

Operation Manual

Level Plus[®] – LLH

Magnetostrictive Liquid Level Transmitters with Temposonics[®] Technology

- Compact Sanitary Level Measurement
- Inherent Accuracy +/- 0.5 mm
- No Scheduled Maintenance or Recalibration

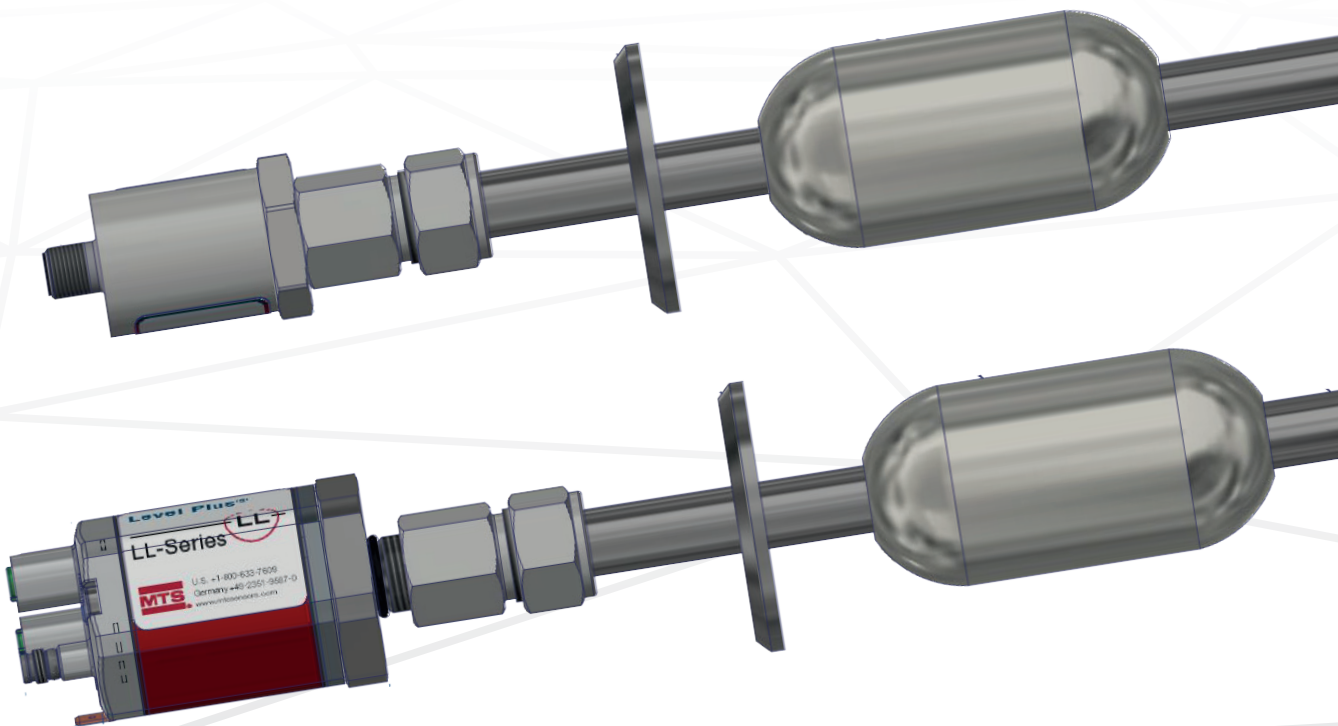


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2. Terms and definitions

A

Analog Output

For a sensor with analog output, the measured value is output as an analog voltage signal or current signal.

D

Differential

For differential measurement, the distance between the two position-magnets is output as a value.

I

Interface

Noun; The measurement of the level of one liquid when that liquid is below another liquid.

Interface

Adj.; The Software *Graphical User Interface* (GUI) that allows the user to access software protocols (*HART*®, *DDA*, *MODBUS*).

N

NPT

U.S. standard defining tapered pipe threads used to join pipes and fittings.

S

Specific Gravity

The *density ratio* of a liquid to the density of water at the same conditions.

R

Resolution

The sensor precisely measures time to provide the position measurement. For the analog output the measured time value is converted into an analog voltage signal or current signal using a high-performance Digital to Analog Converter (DAC) having 16 bits of resolution.

3. Introduction

3.1 Purpose and use of this manual

Important:

Before starting the operation of the equipment read this documentation thoroughly and follow the safety information.

The content of this technical documentation and of its various annexes is intended to provide information on mounting, installation and commissioning by qualified automation personnel or instructed service technicians who are familiar with the project planning and dealing with the Level Plus liquid level transmitters.

3.2 Used symbols and warnings

Warnings are intended for your personal safety and for avoidance of damage to the described product or connected devices. In this documentation, safety information and warnings to avoid dangers that might affect the life and health of personnel or cause material damage are highlighted by the preceding pictogram, which is defined below.

Symbol	Meaning
NOTICE	This symbol is used to point to situations that may lead to material damage and/or personal injury.

4. Safety instructions

4.1 Intended use

The liquid level transmitter is intended to be used to measure the level of liquid(s) contained by a structure. The product may only be used for the applications defined under item 1 to item 3 and only in conjunction with third-party devices and components recommended or approved by Temposonics. As a prerequisite of proper and safe operation, the product requires correct transport, storage, mounting and commissioning and must be operated with utmost care.

