ 30 = В;
Ii ≤ 200 мА;
Li ≥ 3 мГн;
Ci ≥ 0,08 мкФ;
Pi ≤ 1 Вт;

For connect level sensor to external devices necessary use 2 or 3 wires shielded cable. In case use explosion proof version of level sensors necessary use cable mechanical protection facilities and/or color marking (like blue color cable).

The cross-section of the cable must be selected so that the supply voltage on the LLT-RS is not lower than 10 V in the case of the maximum current consumption (21.5 mA) for cable length L. For example: A copper wire 1 m long and 0.5 mm2 cross-section has a resistance of 0.18 Ω. With a cable length of 300 meters (300 meters of supply lead and 300 meters of return wire), the drop in the supply voltage at the maximum current consumption (21.5 mA) is 0.18 Ω × (300 m × 2) × 0.0215 A = 2.322 V , therefore, the power supply must provide a supply voltage of at least 10 + 2,322 = 12,322 V.

In addition, the connecting cable must correspond to the maximum line capacitance and inductance parameters specified in the documentation for the safety barrier or other means of explosion protection.

1.3.3 Level sensors design

Level sensors have two basic designs:

- for work together with the external camera of the LGB level gauge (using the level gauge float);
- for direct measurement of the liquid level with its own float;

Direct measuring design

This construction design intended for direct mounting probe and float in measured media.

The main constructive difference from other design is that the direct mounting device has its own fixing elements (thread, flange, clamping nipple, etc.) and own float. The probe is located at the center of the electronics unit. Used in cases where is no need for local indication, when used on underground tanks and small size containers.

Bypass mounting design

This version of the level sensors, unlike the previous one, does not have its own fixing elements and float. This version intended for installation on the LGB level gauge and operates from the field of LGB float. The probe is located eccentrically of the electronics unit. Typically, this version is used in cases where, in addition to local indication of the level, have required to transmit readings in distributed control systems, in complex technological conditions, with specific requirements of those process and security.

2. Operation

2.1 Safety precautions:

Failure to comply with maximum values of stated process parameters may result in the damage of the level sensor 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 gauges shall read and understand this operation manual and trained on safety.

When LLTs 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.

Recomendations:

- in case of process changes (new abrasive particles/crystallizing medium/polymerizing medium) during operation of the level gauge not intended for use under such new factors, please, consult manufacturer's specialists;
- if the LLT is installed inside the explosion-hazard zone, check that attached devices may be equipped with are duly connected to protected electrical circuits;
- Pay attention to the correct earth connection and potential equalization.

Prohibited:

- exceed in the measuring circuit the maximum permissible total inductance and capacitance;
- to install the level gauge in the proximity (closer than 1 m) of strong electromagnetic field sources;
- to repair or replace the parts of the level gauge without notice of the manufacturer;
- to use the level gauge showing signs of leakage, mechanical damage until elimination of their causes;
- try to independently make changes in the design level sensors;
- the use level sensors in environmental conditions, the neutrality of which to the materials used in the leveler is not proven.

Caution! Failure to comply with requirements of this manual during installation/ start-up/ operation of the LLT level sensors shall enable the manufacturer to waive the guarantee.

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

2.2 Installation and Disassembly Level sensor LLT

Attention! Caution! Before installation/disassembly of the LLT level sensor 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.

During installation, do not allow the guiding tube to bend (except for corrugated pipe versions), and the float is affected by strong impact forces. The LLT-RS level meter for operation in an explosive atmosphere should be installed so that the electronic unit is not located in the hazardous area "0".

To ensure the safety of the magnetic float (6), it is transported in a fixed position on the protective guiding tube (5). Immediately before installation, the fixing elements must be removed. The measurement range is set at the factory and, as a rule, does not need additional tuning. The working area of the float is calculated taking into account the location of the reed switches inside the protective tube and is limited by means of locking rings (8).

2.2.1 Installation

Direct mounting design:

Align the axis of the protective tube guide (5) with the center of the mounting hole. Lower the pipe to the level 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 transmitter 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.

