

# Level transmitter LT600RSH

Submersible digital transmitter for level measurement in liquids



Level transmitter with submersible probe in stainless steel for level measurement in vessels where pressure connection at the bottom of the vessel is not possible or desirable. For example pump pits, reservoirs or plastic tanks.

## INNOVATIVE AND FLEXIBLE DESIGN. KEY FEATURES:

- Digital electronics. 4-20 mA signal.
- Accuracy 0,1 % (option 0,075%).
- HART Communication as standard. Useful for configuration, maintenance and transfer of measuring values.
- MODBUS Communication (RS485) as standard. Registry based for all needs (transfer of values, configuration and maintenance).
- Innovative Autozero function. Just shorten two cables.
- Range turn down 1:100. One type fits most applications.
- Withstands media temperatures up to 80 °C continuously.
- Lightning protected (option). Fulfills the demands for Class 1 testing according to IEC61643-1, 5 kA (10/350 uS). This means that the transmitter can withstand a stroke of lightning close to the supply/signal cables.
- Stainless steel IP68 measurement probe with a rugged Hastelloy C 276 diaphragm (others on request).
- Embossed diaphragm, insensitive to particles and contact. Can easily be cleaned without deformation.
- Completely potted electronics for highest possible reliability.
- Well tested and approved for CE (EMC and PED), CSA Ex (pending), ATEX (pending) and DNV (pending).



## Types and order codes:

The transmitters order codes for different configurations can be found from the table below.

### LT600xxxxx- X X X X

	Description	Suffix	Figure 1	Figure 2	Figure 3	Figure 4		
<b>Electronics</b>	HART, MODBUS and lightning protection	RSHL						
	HART, MODBUS and Exia	RSHE						
	Titanium, HART, MODBUS and lightning protection	TRSHL						
	Titanium, HART, MODBUS and Exia	TRSHE						
<b>Diaphragm</b>	Titanium		1					
	Stainless steel 316L		3					
	Hastelloy C-276		4					
<b>Connection</b>	Submersible probe			0				
	Submersible probe with G1/2" thread			01				
<b>Span min.-max.</b>	0,035-3,5 mH2O (4°C)				2			
	0,2-20 mH2O (4°C)				4			
	2-200 mH2O (4°C)				6			
<b>Design</b>	Atmospheric pressure					0		
<b>Cable</b>	Other cable lenght							state m
<b>Thread on top</b>	R 3/4"							G

#### Ordering example

Lightning protected level transmitter with submersible measuring probe, 10 m cable and calibrated range 0-1,5 m water level will have the order code: **LT600RSHL-4020** with calibrated range 0-1,5 mH2O

## Description

LT600 is a level transmitter for applications where pressure connection at the bottom of the vessel is not possible or desirable, for example pump pits. LT600 consists of a measurement probe with the diameter 31 mm. The probe has a Hastelloy C-276 measuring diaphragm for highest corrosion resistance (other material as options). The diaphragm is also very insensitive to mechanical damage because of its design.

The probe are suspended in its connection cable. Standard length for the probe cable is 10 m. The cable is reinforced with a Kevlar cord and can be delivered in length up to 1000 m. For extremely corrosive media the cable can be delivered with teflon coating, max length 25 m. Connection of the probe cable can be done in optional connection box. A specially designed connection box can be delivered as an accessory. This box is equipped with an appropriate connection for the probe cables atmospheric vent tube.

Its also possible to equip this box with a local display. LT600 can as an option be delivered with a good lightning

protection (see next page for description).

LT600 can as an option also be delivered in intrinsic safe design, Exia.

#### Function

LT600 has a piezoresistive sensor connected to the media by means of a diaphragm and a capillary tube. The media pressure acts on the diaphragm and is transferred to the sensor through a pressure intermediate oil. Since this oil completely fills the volume between the diaphragm and the sensor the diaphragm movement is very small when the pressure changes. Since the diaphragm are embossed to the surface underneath it is very insensitive to particles and contact. The capillary tube protects the sensor from high overloads because of short pressure shocks. To obtain atmospheric pressure on the back side of the sensor (for reference pressure) it is connected to the surrounding through a capillary tube inside the probe cable.

LT600RSH has microcomputer-based electronics, which communicate with the outside world with 4 to 20 mA signal as well as HART and MODBUS

communication. The electronics measure and converts the output signal from the pressure dependent sensor bridge to digital values. Furthermore the temperature is measured with a PT1000 element. This temperature represents the media temperature.

The electronics perform compensation for temperature drift of the sensor by means of compensation values entered at the factory calibration and at the same time the temperature measurement is calibrated. Compensation for the non-linearity in the sensor is done in the same manner. Different kinds of transfer functions, such as linear, square root, curves..., can be selected. The electronics perform the calculation for the selected transfer function and then the digital value is converted to analogue for the 4 to 20 mA current loop. The digital value can also be read via HART and MODBUS communication in optional engineering units, percentage or current. LT600H can be configured/ calibrated fully by means of a hand terminal or a PC via HART and MODBUS communication.

