Level transmitter LT60

Submersible digital transmitter for level measurement in liquids

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

INNOVATIVE AND FLEXIBLE DESIGN. KEY FEATURES:

- Digital electronics. 4-20 mA signal. Level and temperature values via MODBUS communication (LT60RS).

- MODBUS communication via RS485 (LT60RS). Registry based for all needs (transfer of values, configuration and maintenance).

- Innovative Autozero function as standard. Just shorten two cables.

- Fixed or adjustable ranges (can on LT60RS be readjusted via MODBUS communication).

- Accuracy 0,35 % (option 0,15 %).

- Lightning protected (option). Fulfills the demands for Class 1 testing according to IEC61643-1 5 kA. This means that the transmitter can withstand a stroke of lightning close to the supply/signal cable.

- Withstands media temperatures up to 80 °C continuously.

- Stainless steel IP68 measurement probe with a rugged Hastelloy C276 stainless steel diaphragm (others on request).

- Well protected embossed diaphragm.

- Completely casted electronics for highest possible reliability.

- Well tested and approved for CE (EMC and PED).

Types and order codes:

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

LT60xxx-   x   x   x   x

	Description	Suffix	Figure 1	Figure 2	Figure 3	Figure 4	Standard cable lenght
Electronics	**Fixed digital**	**FD**					
	Modbus communication	**RS**					
	Fixed digital, lightning protected	**FDL**					
	Modbus communication, lightning protected	**RSL**					
Diaphragm	**Stainless steel 316L**		**3**				
	Hastelloy C276		**4**				
	Ceramic		**5**				
Connection	**Submersible probe**			**0**			
	Submersible G1/2"			**01**			
Span min.-max.	**0-3,5 mH2O (4 ℃)**				**1**		**10 m**
	0-5 mH2O (4 ℃)				**2**		**10 m**
	0-10 mH2O (4 ℃)				**3**		**15 m**
	0-20 mH2O (4 ℃)				**4**		**25 m**
	0-50 mH2O (4 ℃)				**5**		**55 m**
	0-100 mH2O (4 ℃)				**6**		**specify**
	0-200 mH2O (4 ℃)				**7**		**specify**
	0-400 mH2O (4 ℃)				**8**		**specify**
Design	**Atmospheric pressure**					**0**	
	Absolute pressure					**2**	

Ordering example

Level transmitter with submersible measuring probe, Hastelloy C276 diaphragm, Modbus communication and Autozero, 10 m cable and calibrated range 0-5 m water level will have the order code: **LT60RS-4020**

Description

LT60 is a level transmitter for applications where pressure connection in the bottom of the vessel is not possible or desirable, for exampel pump pits. LT60 consists of a measurement probe with the diameter 31 mm. As standard the probe has a very robust Hastelloy C276 stainless steel measuring diaphragm for high corrosion resistance (other on request). The probe can be equipped with diaphragm protection covers if needed. The probe are suspended in its connection cable. (Standard lenght see above.) The cable is reinforced with a Kevlar cord and can be delivered in lenght up to 1000 m. For extremely corrosive media the cable can be delivered with teflon coating, max 10 m. Connection of the probe cable can be done in optional connection box, BOX100. This box is equiped with an appropriate connection for the probe cables atmshperic vent tube. Its also possible to equip this box with a local display and reinforced lightning protection. LT60FD have fixed measuring ranges and no communication.

LT60RS can communicate via MODBUS. Range etc. can be set by the user.

Function

LT60 has a piezoresistive sensor connected to the media by means of a diaphragm. The media pressure acts on the diaphragm and is tranfered 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. 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 (absolute pressure versions have no tube).

LT60 has microcomputer-based electronics, which communicate with the outside world with 4 to 20 mA signal as well as MODBUS communication (LT60RS). The electronics measure and converts the output signal from the pressure dependent sensor bridge to digital values. The digital value is converted to analogue for the 4 to 20 mA current loop.