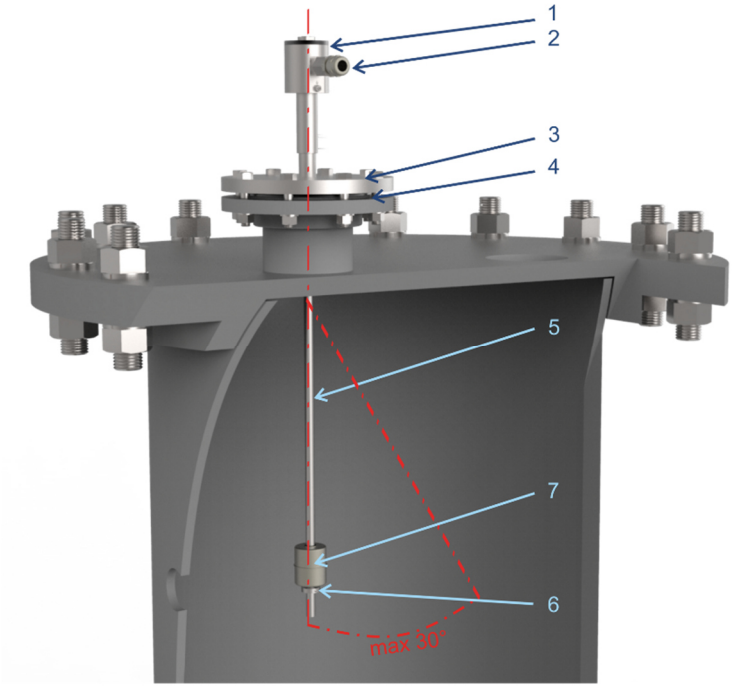


Figure 3. Installation exmple

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

In the case where the float is larger than the mounting hole in the tank, and there is the possibility of installing the float from the inside of the container, the procedure described below should be followed.

Remove the float. To do this, unscrew the hexagonal screw on the circlip (8), previously noting the location of the ring and the top of the float (6). Then gently remove the float from the guide tube and put it back after installing the transmitter. Secure the float with a retaining ring in the same position. Between the float and the retaining ring, a damping gasket (7) must always be inserted.

The junction box (1) is intended for mounting a secondary converter or connecting the transmitter to adjacent equipment by means of terminals, for this purpose, suitable landing pads and a hole for the cable entry (2) are provided in the junction box.

Bypass mounting design:

In this design, the level gauges are delivered already installed on the LGB level indicator. In the event of a change in the density of the medium to be measured during operation, it is allowed to move the level gauge along the remote camera of the LGB level indicator to adjust the initial measuring point.

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

Make sure the electrical circuits are de-energized. Open the cover of the junction box. Then loosen the union nut of the cable entry. Pass the cable into the cable gland and connect the divided wires of the cable to the terminal block / secondary transmitter, observing the polarity and marking. Securely fix the cable in the cable gland using the union nut. Replace the cover of the junction box.

Typical connection scheme for the secondary transmitter with “current loop” output signal in the general industrial PR Electronics 5343A is shown in Fig. 4.