### MODBUS Communication

MODBUS communication can be used for transfer of measured values, for example the level and the media temperature (etc.). The communication can also be used for configuration of all LT600 parameters direct from a suited control system or from a PC (with appropriate software).

The MODBUS communication is fully registry based (see the manual for LT600 for more information).

Physical interface for MODBUS is RS485, 4 lines. Supply voltage (11-48 VDC) use the 4-20 mA lines and the communication use two separate lines A and B.

A standard RS485 dongle can be use (but it is optimal to use an optoisolated RS485 dongle).



### Lightning protection

As an option LT600 can be equipped with lightning protection. The transmitter will then have the code LT600RSHL where L indicates "Lightning protected". This option can not be combined with the intrinsic safe option (see below).

The lightning protection is built in at the factory. No external changes or external components are needed.

The protection is designed to withstand a lightning stroke close to the probe cable and connection cables but can not withstand a direct stroke. The protection is designed to meet the demands for Class 1 testing according to IEC61643-1 5 kA (10/350 uS).

This protection is normally enough in most applications. In specially exposed installations, where there is high risk for direct strokes, the protection ought to be reinforced (for example by using the connection box, see next page).

The lightning protection is built up

### HART Communication

HART is a standard communication protocol that can be used for signalling of measured values and for full configuration of all LT600 parameters.

The HART protocol have three levels of commands, Universal, Common Practice and Transmitter Specific commands.

Universal and most Common Practice commands can be handled by standard hand held terminals (for example ABB DHH805, Fluke 709H or Martel LC-110H) and by generic PC software. A HART modem must be used.

The physical interface use FSC (Frequency Shift Communication) signaling. This is done by overlaying a 1200 Hz or 2400 Hz full sine wave on the current loop. The 4-20 mA signalling is fully unaffected by this.



as a three step protection.

The pulse that enters the transmitter is caught by two varistors, three transient protection diodes and a double surge arrester.

The probe cables shield must be appropriately grounded for the protection to fulfill its purpose.



### Marine approval

LT600 is approved for use in Marine applications by DNV (pending).



### Autozero function

LT600 has an innovative solution to eliminate the problem of zero shift (due to for example covering, corrosion or mechanical damage of the diaphragm). Just place LT600 in free air (zero pressure on the diaphragm) and shorten two cables. This action resets the 4 mA to zero pressure (and also makes the communication to send zero level in engineering units).

### Approvals

LT600 is CE approved according to the EU directives for pressure equipment, PED, and EMC.

The pressure intermediate oil is a FDA approved silicon oil.



### Intrinsic safety, Exia

LT600 can as an option be delivered in intrinsic safe design, Exia IIC T4, according to ATEX and CSAus-c (pending). The transmitter will then have the code LT600RSHE where E indicates "Exia".

This option can not be combined with the lightning protected option (see above).



**Connection box**

A specially designed connection box can be delivered as an accessory. The box is equipped with cable glands and terminals for connection of the probe cable and the signal/supply cable. The box can also be equipped with a local display and reinforced lightning protection. The box is equipped with an appropriate connection for the probe cables atmospheric vent tube. This connection does not affect the tightness of the box. Protection class IP67. The vent connection is design so that high pressure water from for example cleaners not can enter the vent or the box.

**Display**

The box can also be equipped with a local display. The display can show the the signal in optional engineering units, for example mWc or mH2O. Unit and limits is made to order. The display is connected in series with the signal/supply cable and is feed by the current loop.

**PI100**

PI100 is a software tool on CD-ROM for Windows for configuration, calibration and documentation. PI100 contains a database with available transmitter types. The program can configure transmitter

specific values and perform maintenance, output signal and factory calibration. Furthermore, PI100 performs copying of current configuration, backup on to hard disc, transmitting/receiving via standard HART communication and a self-test with alarm functions. PI100 contains online presentation of help functions, data sheets and user manual.

**Hand terminal**

For parameter settings a hand terminal of HART type can be used (for example ABB DHH805, Fluke 709H or Martel LC-110H).

**Connection and adjustment**

**Connection**

The probe cables consists of 6 wires, shield and a vent tube. The wires is colour marked:

White	Signal/supply +
Brown	Signal/supply -
Green	RS485 A
Yellow	RS485 B
Grey	Autozero 1
Pink	Autozero 2
Shield	Ground
Vent tube	Atmosphere

On the Vent tube there is a Fluid Filter mounted to prevent moisture to enter.

**Adjustment**

Adjustments can be done through HART and MODBUS communication. Connect the HART modem or a hand terminal over a 250 ohm (min) resistor.