The digital value can also be read via MODBUS communication (LT60RS) in optional engineering units, percentage or current. LT60RS can be configured/ calibrated fully by means of a PC via 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 LT60RS 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 LT60 for more information). Physical interface for MODBUS is RS485, 4 lines. Supply voltage (8-36 VDC) use the 4-20 mA lines and the communication use two separate lines A and B. A standard RS485 dongle can be use (it is recomended to use an optoisolated RS485 dongle).

Autozero function

LT60RS and LT60FD has an innovative solution to eliminate the problem of zero shift (due to for example covering or mechanical damage of the diaphragm). Just place LT60 in free air (zero pressure on the diaphragm) and shorten two cables for ten seconds. This action resets the 4 mA to zero pressure (and also makes the communication to send zero level in engineering units).

Approvals

LT60 is CE approved according to the EU directives for pressure equipment, PED, and EMC.

PI 200PS and MEP7 Modbus Tool

PI200PS is a configuration tool complete with the PC program MEP7 Modbus Tool, RS485 modem and battery supply (see separate documentation).
The PC program MEP7 Modbus Tool is a Windows software tool for reading of values, configuration, calibration and documentation.

The program can configure transmitter specific values and perform maintenance, output signal and factory calibration.

Lightning protection

As an option LT60 can be equipped with lightning protection. The transmitter will then have the code LT60RSL or LT60FDL where L indicates "Lightning protected".
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 normaly enough in most applications. In specially exposed installations, where there is high risk for direct strokes, the protection ought to be reinforced. Use for example connection box, BOX100.

Connection box, BOX100

A specially designed connection box can be delivered as an accessorie. The box is equiped with cable glands and terminals for connection of the probe cable and the signal/supply cable. The box is equiped with an appropriate connection for the probe cables atmoshperic 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 equiped with a local display. The display can show 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.
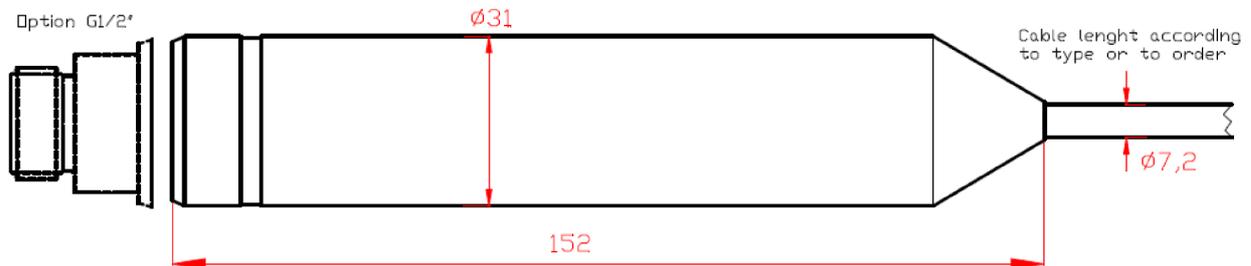
Connection and adjustment

Connection

The probe cables consists of 4 wires, shield and a vent tube. The wires are color marked:

White	Signal/supply +
Brown	Signal/supply -
Green	RS485A/Autozero 1
Yellow	RS485B/Autozero 2
Shield	Ground
Vent tube	Atmosphere pressure

(in the absolute pressure version there is no vent tube)

On the Vent tube there is a Fluid Filter mounted to prevent moisture to enter. DO NOT REMOVE!

Adjustment

Adjustments can be done through MODBUS communication and with the Autozero function.

Size

Probe size:

Diameter	20 mm
Lenght	157 mm

Cable:

Lenght (standard)	see text
(option up to 1000 m)	
Diameter	7,2 mm
Area	0,34/0,25 mm2
Vent tube (diam.)	2,3 mm

Reinforced with a Kevlar cord.

To consider

Dont expose the diaphragm to unnecessary damage. As standard the probe is delivered with a diaphragm protection cover.
Dont descend the probe so that it stands on the bottom of the vessel. If the media are turbulent or flowing fasten the probe appropriately. Highest media temperature is +80ºC.
Make sure that the vent tube is connected to the surrounding atmosphere (via the Fluid Filter) without the risk for plugging.
Make sure there is no free hydrogen ions in the media!
Make sure that the diaphragm withstands the media!