1. Application does not exceed product's performance specification in chapter 5.5.
2. The liquid(s) being measured are compatible with the selected wetted parts of the product.
3. Temposonics floats should be used for proper functionality and safety approval.

4.2 Foreseeable misuse

Foreseeable misuse	Consequence
Wrong sensor connection	Possible damage to electronics See chapter 7 for Electrical Connections
Improper Installation	Physical damage to packaging See chapter 6 for Installation
Process Temperature out of range	Signal Degradation, Possible Damage to Sensor See chapter 5.6 for Specifications
Power Supply out of range	No Communication, Possible Damage to Sensor See chapter 5.6 for Specifications
Process Pressure out of range	Possible Damage to Sensor, See chapter 5.6 for Specifications
Improper Chemical Compatibility	Possible Damage to Sensor, Customer Must Select Wetted Material that is compatible with liquid(s) in tank
Modifying Sensor	Warranty Void, Hazardous Approval Void Customer should contact factory for custom unit
Improper Grounding	Possible Damage to Sensor, Full Protection Compromised, See chapter 7.3 for Grounding
Use of float not sold by Temposonics	Unit may not function correctly or may have erratic output

Fig. 1: Foreseeable misuse

4.3 Installation, commissioning and operation

The liquid level transmitter should be used only in technically safe conditions. To maintain this condition and to ensure safe operation, installation, connection and service, work may be performed only by qualified technical personnel.

If danger of injury to persons or of damage to operating equipment could be caused by sensor failure or malfunction, additional safety measures should be included in the overall automation solution. In the event of trouble, shut down the sensor and protect it against accidental operation.

1. Wear proper personal protection equipment such as hard hat, safety shoes, safety glasses, gloves, and hearing protection.
2. Do not open or dismantle the sensor.
3. Follow the specifications given in the technical documentation.
4. Two (2) individuals are recommended to conduct proper installation, commissioning, and repair of the level transmitter.
5. Protect the sensor against mechanical damage during installation and operation.
6. Do not use damaged products and secure them against unintentional use. Mark damaged products as being defective.
7. Connect the sensor very carefully and pay attention to the polarity of connections. Temposonics recommends to not make connections while power is live.
8. Before turning on power, ensure that nobody's safety is jeopardized by starting level transmitter and/or process.
9. Regularly follow preventative maintenance to prevent safety risks
10. Make sure that no wire strands are loose or sticking out of the terminal block connection which could short and cause a problem.

5. Product overview

The Level Plus LLH satisfies the demand for an accurate and robust liquid level transmitter for sanitary/hygienic applications. The LLH can provide product level and/or interface level in a compact mechanical design. There is no requirement for scheduled maintenance or recalibration for the expected 10 year life of the sensor. Set it and Forget it.

The LLH liquid level transmitter can be mounted on most tanks offering NPT and Tri-clamp connections from 3/4 to 6 inches. The LLH also offers a variety of outputs including Analog, CANbus, SSI, IO-Link, Powerlink, ProfiNet, Ethernet IP, and EtherCat. Included in the model number is the selection of float(s) and cable. The single model number offers everything needed for level measurement in a variety of applications.

Applications

- Sanitary Finish Ra 25 uin (0.64 um)
- Product Level
- No scheduled maintenance or recalibration
- Inherent Accuracy +/- 0.5 mm
- IP69K
- 100 g Shock/15 g Vibration

Features

- Bottle Filling Machines
- CIP Tanks
- Skids
- Balance Tanks
- Fermentation Tanks
- Dispensing

5.1 Components

The Level Plus® LLH liquid level transmitter consists of three main components; a base model, float, and process connection. Varying the components of the transmitter allows the transmitter to be customized to almost any application.

Base Model

The base model of the LLH consist of the housing, M18 threads, M12 connector, 10 mm inner pipe, 5/8" OD outer pipe, and pipe connection fitting. The drawing of the base model is shown in section 5.7 Technical Drawing.

Floats

LLH transmitters offer numerous floats for different applications such as stainless steel for product level. For detailed information about floats, refer to the 'Accessories Catalog', (Temposonics Part # 551103).

For assistance with selecting a specific float for your application,

please contact Technical Support with the following information:

- Specific gravity of liquid(s) being measured
- Process temperature
- Process opening size
- Vessel pressure

Process Connection

The LLH is available with multiple connection types and sizes to allow for mounting on the tank. The options include a 3/4" NPT fitting or a Tri-clamp available from 1.5 to 6".

Accessories

Temposonics also offers a series of displays, housings, converters, and other accessories, please refer to the 'Accessories Catalog', (Part #551103).

5.2 Accuracy

For magnetostrictive transmitters inherent accuracy is measured in terms of non-linearity. Non-linearity is a measurement of any imperfections in the waveguide that are reflected in the linearity of the transmitter's output. Temposonics tolerances reflect a maximum non-linearity of +/- 0.5 mm Temposonics is able to achieve such strict tolerances by manufacturing all of its own waveguide from a proprietary alloy and testing 100% of all transmitters before shipping.

5.3 Warranty

Important:

Contact Technical Support or Customer Service for assistance if you suspect that the transmitter is not working correctly. Technical support can assist you with troubleshooting, part replacement, and Returned Material Authorization (RMA) information if required.

All Level Plus® transmitters come with a two year limited warranty from the factory shipment date. An additional extended warranty can be purchased. A Return Materials Authorization (RMA) number is required and must accompany any transmitter returns. Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory. A Material Safety Data Sheet (MSDS) must also accompany the transmitter that was used in any process.