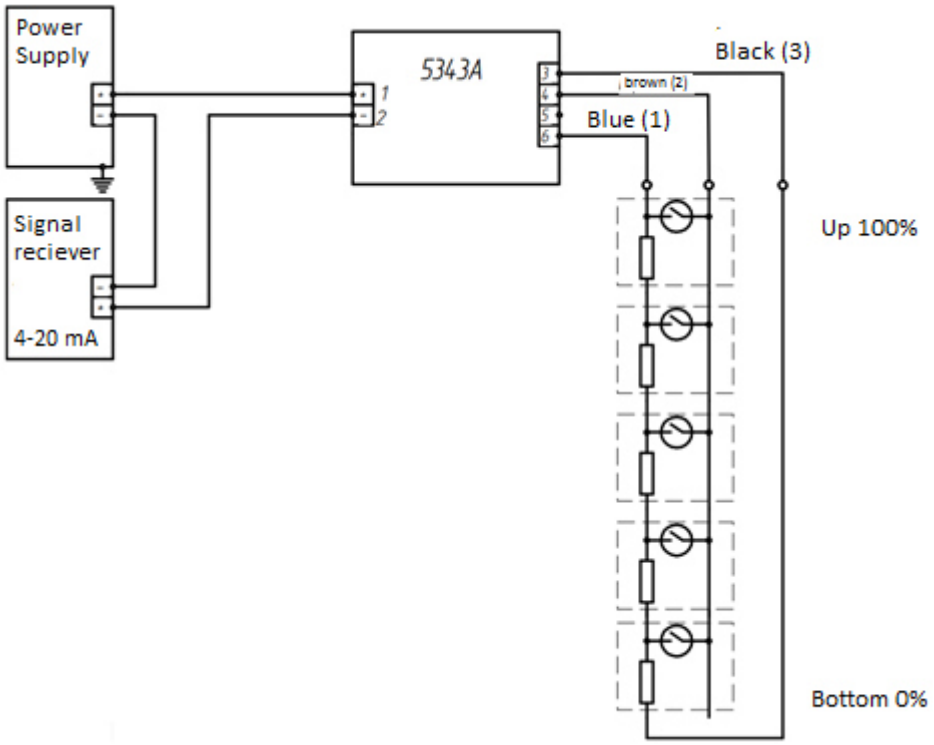


Figure 4. Wiring diagram of level sensors with output signal 4-20 mA.

Legend:

Power supply: 10 ... 30 VDC;

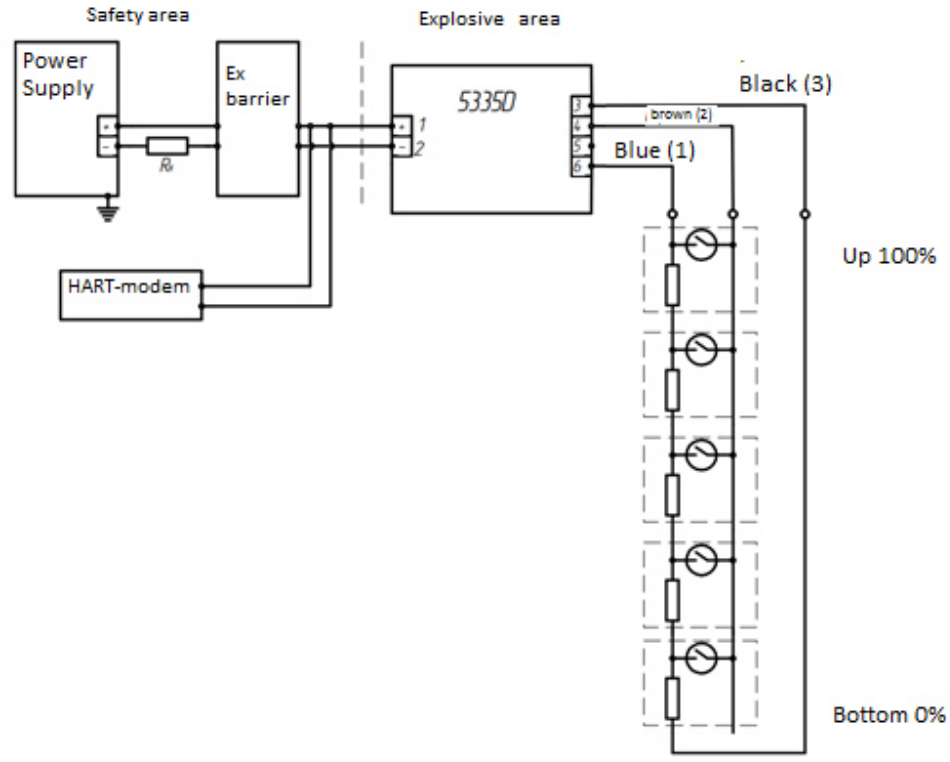


Figure 5. Wiring diagram of level sensor in a two-wire scheme with HART support

Only intrinsically safe level sensors can be installed in an explosive area. Such devices are contained in the summary code and designate explosion protection in accordance with IEC 60079.

The level sensors is connected to the system in this case through an intrinsic safety barrier or an intrinsically safe power supply converter installed in a safe zone.

Signal receiver

Rh - resistance, not less than 250 Ohm;

HART-modem - device with HART protocol version 5 and higher (1);

(1) it is recommended to use Metran-682 as a HART modem.

Figure 5 shows the connection diagram through the intrinsically safe PR converter Electronics 5335D with HART protocol support.

In addition, it is possible to connect the transmitter to any device having a potentiometric input, or a line resistance input using a terminal block installed in the electronic unit of the transmitter (Figure 6).