Technical specification LT60:

Type:	Electronic submersible level transmitter with digital electronics	**Filling liquid:**	Silicon oil
Function:	Directly connected transmitter with piezoresistive sensor	**Series resistance:**	R kohm = (Supply voltage - 6)/20.
Operating range:	From 0% to 100% of upper sensorlimit	**Series resistance dependence:**	Better than +/- 0,1%
Span:	Fixed or adjustable ranges see page 2	**Supply voltage dependence:**	Better than +/- 0,1%
Zero:	0 mH20 fixed or adjustable (4 mA+/-0,35%)	**Temperature dependence:**	From -10 to 70 degrees C.
Overload: 3,5 mH2O:	Max 30 mH2O	Zero:	Max +/-0,5 % *2
5 mH2O:	Max 30 mH2O	Span:	Max +/-0,7 % *2
10 mH2O:	Max 30 mH2O	**Long time stability:**	Better than 0,1 % per year.
20 mH2O:	Max 60 mH2O	**Vibration dependence:**	
50 mH2O:	Max 150 mH2O	Perpendicular to the diaphragm:	Max +0,3 kPa/G
100 mH2O:	Max 200 mH2O	Parallell to the diaphragm:	Max +0,02 kPa/G
200, 400 mH2O:	Max 600 mH2O	**Repeatability:**	Better than +/- 0,1% of max range.
Material: Diaphragm:	Hastelloy C276 (others on request)	**Accuracy:**	Better than +/- 0,35% of max range (including nonliearity, hysteresis and repeatability).*1
Other media tuched parts:	Stainless steel SS2343	**Electrical connection:**	Lose wires, 2x0,34 and 2x0,25 mm2 (twisted pair)
Cable:	Polyurethane	**Encapsulation:**	Better than IP68 (tested to 500 m depht)
Ambient temperature:	-20 to +80 degrees C	**Electrical safety:**	According to EN 60204-1
Damping:	1 s fixed or adjustable	**EMC:**	According to EN 61326-1-2-3
Media temperature:	Max 80 degrees C	**PED:**	According to 97/23/EG
Output:	4-20 mA, two wire connection, signal proportional to the pressure. Max current at overload 24 mA. MODBUS communication.	**Lightning protection (option):**	Class 1 testing according to IEC61643-1. 5kA (10/350 uS).
Supply:	6-36 V DC	**Weight:**	750 g including 10 m cable.

*1 Option accuracy 0,15% (for 3,5 mH2O range 0,25%)
*2 Span and zero temperature dependance for 3,5 mH2O range max +/-0,6 %.

MODBUS is a registred trademark for Modbus Organisation.

www.pondus-instruments.se
www.lt-series.se

Manual   **LT60**   **Level Transmitter**

Autozero Function:
LT60 can easily be put to zero when installed.
Make sure LT60 is connected to supply via brown (-) and white (+) cables.
Make sure that the pressure on the diaphragm is zero (or the exakt pressure that should be represented by 4,00 mA).
Shorten green and yellow cables for ten seconds.
Done!
Autozero can also be done via Modbus communication with LT60RS.
NOTE! Make sure not to connect green or yellow cable to supply! This can damage the product! Leave these cables isolated when not in use!

MODBUS Communication:
LT60RS can communicate via MODBUS communication for sending measurements (level, temperature, etc.) and for configuration.
For MODBUS communication a RS485 modem (preferably use an optoisolated modem) an a computer is needed. The modem can be bought from your supplier.
Connect the RS485 modem to cable green and yellow (make sure A and B is correctly connected, change if it does not work).
Use a generic PC program or PI Modbus Tool PC program for configuration.
A suited control system can fetch measurement data continuesly via MODBUS communication.
Setting of range, damping, units etc, is possible via this communication.
MODBUS Communication can be used at the same time as signaling via 4-20 mA.
NOTE! Make sure not to connect green or yellow cable to supply! This can damage the product! Leave these cables isolated when not in use!