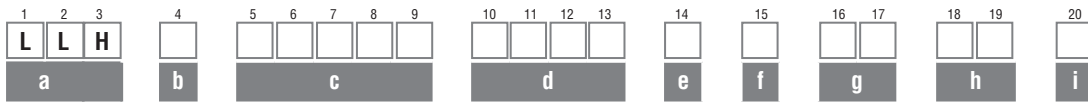
The Temposonics obligation is limited to repair or replacement of any defective part of the unit. No warranty can be provided for defects that are due to improper use or above average stress of the product, as well as for wear parts. Under no circumstances will Temposonics accept liability in the event of offense against the warranty rules, no matter if these have been assured or expected, even in case of fault or negligence of the company.

Temposonics explicitly excludes any further warranties. Neither the company's representatives, agents, dealers nor employees are authorized to increase or change the scope of warranty.

5.4 Storage

If storage is required prior to installation, store indoors in a dry environment at ambient temperature range not to exceed $-40\dots+71^{\circ}\text{C}$ ($-40\dots+160^{\circ}\text{F}$).

5.5 Model Number Identification



a	Sensor model		
L	L	H	E-Series/R-Series

b	Sensors pipe		
C	Sanitary, T-bar, TB		
D	Sanitary, drain-in-place, DP		
E	Sanitary, clean-in-place, CP		
F	Sanitary, drain-in-place, no hole, DN		

c	Order length				
X	X	X	X	M	0156...2646 mm
X	X	X	X	U	006.2...104.2 in.

d	Output			
Voltage				
V	1	1	0	10...0 Vdc (1 output channel with 1 position magnet)
Current				
A	1	1	0	20...4 mA (1 output channel with 1 position magnet)
U	4	0	1	Profinet RT & IRT
U	4	0	2	Profinet RT & IRT
U	2	0	1	EtherNet/IP
U	3	0	1	POWERLINK
U	1	0	1	EtherCAT
L	0	0	0	IO-Link

d	Output			
S	1	B	0	SSI, 25 bit, Binary, 0.1 mm resolution*
S	1	G	0	SSI, 25 bit, Gray, 0.1 mm resolution*
S	2	B	0	SSI, 24 bit, Binary, 0.1 mm resolution*
S	2	G	0	SSI, 24 bit, Gray, 0.1 mm resolution
C	3	1	1	CANopen, 1000 kBit/s, 20 um, 1 magnet
C	3	2	1	CANopen, 500 kBit/s, 20 um, 1 magnet
C	3	3	1	CANopen, 250 kBit/s, 20 um, 1 magnet
C	3	4	1	CANopen, 125 kBit/s, 20 um, 1 magnet
C	4	1	1	CANopen (bus terminator), 1000 kBit/s, 20 um, 1 magnet
C	4	2	1	CANopen (bus terminator), 500 kBit/s, 20 um, 1 magnet
C	4	3	1	CANopen (bus terminator), 250 kBit/s, 20 um, 1 magnet
C	4	4	1	CANopen (bus terminator), 125 kBit/s, 20 um, 1 magnet
V	1	0	1	10...0 Vdc RH-V
A	1	0	1	20...4 mA RH-V

e	Process Connection Type		
1	NPT **		
4	Welded Tri-Clamp		
5	Adjustabel Tri-Clamp		
Z	Custom Flange		

f See next page

*/ Measurement direction is set to measure away from housing towards tip.

**/ Only available with Sensor Pipe options E and F

f	Process Connection Size
A	3/4" ***
B	1" ***
C	1½"
D	2"
F	2½"
G	3"
H	4"
J	6"
X	None
Z	Custom Flange

g	Float 1 ****
X	X None
S	1 401513-2
S	5 200931-6
S	7 251234-2
S	8 252228-2
S	9 403374
S	A 560564-2

h	Float 2
X	X None


f	Options
C	5 m cable
X	None

**Manuals, Software & 3D models available at:
www.temposonics.com**

***/ Only available with Sensor Pipe Options E and F and NPT Process Connection Type

****/ Make sure to order the sensor with a process connection large enough to fit the float when ordering Sensor Pipe options E or F.