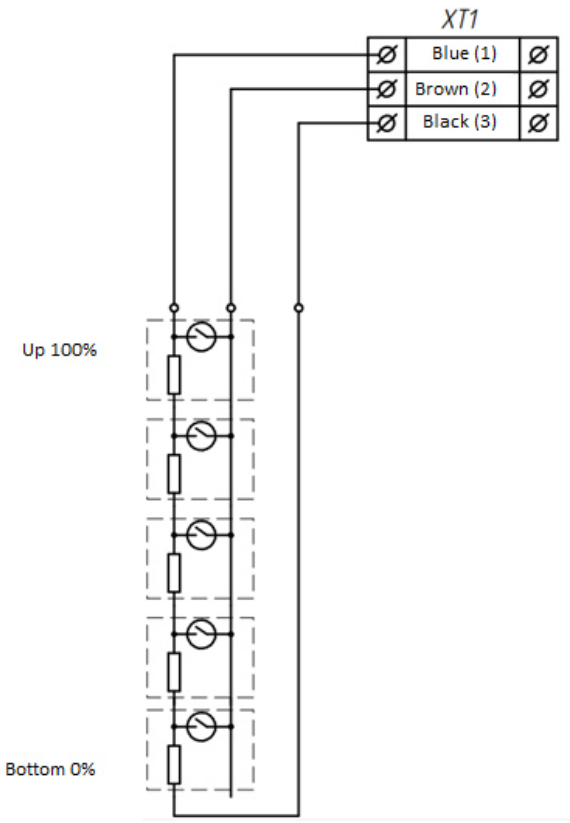


Figure 6. Connecting the sensor to the ACS via the terminal block.

2.3 Maintenance

The LLT level sensors 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 sensors. To remove and assemble the float, please, follow instructions of section 2.2 "Installation and Disassembly" of this manual.

Periodic metrology verification must be carried out in accordance with the procedure for verification the LLT-RS.

Functional testing

The functional test of the instrument should only be carried out on a dismounted level sensor. If the device is switched off, unexpected changes in the process control system may occur, which can create a hazard for the personnel and lead to material damage. For this reason, it is necessary to first take the level gauge out of the plant's ACS, informing the responsible persons.

1. Remove the level sensor.
2. Connect the ohmmeter to the two wires / terminals (see table 1).
3. Manually move the float from the minimum position to the maximum and back.
4. The ohmmeter reading should vary according to the contents of Table 1

Table 2.

Black - brown	Blue - brown	Black - blue
The value of the resistance increases in proportion to the height of the float	The resistance value is reduced based on the value of the total resistance inversely proportional to the float height	The total resistance of the resistive-reed chain

The adjustment of the LLT-RS sensors with a digital output can be carried out via a PC using PACTware software version 4.0 and higher, with integrated device drivers (DTMs) in accordance with the FBD standard. The software required to configure the level gauges is supplied on a DVD disc complete with the device or is available for downloading on the website www.rivalcom.ru.

To ensure the support of all device functions, it is strongly recommended to use the latest version of DTM.

LLT-RS level sensors can be equipped with PR Electronics secondary transmitters, in this case PReset software version 6.07.1007 and higher can be used for configuration.