Register	Description	Representation	Equivalent HART command (if any)	Comment 1	Comment 2
	MODBUS Specification LT60RS	**Level Transmitter**			
	Default Slave address= 10				
	Default Baud Rate= 9600	**8 bit, no parity, 2 stopbit**			
	MODBUS Specification LT60RS				
	Read Input Register , Function code 04	Read only	Reg= 16 bit Right alignment		
1000	Manufacturer Id code	1 byte	Universal Command 0	Unique Id	Set by manufacturer
1001	Device type code	1 byte	Universal Command 0	Unique Id	Set by manufacturer
1002-1003	Device Id number	3 byte	Universal Command 0	Unique Id	Set by manufacturer
1004-1005	Primary value (Level in enginering units)	Float	Universal Command 1	Dynamic variable	Level in engineering units
1006-1007	Current (4-20 mA) for calibrated range	Float	Universal Command 2	Dynamic variable	4-20 mA for calibrated range
1008-1009	% of calibrated range	Float	Universal Command 2	Dynamic variable	
1010-1011	Secondary value	Float	Universal Command 3	Dynamic variable	Temperature in engineering units
1012-1023	Message	24 byte	Universal Command 12		Optional text
1024-1026	Tag	6 byte	Universal Command 13		Optional text
1027-1032	Descriptor	12 byte	Universal Command 13		Optional text
1033-1034	Date	3 byte	Universal Command 13		Optional text
1035-1036	Sensor serial number	3 byte	Universal Command 14	PV Sensor info	Not used
1037-1038	Upper sensor limit	Float	Universal Command 14	Preset value	Set by manufacturer
1039-1040	Lower sensor limit	Float	Universal Command 14	Preset value	Set by manufacturer
1041-1042	Minimum allowed span	Float	Universal Command 14	Preset value	Set by manufacturer
1043	Alarm select code	1 byte	Universal Command 15	Output information	User selectable
1044	Transfer function code	1 byte	Universal Command 15	Output information	User selectable
1045-1046	Upper range value (set by user)	Float	Universal Command 15	Output information	User selectable
1047-1048	Lower range value	Float	Universal Command 15	Output information	User selectable
1049-1050	Damping value 0,1-10 sec	Float	Universal Command 15	Output information	User selectable
1051	Write protect code	1 byte	Universal Command 15	Output information	
1052	Authorisation level	1 byte	Device Specific Command 131	Output information	User selectable
1053	Alarm condition	1 byte	Device Specific Command 156	Output information	User selectable

	MODBUS Specification LT60RS		**Level Transmitter**		
	Holding Register , Function code 03,06	Read/Write	Reg= 16 bit Right alignment	Used for command and parameter setting	
Register	**Description**	**Representation**	**Equivalent HART command (if any)**	**Comment 1**	**Comment 2**
1-13	**Write message**		Universal Command 17		
1-12	Text input	24 byte			
13	**Excute command**	2 byte		0x0100= update	Return: 0=OK 0x80=Error
14-25	**Write Groupe: Tag, Descriptor, Date**		Universal Command 18		
14	Tag	3 byte			
17	Descriptor	12 byte			
23	Date	3 byte			
25	**Excute command**	2 byte		0x0100 = update	Return: 0=OK 0x80=Error
26-28	**Write damping value**		Common Practice Command 34		
26-27	Value in sec	Float			(From 0,1 sec to 10 sec)
28	**Excute command**	2 byte		0x0100 = update	Return: 0=OK, 0x80=Error, 0x87=Write protected, 3=To large, 4=To small
29-34	**Write Groupe: PV range values**		Common Practice Command 35		
29	Range unit code	1 byte			(See Code table)
30	Upper range	Float			
32	Lower range	Float			
34	**Excute command**	2 byte		0x0100 = update	Return: 0=OK, 0x80=Error, 0x87=Write protected
35	**Set PV zero**	2 byte	Common Practice Command 43		
35	**Excute command**			0x0100	Return: 0=OK, 0x80=Error, 0x87=Write protected
36	**Write PV units**	2 byte	Common Practice Command 34		
36				Low byte = Data	(See Code table)
36	**Excute command**			High byte = 0x01	Return: 0=OK, 0x80=Error, 0x87=Write protected
37	**Write Transfer function code**	2 byte	Common Practice Command 34		
37				Low byte = Data	(See Code table)
37	**Excute command**			High byte = 0x01	Return: 0=OK, 0x80=Error, 0x87=Write protected
38-41	**Write Group: Set authorisation level**		Device Specific Command 128		
38	Level	1 byte			(See Code table)
39-40	Password	6 byte			
41	**Excute command**	2 byte		0x0100	Return: 0=OK, 0x88=Access restricted
42	**Write Secondary unit code**	2 byte	Device Specific Command 135		
42				Low byte = Data	(See Code table)
42	**Excute command**			High byte = 0x01	Return: 0=OK, 0x87=Write protected
43-50	**Write Groupe: Write new password**		Device Specific Command 129		
43	Authorisation level (1-4)	1 byte			(See Code table)
44-46	Old password	6 byte			
47-49	New password	6 byte			
50	**Excute command**	2 byte		0x0100	Return: 0=OK, 0x88=Access restricted