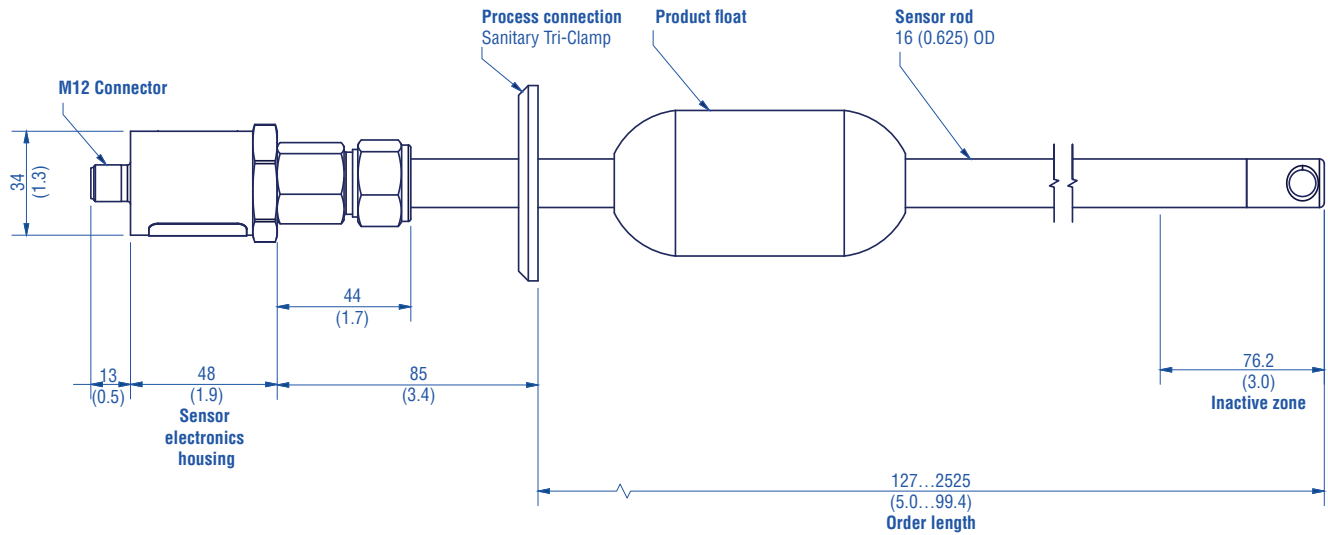
5.6 Technical data

Output Options	
Voltage	0...10 VDC or 10...0 VDC, 0...10 VDC and 10...0 VDC (controller input resistance $R_L > 5 \text{ k}\Omega$)
Current	4...20 mA or 20...4 mA (minimum / maximum load: 0 / 500 Ω)
SSI (Synchronous Serial Interface)	Binary or Gray, 24 or 25 bit
CANbus	CANopen: CIA standard DS 301 V3.0 / encoder profile DS 406 V3.1, CAN System ISO-11898
IO-Link	V1.1, 32 bit signed, COM3 (230.4 kBaud)
EtherCAT	100 Base-Tx, Fast Ethernet, 100 Mbits/s max
POWERLINK	Ethernet POWERLINK V2
EtherNet/IP	Encoder CIP device profile with CIP Sync and DLR capabilities, 100 Mbits/s max
Profinet	Profinet RT, Profinet IRT version 2.3, MTS Profile and Encoder Profile 4.1, 100 Mbits/s max
Measured value	Product Level and/or Interface Level
Measurement parameters	
Resolution	0.1 mm or greater
Inherent accuracy	+/- 0.5 mm
Repeatability	$\leq \pm 0.005 \%$ F.S. (minimum $\pm 20 \mu\text{m}$)
Operating conditions	
Operating temperature	-40...+75 °C (-40...+167 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection ¹	IP67 / IP69K (select outputs only, see manual 552103) (correctly fitted)
Shock test	100 g (single shock) IEC standard 60068-2-27
Vibration test	15 g / 10...2000 Hz IEC standard 60068-2-6 (resonance frequencies excluded)
EMC test	Electromagnetic emission according to EN 61000-6-3 Electromagnetic immunity according to EN 61000-6-2 The sensor meets the requirements of the EU directives and is marked with 
Design/Material	
Sensor electronics housing/Flange	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Wetted parts	Stainless steel 1.4404 (AISI 316L) Ra 25 uin. (Ra 0.625um)
Order Length	127 to 2525 mm (5.0 to 99.4 in)
Operating pressure	5/8" O.D. 69 bar (1000 psi)
Mounting	
Rigid Pipe	NPT (3/4", 1", 1.5", 2", 2.5", 3", 4"), ANSI RF Flange (2", 3", 4", 5", 6") (150#, 300#, 600#)
Electrical connection	
Connection type	M12 male connector (for pin see page 5 and page 6)
Operating voltage	+24 VDC (-15 / +20 %); UL recognition requires an approved power supply with energy limitation (UL 61010-1), or Class 2 rating according to the National Electrical Code (USA) / Canadian Electrical Code
Ripple	$\leq 0.28 \text{ V}_{pp}$
Current consumption	Analog: 50...140 mA, SSI, CANbus & IO-Link: 60 mA
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to -30 VDC
Overvoltage protection	Up to 36 VDC

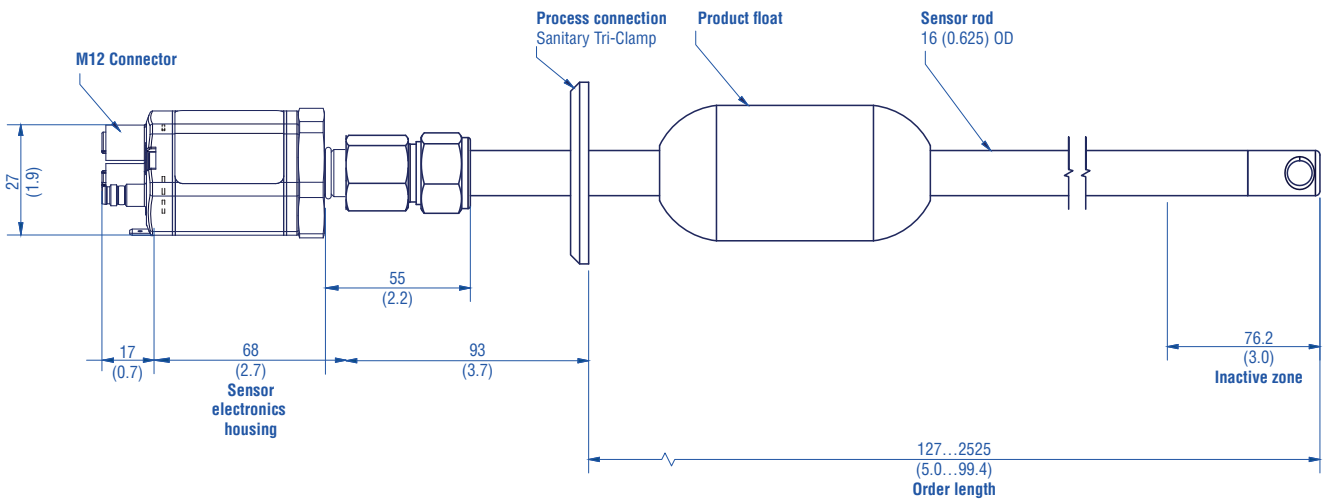
¹/The IP rating is not part of the UL recognition