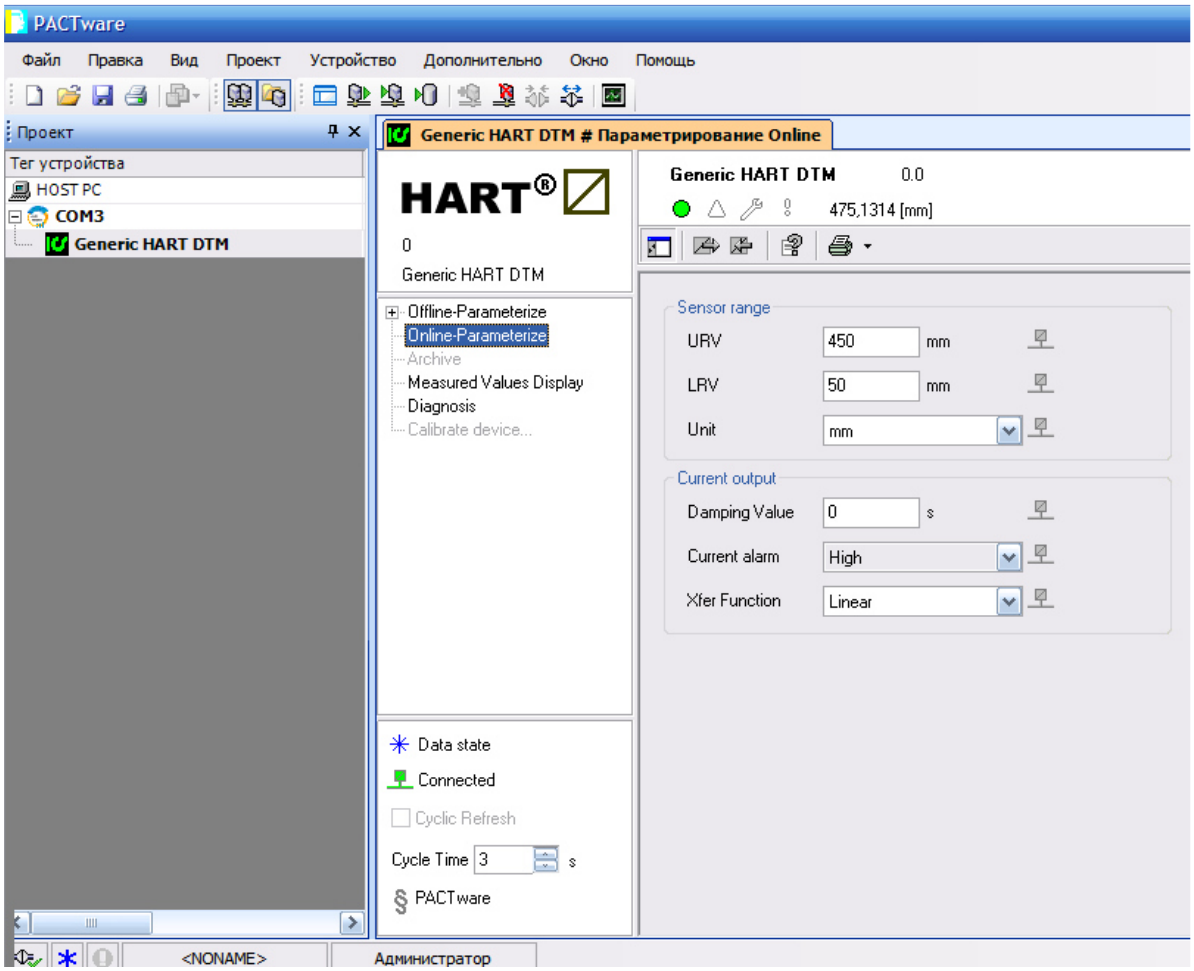


Figure 7. Parameterization of LLT-RS via PACTware software

Table 3. Designation of menu items in the PACTware software.

Title	Description
Mesuring Point (Точка измерения)	Name of the device. Available fields: – description; – tag; – text note; – the date of the last change;
Device (Устройство)	Description of unique device identification information
Input (Вход)	In this menu item it is possible to trim / extend the measuring range, as well as to set the measurement range offset, to select the units of measurement.
Output (Выход)	Here it is possible to set polling time of the transmitter, the signal "sensor break", mathematical algorithms for linearizing the output function. (Optionally), some software versions can be equipped with the "PV Upper Range" and "PV Lower Range" buttons to accept the current value (PV) for the upper measurement limit and the lower measurement limit, respectively.
HART	This item is not available for user modification.
Online-Parametrize (Параметрирование в реальном времени)	In this menu item it is possible to trim / extend the measuring range, as well as to set the measurement range, select the units of measure, set the polling time and the linearizing function.
Measured Values Display (Экран измеренных значений)	This menu item serves to visualize the measured in real time * values. (*) taking into account damping time
Device Variables (Переменные устройства) (not for all models)	This item is used to set the offset of the measurement start point (tuning)

The parametrization of the PR Elecronics transmitter can be carried out using the programming tool PR 5909 "LoopLink" (art. No. 1091463). Detailed information can be found in the PR 5909 operating manual.