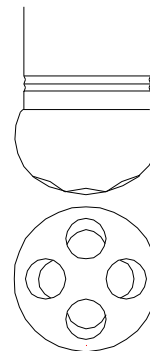
**Size**

Probe size:  
 Diameter 31 mm  
 Lenght 180 mm

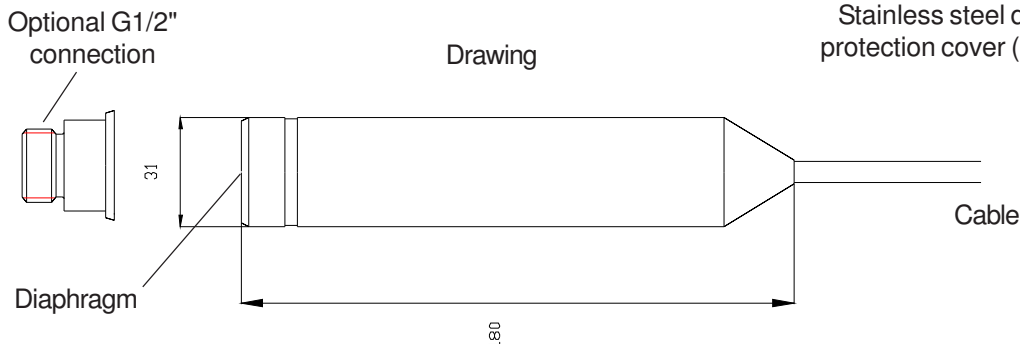
As standard the probe is delivered with a transportation diaphragm protection cover. This can also be used in normal operation if required. A stainless steel cover is available as an accessory.

**Cable:**

Lenght (standard) 10 m  
 (option up to 1000 m)  
 Diameter 6,5 mm  
 Area 0,23 mm<sup>2</sup>  
 Vent tube (diam.) 2,3 mm  
 Reinforced with a Kevlar cord.



Stainless steel diaphragm protection cover (accessory).



**To consider**

- Dont expose the diaphragm to unnecessary damage (even though its very robust and insensitive).
- Dont descend the probe so that it stands on the bottom of the vessel.
- Highest media temperature is +80°C.
- Make sure that the vent tube is connected to the surrounding atmosphere without the risk for plugging (NOTE via the Fluid Filter).
- If the media are turbulent or flowing fasten the probe appropriately.

## Technical specification LT600:

<b>Type:</b>	Electronic submersible level transmitter with microcomputer based electronics	<b>Series resistance:</b>	$R_{kohm} = (Supply\ voltage - 11)/20$ . For HART communication min 250 ohm
<b>Function:</b>	Directly connected transmitter with piezoresistive sensor	<b>Series resistance dependance:</b>	Better than +/- 0,1%
<b>Operating range:</b>	From -100% to 100% of upper sensorlimit	<b>Supply voltage dependance:</b>	Better than +/- 0,1%
<b>Span:</b>	Adjustable between upper sensor limit and 1/100 of this.	<b>Temperature dependance:</b>	Better than +/- 0,1% of max range. (From -10 to +70 degrees C.)
<b>Zero:</b>	Adjustable between -100% and 100% of upper sensor limit	<b>Long time stability:</b>	Better than 0,08 % per year.
<b>Overload:</b>	3,5 mH2O: Max 25mH2O	<b>Vibration dependance:</b>	
	20 mH2O: Max 60 mH2O	Perpendicular to the diaphragm:	Max +0,3 kPa/G
	200 mH2O: Max 600 mH2O	Parallell to the diaphragm:	Max +0,02 kPa/G
<b>Material:</b>	Diaphragm: Hastelloy C-276 or 316L (certain coatings on request)	<b>Repeatability:</b>	Better than +/- 0,1% of max range.
	Other media tuched parts: Stainless steel SS2353	<b>Accuracy:</b>	Better than +/- 0,1% of max range (including nonlinearity, hysteresis, repeatability)*1
	Cable: Polyurethane	<b>Electrical connection:</b>	Lose wires
<b>Ambient temperature:</b>	-20 to +80 degrees C	Wire area:	0,23 mm2
<b>Damping:</b>	0,1-10 s. At delivery 0,1 s.	<b>Encapsulation:</b>	IP68
<b>Media temperature:</b>	Max 80 degrees C	<b>Electrical safety:</b>	According to EN 60204-1
<b>Output:</b>	4-20 mA, two wire connection, signal proportional to the pressure. Max current at overload 22,5 mA. HART and MODBUS communication	<b>EMC:</b>	According to EN 61326-1-2-3
<b>Supply:</b>	11-48 V DC	<b>Intrinsic safety (option):</b>	Exia IIC T4 according to ATEX and CSA for US and C
<b>Filling liquid:</b>	AK100, food approved siliconoil (FDA approval)	<b>PED:</b>	According to 97/23/EG
<b>Weight:</b>	700 g including 10 m cable.	<b>Lightning protection (option):</b>	Class 1 testing according to IEC61643-1. 5kA (10/350 uS).

\*1 Applies for turn down 1:1 to 1:30. For turn down 1:30 to 1:100 accuracy increases to 0,25%.  
Option 0,075%.

MODBUS is a registred trademark for Modbus Organisation.  
HART is a registred trademark for Hart Communication Foundation.