5.7 Technical drawing

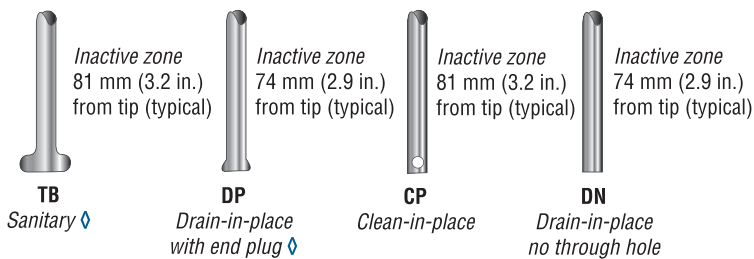
LLH - E-Series



LLH - R-Series



End plug options



◆ End plug style comes with permanently mounted floats. These floats cannot be removed from the pipe.

Fig. 2: Technical drawing LLH and End plug options

6. Installation and mounting

6.1 Training

Installation should only be conducted by qualified service personnel according to local regulations or Temposonics trained service technicians. Temposonics offers web based and in person training for installation, commissioning, maintenance, and repair. Temposonics also offers factory direct services for these same functions. Contact Temposonics to discuss training or factory direct services before starting.

6.2 Stilling wells and guide poles

Level Plus® transmitters can be mounted in slotted or unslotted stilling wells but a slotted stilling well is always preferred. Using a unslotted stilling well will negatively affect performance of any level device as the level in the stilling well can differ from the level in the tank. The Level Plus® transmitter can also be installed to one side of the stilling well to also allow for sampling and manual gauging from the same opening as the automatic tank gauging. Contact technical support for details.

Level Plus® transmitters do not require a stilling well for installation. Our transmitters are installed in numerous tanks without stilling wells with no loss in performance due to our patented flexible waveguide and hose. A stilling well is highly recommended for agitated, turbulent, and/or fast filling tanks.

6.3 Tools

- Adjustable pliers
- Large pipe wrench
- Common head screwdriver, slotted screwdriver

6.4 Installation steps

Caution:

It is recommended that assembly and mounting of this transmitter should not be done alone. To ensure proper and safe assembly of the level transmitter, a minimum of two (2) individuals are recommended. Gloves are also recommended. PPE may be required for work areas such as safety shoes, safety glasses, and hard hat.

1. Consult chapter 4.3 before starting.
2. Perform steps 1-10 in chapter 8.4.1
3. For pipe options C with T-bar end plug and D with DP end plug the floats are captive and cannot be removed.
4. For pipe options E with Clean-in-Place end plug and F with DN end plug the floats can be removed.
5. The pipe options E and F can be ordered with the 3/4" NPT fitting. For this combination, remove the float and add adapter. Slide adapter up the pipe and do not scratch the pipe. Place float on pipe at the bottom. Do not drop float or allow it to free fall along the rigid pipe as damage may result.
6. Insert the rigid pipe and floats through the tank opening and lower the transmitter/ float assembly into the tank.
7. For Tri-clamp process connections, lower until the Tri-clamp rest on the mating connection of the tank. Install Tri-clamp.
8. For NPT connections, connect the adapter to the tank. Position level transmitter at desired height and tighten NPT fitting.
9. Connect cable to connector.
10. Terminate the pigtail cable noting proper wire orientation. Wiring diagram is shown in Section 7.

Consult Section 5.7 Technical Drawing to reference what the finished installation should look like.

6.5 Mounting

The method of mounting the transmitter is dependent on the vessel or tank in which it is being used, and what type of transmitter is being mounted. For model LLH there is a NPT thread mount or Tri-clamp mount.

NPT Threaded mounting

In some applications, the model LLH transmitter can be mounted directly to the tank or flange via a NPT threaded fitting, assuming there is a proper threaded connection available. If the float will not fit through the flange opening when the flange is removed, there must be some alternative means to mount the float on the transmitter from inside the vessel; this may require an access port nearby the entry point of the transmitter as shown in Fig. 3.