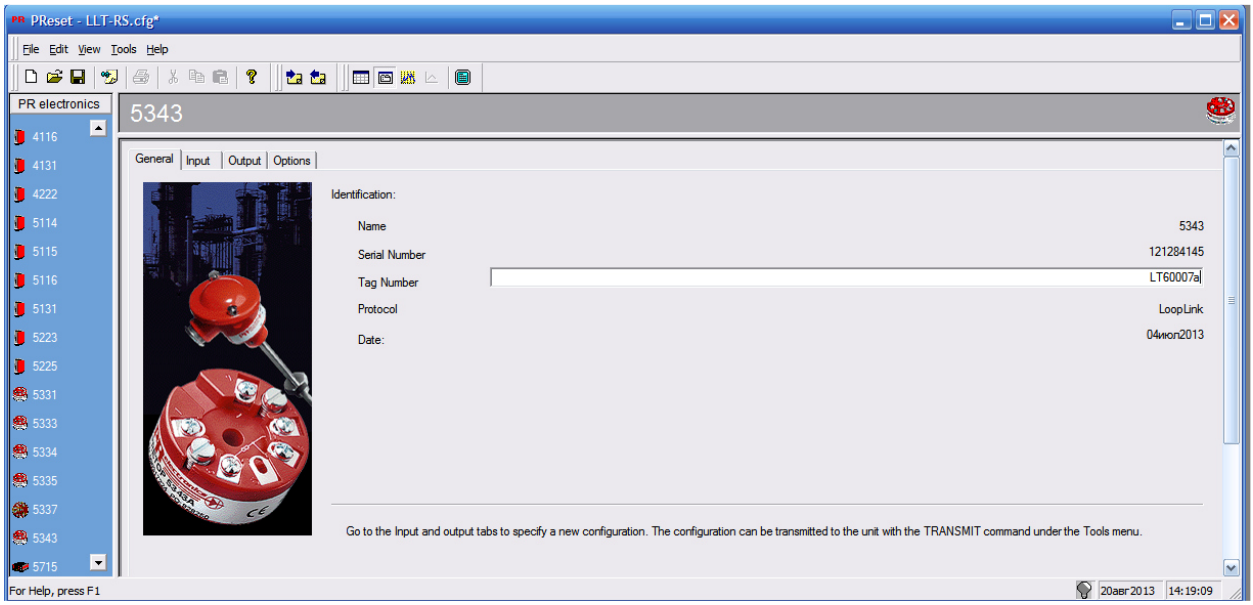


Figure 8. The PReset program window.

After the program starts, a window appears in which you must select the virtual COM/USB port used from PR5909 from the suggested list. After that, the program will try to automatically determine the type of the secondary converter connected to the PR 5909. After this, it is necessary to verify the conformity of the programmable and the selected converters. Then you can start configuring the converter.

Table 4. Designation of menu items for software PReset.

Title	Description
General (Общие)	Name of the device. Available fields: – description; – tag; – text note; – the date of the last change;
Input (Вход)	In this menu item it is possible to trim / extend the measuring range, as well as to set the measurement range offset, to select the units of measurement.
Output (Выход)	Here it is possible to set polling time of the transmitter, the signal "sensor break", mathematical algorithms for linearizing the output function. (Optionally), some software versions can be equipped with the "PV Upper Range" and "PV Lower Range" buttons to accept the current value (PV) for the upper measurement limit

	and the lower measurement limit, respectively.
Options (Опции)	This tab serves for calibration of the converter and analog output signal, adding notes, setting the linearization.

Detailed information on PRESet functions such as plotting, storing firmwares, printing data, user linearization, etc. can be found in the operating manual on the software tool PR Elecronics 5909 Loop-link.

3. Local digital indicator

The LLT can be equipped with a four-digit LED 4 ... 20mA. The indicator is compatible with the HART protocol.

Scope: Local display of the output analog signal "current loop" 4 ... 20mA.

Specifications:

Span of input signal:	3 mA … 23 mA
Span of output signal:	-1999 … 9999
Ambien temperature:	-50 … +60 °C (without heater) -60 … +60 °C (with heater or without indication)
Supply voltage dropping:	3,5…5,5 VDC

To activate the indicator menu Hold down the "▲ + ▼" keys until the Set2 symbols on the indicator are displayed. To select the menu item "▲", press the "▲ + ▼" button once to confirm the selection and activate the menu. To exit the menu, use "B" until the display values appear.

Settings:

Setting the lower limit of measurement (4mA)

Select **Set2** from the menu and activate it with a single press of "▲ + ▼".

The "▼" key is used to increment the current character from 0 to 9, to move between the characters use the "▲" key. When the operation is complete, press "▲ + ▼" once to confirm.

Setting the upper limit of measurements (20mA)

Select **Set5** in the menu and activate it by pressing "▲ + ▼" once.