Write Holding Reg.

51-55	**Write Groupe: Write lower level password**		Device Specific Command 130		
51	Level (1-3)	1 byte			(See Code table)
52-54	Password	6 byte			
55	**Excute command**	2 byte		0x0100	Return: 0=OK, 0x88=Access restricted
56	**Write new MODBUS slave address (1-255)**	2 byte	----		
56				Low byte = Data	(1-255)
56	**Excute command**			High byte = 0x01	Return: 0=OK 0x80=Error

Code table

Code tables	LT60RS			Level Transmitter			
PV unit codes	(Primary value)	Level/Pressure		**SV unit codes**	(Secondary value)	Temperature	
Code	Description	Comment		Code	Description	Comment	
2	In HG			32	degree C		
3	Ft HG			33	degree F		
5	mm HG			35	Kelvin		
6	PSI						
7	BAR						
8	mBAR						
9	G/cm2						
10	KG/cm2						
11	Pa						
12	kPa						
13	Torr						
14	Atm						
237	Mpa						
238	In H2O						
239	mm H2O						
240	m H2O						
241	Kp/cm2						

Transfer function code (not used in LT60RS)		PV output		**Authorisation level (not used in LT60RS)**			
Code	Description	Comment		Code	Description	Comment	
0	Linear			1	Read only		
1	Square root			2	Read and Write Universal Commands		
2	Special curve	not used		3	Read and Write all		
3	Exponential	not used		4	Factory code		

EC DECLARATION OF CONFORMITY

according to ISO/IEC 17050:2004

Document number: CON180301_LT60FD_RS_CE

Manufacturer: Pondus Instruments AB, Vällingby, Sweden

The manufacturer hereby declares that the product

Product: LT60FD/RS/FDL/RSL-abcd where a-d can be a number 0-9 or a letter between A-Z.

is in conformity with the provisions of the following EC directives including the last amendments, and with national legislation implementing these directives

Directive 2014/30/EU (EMC) as of February 2014 due to compliance with the following standards: EN 61326-1-2-3

Directive 2014/68/EU (PED) due to compliance with the following basic technical standards/product standards:
                    AFS2016:1 with the following exceptions:
a) if the product is used as safety equipment it must be CE marked in the complete construction.

Directives REACH EU1907/2006, RoHS 2002/95/EU, RoHS2 2011/65/EU

following the provisions of the Regulation(s) including correction EU1907/2006 EUT L 36/84 05-02-2009.

Supplementary information:
The products conform to REACH and RoHS regulations concerning:
- substances used in own production
- substances in electronic and electrical components

As far as we know until today all of our suppliers have pre-registered substances in own production or in products where applicable.
The products manufactured and delivered by Pondus Instruments AB do not need to be registered according to REACH regulation EU1907/2006

Issued: 20 Mars 2018, Stockholm, Sweden
                    Lars Göransson, Head of Quality