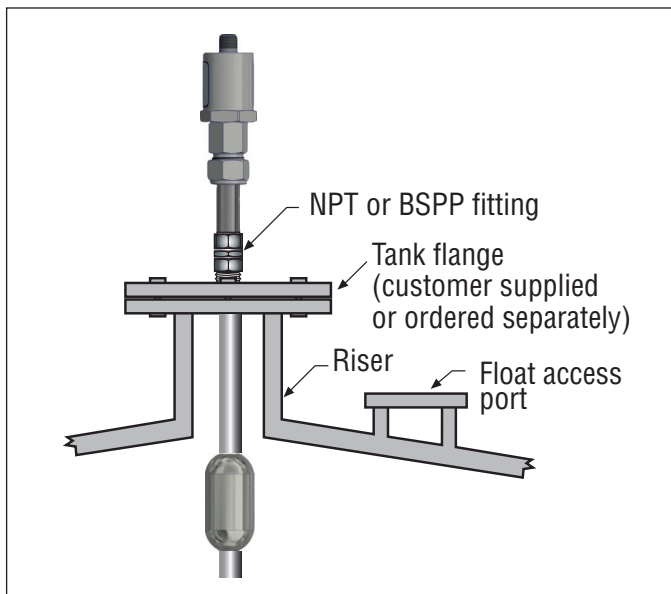


Fig. 3: NPT Threaded mounting

Tri-Clamp mounting

The model LLH can also be mounted to a Tri-Clamp as shown in Fig. 4. Depending on the end plug the float may come on the level transmitter. If not, install the float on the level transmitter. To complete the installation, mount the transmitter, Tri-clamp and float as a unit into the tank.

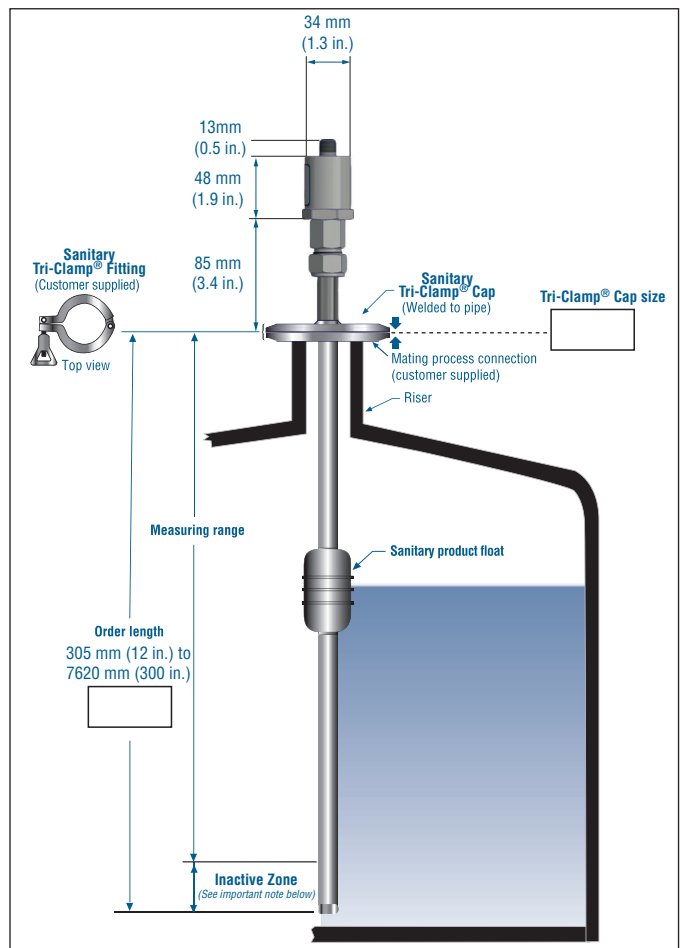


Fig. 4: Tri-Clamp mounting

7. Electrical connections

7.1 Basic information

Placement of installation and cabling have decisive influence on the sensor's electromagnetic compatibility (EMC). Hence correct installation of this active electronic system and the EMC of the entire system must be ensured by using suitable metal connectors, shielded cables and grounding. Overvoltages or faulty connections can damage its electronics despite protection against wrong polarity.

NOTICE

1. Do not mount the sensors in the area of strong magnetic or electric noise fields.
2. Never connect / disconnect the sensor when voltage is applied.

7.2 Safety recommendations

Be sure to:

1. Always follow applicable local and national electrical codes and observe polarity when making electrical connections.
2. Never make electrical connections to the level transmitter with power turned on.
3. Use low-resistance twisted pair and shielded cables. Connect the shield to ground externally via the controller equipment.
4. Keep control and signal leads separate from power cables and sufficiently far away from motor cables, frequency inverters, valve lines, relays, etc.
5. Use only connectors with metal housing and connect the shielding to the connector housing.
6. Keep the connection surface at both shielding ends as large as possible. Connect the cable clamps to function as a ground.
7. Keep all non-shielded leads as short as possible.
8. Keep the earth connection as short as possible with a large cross section. Avoid ground loops.
9. With potential differences between machine and electronics earth connections, no compensating currents are allowed to flow across the cable shielding. Recommendation: Install potential compensating leads with large cross section or use cables with separate double shielding, and connect only one end of the shield.
10. Use only stabilized power supplies in compliance with the specified connecting values

7.3 Grounding

Earth/Machine Ground

The LLH is earth grounded through the process connection to the tank with the assumption that the tank is grounded. If the tank is not grounded then a ground will need to be connected to the housing of the LLH. Without correct grounding the overvoltage protection will be compromised.

Shield Ground

Immunity performance of the sensor from external sources of surge, burst, RF, radiated emissions and other noise is dependent on a proper ground for the shield of the communications cable. The communications cable shield should be of a braided type and connected to the internals.