In other respects, the setting is similar to 1 "Setting the lower limit of measurement"

Decimal point

To select the width of the set measuring range, use **dECl**. To select this menu item, use the single-press "▲ + ▼". After displaying on the indicator _ _. _ _ with the "▲" key Select the position of the separation point or its absence. When the operation is complete, press "▲ + ▼" once to confirm.

Damping time:

To set a different damping time, go to the **dELA** menu item. The indicator supports a damping function in the range from 0 to 29.5 seconds. It is possible to set the damping time in the indicated range in 0.5 second increments. The default value is 0.5 seconds.

If the current signal is outside the 3.5 ... 21.5 mA range, the indicator displays an alarm message about the error.

Electrical connection of indicator:

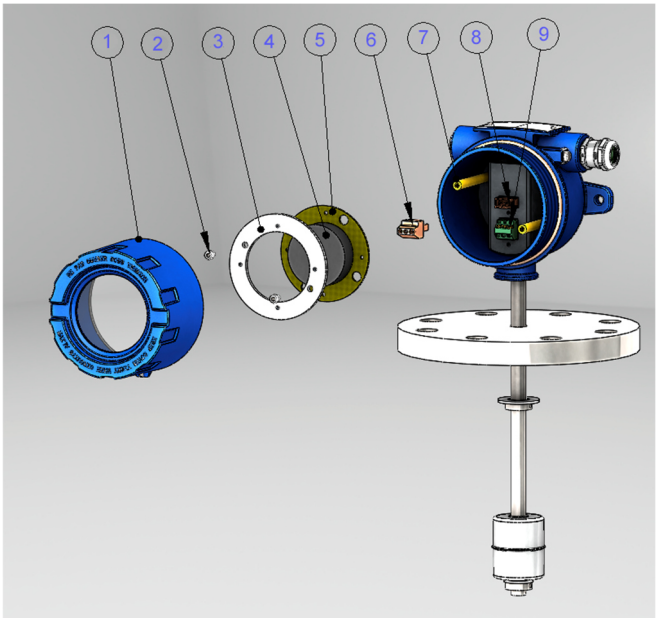


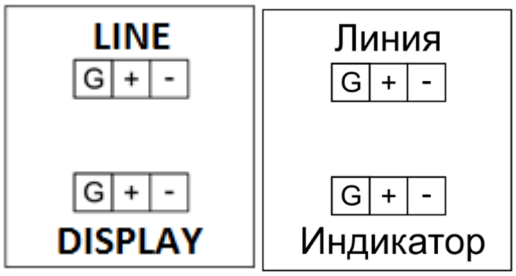
Figure 8. Scheme of assembly electrical unit DA with digital indicator

The indicator is delivered after the factory setting to the measuring range in the mounted state, however, to connect the transmitter to the electrical circuit, it is necessary to disassemble the indicator, connect the signal cable to the terminal block of the level sensor and put the indicator in place.

To turn off the indicator, remove the top cover (1) of the electronic unit. Then, using the hexagonal wrench, unscrew the fixing screws (2) of the indicator ring (3) of the indicator. After this, remove the fixing ring, and then remove the indicator (4) mounted on the mounting plate (5) from the threaded supports (7). On the back of the board is the terminal block of the indicator. When removing the circuit board, it is necessary to disconnect the terminal block (6) and the socket (8).

The connection is in the reverse order.

The electrical circuits may be connected according to the following scheme



The signal cable of the transmitter is to be connected to the "Line" terminal block, and the indicator, respectively, to the "Indicator" terminal block with the specified polarity.

Appendix 1. Certificates and approval documentation

Pattern approval certificate of measuring instruments ОС.С.29.004.А № 73597, № 74747-19. Valid through 17.04.2024г.

Certificate of conformity TR CU 012/2011, № ЕАЭС RU C-RU.HA65.B.00755/20, series RU № 0249390. Valid through 24.09.2025г.

Declaration conformity TR CU 020/2011, № ЕАЭС N RU Д-RU.ПХ01.B.17333/20. Valid through 19.05.2025г.

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

Certificate of conformity GOST R № РОСС RU.HB61.H06800. Valid through 19.05.2023г.

Certificate of conformity GOST R № РОСС RU.АД07.H01048. Valid through 13.10.2022г.

Certificate of conformity № РОСС RU.ТЖС000045. Valid through 04.08.2024г.