7.4 Wiring Connections


D34 Analog		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	+24 VDC (-15 / +20 %)
	2	Output 1
	3	DC Ground (0 V)
	4	Output 2
	5	DC Ground

Fig. 5: D34 Analog


D84 SSI		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Clock (+)
	2	Clock (-)
	3	Data (+)
	4	Data (-)
	5	Not connected
	6	Not connected
	7	+24 VDC (-15 / +20 %)
	8	DC Ground (0 V)

Fig. 6: D34 SSI

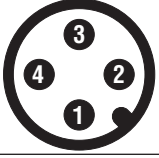
D44 IO-Link		
Signal + power supply		
M12 A-coded	Pin	Function
	1	+24 VDC (± 25 %)
	2	DI/DQ
	3	DC Ground (0 V)
	4	C/Q

Fig. 7: D44 IO-Link


D34 CAN		
Signal + power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Shield
	2	+24 VDC (-15 / +20 %)
	3	DC Ground (0 V)
	4	CAN_H
	5	CAN_L

Fig. 9: D84 CAN

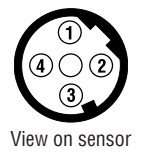
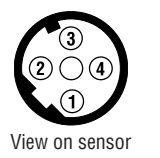
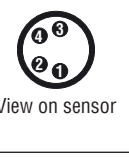
D56		
Port 1 – Signal		
M12 female connector (D-coded)	Pin	Function
 <p>View on sensor</p>	1	Tx (+)
	2	Rx (+)
	3	Tx (-)
	4	Rx (-)
Port 2 – Signal		
M12 female connector (D-coded)	Pin	Function
 <p>View on sensor</p>	1	Tx (+)
	2	Rx (+)
	3	Tx (-)
	4	Rx (-)
Power supply		
M8 male connector	Pin	Function
 <p>View on sensor</p>	1	+12...30 VDC (± 20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 8: D56




D58		
Port 1 – Signal		
M12 female connector (D-coded)	Pin	Function
 <p>View on sensor</p>	1	Tx (+)
	2	Rx (+)
	3	Tx (-)
	4	Rx (-)
Port 2 – Signal		
M12 female connector (D-coded)	Pin	Function
 <p>View on sensor</p>	1	Tx (+)
	2	Rx (+)
	3	Tx (-)
	4	Rx (-)
Power supply		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	+12...30 VDC (±20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 10: D58

8. Maintenance

8.1 Training

Installation should only be conducted by qualified service personnel according to local regulations or Temposonics trained service technicians. Temposonics offers web based and in person training for installation, commissioning, maintenance, and repair. Temposonics also offers factory direct services for these same functions. Contact Temposonics to discuss training or factory direct services before starting.

8.2 Tools

- Adjustable wrench
- Anti-seize

8.3 Inspection

Below are some standard items that should be inspected on a regular basis to make sure that the level transmitter and surrounding environment are in operating condition.

- There are no visible unauthorized modifications
- Electrical connections are tight
- No obvious damage to cable
- Housing is not damaged or cracked
- No corrosion on visible parts

8.4 Preventative maintenance

The level transmitters do not typically require preventative maintenance but may require preventative maintenance dependent on the application. For general purpose applications where there is no potential for buildup on the pipe and/or float there is no need for preventative maintenance but routine inspection is still suggested. For severe service applications where there is potential for buildup on the pipe and/or float then preventative maintenance is

8.4.1 General purpose applications

8.4.1.1

Perform Inspection suggested in chapter 8.3.

8.4.1.2

It is suggested to disconnect the process connection between the tank and the level transmitter and anti-seize or similar lubricant to prevent damage to threads.

8.4.1.3

No additional preventative maintenance is necessary. Preventative maintenance suggested for Severe Service Applications may be performed.

NOTE

It is best to clean the pipe as it is removed from the tank to minimize the amount of product that is removed from the tank. The user should take caution and abide by all regulations so that product is not spilled and the environment is not contaminated.

8.4.2 Severe Service Applications

8.4.2.1

Perform Inspection suggested in chapter 8.3.

8.4.2.2

Disconnect Power.

8.4.2.3

Disconnect process connection from tank. Remove level transmitter from tank.

8.4.2.4

When the bottom of the pipe is reached inspect the float(s).

8.4.2.4.1

If the floats are highly contaminated then remove the assembly from the tank and remove the floats from the pipe.

8.4.2.4.2

If the floats are slightly contaminated then clean the floats without removing the floats from the pipe.

8.4.2.5

Add anti-seize or similar lubricant to connection to prevent damage to threads. Replace rigid pipe and floats in tank.

8.4.2.6

Connect process connection to tank.

8.4.2.7

Connect Power.

8.4.2.8

The process should be carried out regularly until a consistent pattern has been established as to how long the intervals between cleanings should be.

9. Repair

9.1 RMA policy

Important:

Contact Technical Support or Customer Service for assistance if you suspect that the transmitter is not working correctly. Technical support can assist you with troubleshooting, part replacement, and Returned Material Authorization (RMA) information if required.

All Level Plus® transmitters come with a two year limited warranty from the factory shipment date. A Return Materials Authorization (RMA) number is required and must accompany any transmitter returns. Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory. A Material Safety Data Sheet (MSDS) must also accompany the transmitter that was used in any process.

9.2 Training

Repair should only be conducted by qualified service personnel according to local regulations or Temposonics trained service technicians. Temposonics offers web based and in person training for installation, commissioning, maintenance, and repair. Temposonics also offers factory direct services for these same functions. Contact Temposonics to discuss training or factory direct services before starting.

9.3 Troubleshooting

Symptom	Possible cause	Action
No communication with transmitter	No power	Check voltage at transmitter
	Wiring incorrect	Reference installation drawing chapter 7.4
	Wrong protocol	Confirm software and transmitter are same protocol

Fig. 11: Troubleshooting reference

10. Spare Parts

Below are the spare parts list for the LP-Series shown as the display, electronic module, sensing element, and flexible hose. Please contact Temposonics Technical Support with any questions.

Cable	Part number
Analog	370675
IO-Link	370675
CANopen	370675
SSI	370676
Ethernet Power	530066
Ethernet Communication	530065
Process Connection	Part number
1 " NPT	562349-1
1,5 " NPT	562349-2
2 " NPT	562349-3
2,5 " NPT	562349-4
3 " NPT	562349-5
4 " NPT	562349-3

Fig. 12: Spare parts

11. Interface

11.1 Analog output

The analog output for LLH is a single output. The output codes starting with V are voltage outputs and the codes starting with A are current outputs. The first digit is the voltage or current closest to the head and the second is closest to the tip. For example, A010 4..20mA has the 4mA set point closest to the head and 20 mA closest to the tip. The analog output cannot be adjusted.

11.2 IO-Link output

IO-Link is an open standard according to IEC 61131-9. It is a serial, bi-directional point-to-point connection for signal transmission and energy supply. The bi-directional communication enables consistent communication between sensors and the controller as well as consistent diagnostic information down to the sensor level. For additional details on setup please consult the EH IO Link manual 551485 section 5.

The measurement direction of IO Link can be programmed by the customer. The Parameter Measuring Direction, Index 0x73, can be set to False to measure from the housing to the tip of the pipe or True to measure from the tip of the pipe to the housing.

11.3 SSI output

The SSI output is available as either 24 or 25 bit, Binary or Gray code, and 0.1 mm resolution. The measurement direction is set to measure up from the tip of the pipe.

11.4 CANopen output

CANbus (Controller Area Network) is designed for high-speed data exchange at machine level. CAN is a vendor independent open fieldbus system, based on standard ISO 11898. CAN specifies the functional and technical parameters with which the intelligent digital automation devices can be networked via a master-slave serial link by using a communication profile. Protocol architecture of functional and applications data is oriented to the OSI reference model (ISO 7498). Bus technology is administrated and developed by the user organisation CiA (CAN in Automation)

The CANOpen output of the LLH is available with or without integral termination, selectable Baud rate of 1000, 500, 250, or 125 kBit/s. The resolution is set at 0.02 mm and the output can be configured for 1 or 2 floats. The measurement direction is set to measure away from the electronic housing and towards the tip of the pipe

11.5 Profinet RT & IRT

The model LLH is available with PROFINET RT (Real Time) and IRT (Isochronous Real Time). PROFINET IRT offers a synchronized communication with a minimum cycle time of 250 µs. For time-critical applications, linear extrapolation enables synchronized controller communication for any stroke length of the sensor. In addition to the measured position value via the PROFINET protocol further data about the current sensor status, such like the total distance travelled, the internal temperature and the total operating hours, can be displayed for diagnostic purposes

For details on the Profinet RT & IRT output consult operation manual 551973 sections 5 and 6. The measurement direction by default is set to measure away from the housing. The direction can be changed to Reverse to allow for measuring away from the tip of the pipe

11.6 Ethernet/IP

The EtherNet/IP™ output supports CIP Sync™ (Common Industrial Protocol) and DLR (Device Level Ring) capabilities. CIP Sync™ offers synchronization between devices in an EtherNet/IP™ network, allowing for increased control coordination in time-critical applications. DLR capability provides a fault-tolerant network so that the sensor can be used in ring connection topologies when reliable continuous system operation is required.

For details on the EtherNet/IP output consult operation manual 552059 sections 5, 6, 7, and 8. The measuring direction can be changed between forward (measuring away from the housing) and reverse (measuring away from the tip of the pipe). Details are in Table 6 in Section 8.

11.7 POWERLINK

The sensor is equipped with POWERLINK V2 and supports a minimum cycle time of 250 μ s. In time-critical applications, the linear extrapolation can be activated. This offers a cycle time of 200 μ s for every sensor stroke length. The measurement of the sensor can be synchronized to the polling cycle of the controller. In addition to the measured position value via the POWERLINK protocol further data about the current sensor status, such like the total distance travelled, the internal temperature and the total operating hours, can be displayed for diagnostic purposes.

For details on POWERLINK output consult operation manual 552010 sections 5, 6, and 7. The measuring direction can be changed between forward (measuring away from the housing) and reverse (measuring away from the tip of the pipe). Details are in Table 5 in Section 7.

11.8 EtherCAT

The model LLH supports the EtherCAT® specifications including distributed clock. The mechanism of distributed clocks enables a synchronized communication with a minimum cycle time as fast as 100 μ s. For time-critical applications R-Series V with extrapolation allows synchronized controller communication for any stroke length of the sensor. In addition to the measured position value via the EtherCAT® protocol further data about the current sensor status, such like the total distance travelled, the internal temperature and the total operating hours, can be utilized for diagnostic purposes.

For details on EtherCAT output consult operation manual 552059 sections 5, 6, 7, and 8. The measuring direction can be changed between forward (measuring away from the housing) and reverse (measuring away from the tip of the pipe). Details are in Table 6 in Section 8.

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