DeltaSpan™

General Purpose External Mount Pressure Level Transmitter

LD30 Series Manual

Cable Series
(LD30-S_01)

Conduit Series
(LD30-S_11)

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The LD30 Series Industrial Pressure Transmitters converts a single positive pressure into a standard 4-20 mA output signal. The transmitter can be used to accurately measure compatible gases and liquids with full scale accuracy of 0.25%. Designed for industrial environments with a NEMA 4X (IP66) housing, this transmitter resists most effects of shock and vibration.

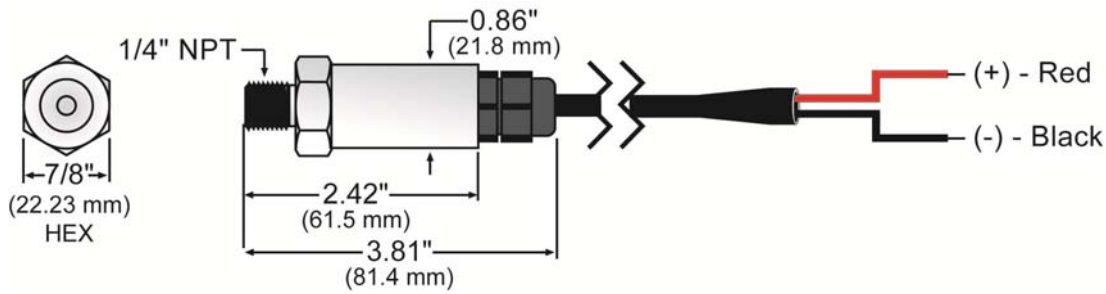
CAUTION: *Do not exceed specified supply voltage ratings. Permanent damage not covered by warranty will result. This device is not designed for 120 or 240 volt AC operation. Use only on 13 to 30 VDC.*

Table of Contents

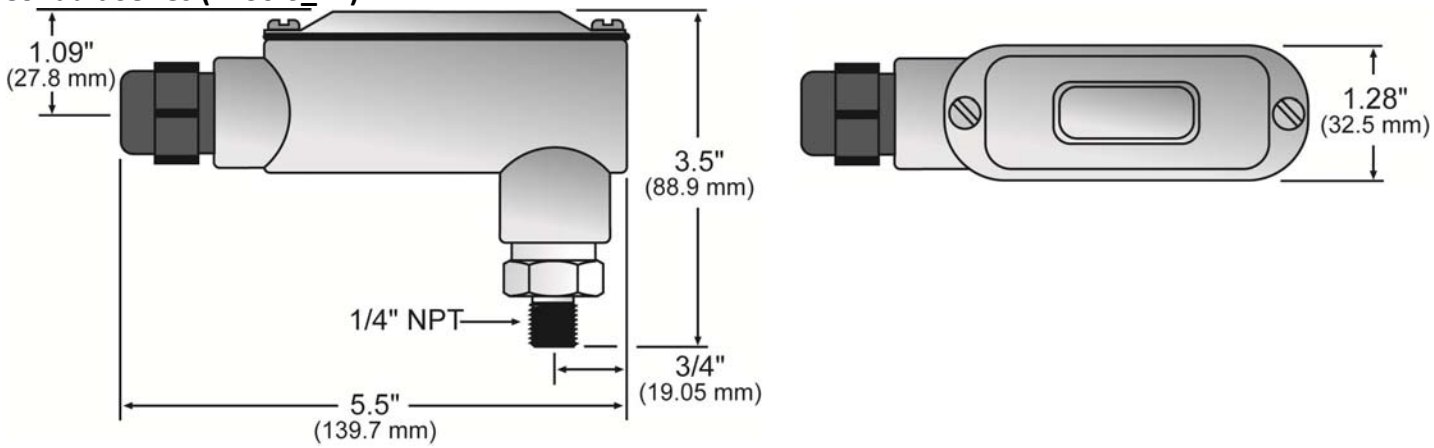
Service:	Compatible gases or liquids
Wetted Materials:	Body: 316 SS, 316L SS
Accuracy:	±0.25% of full scale
Temperature Limit:	F: 0° to 200° C: -18° to 93°
Compensated Temperature Range:	F: 0° to 175° C: -18° to 79°
Thermal Effect:	Less than ±0.02%/°F.
Pressure Limit:	-S0_1: 10 psig (maximum) / 50 psig (over pressure) -S2_1: 30 psig (maximum) / 150 psig (over pressure) -S4_1: 60 psig (maximum) / 300 psig (over pressure)
Power Requirement:	13 to 30 VDC
Output Signal:	4 to 20 mA, 2-wire
Response Time:	50 ms
Max. Loop Resistance:	1300 Ohms @ 30 VDC
Current consumption:	38 mA (maximum)
Electrical Connections:	-S_01: Cable (9’ length) -S_11: Conduit Housing with Terminal Block
Process connection:	¼” male NPT
Enclosure rating:	NEMA 4X (IP 66)
Mounting Orientation:	Mount in any position
Weight:	10 oz. (283 g)
Agency approval (CE):	EN 55022 EN 55024 EN 61000-4-2 EN 61000-4-3 EN 61000-4-4 EN 61000-4-5 EN 61000-4-6

Technology: A pressure transmitter is installed near or on the bottom of the tank by way of a ¼" NPT thread. A stainless steel pressure diaphragm within the pressure transmitter is exposed on one side to the application fluid. The amount of pressure applied to the sensing surface will slightly deflect the diaphragm. The deflection of the diaphragm is measured by a built-in microprocessor that provides greater linearity correction over common thermal compensation methods. A 4-20 mA current signal proportional the height of the liquid or the pressure of the gas is generated from the microprocessor.

Cable Series (LD30-S_01)



Conduit Series (LD30-S_11)



Material Compatibility:

- The LD30 series is made of 316 Stainless Steel (316 SS), 316L Stainless Steel (316L SS).
- The Cable Version (LD30-S_01) is provided with 3' (0.91 m) of cable.
- The Conduit Version (LD30-S_11) is provided with a junction box (including a terminal strip) and a ½' NPT conduit.
- The total length the signal can transmitter is based upon the following formula:
    - RLmax = (Vsup – 13V) / 0.02A,
        - RLmax is the total resistance including the load and the cable length.

Make sure that the switch is compatible with the application liquids. To determine the chemical compatibility between the sensor and its application liquids, refer to the Compass Corrosion Guide, available from Compass Publications (858-589-9636).

⚠ **About this Manual:** PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on all versions of the DeltaSpan Series Industrial Pressure Level Transmitter from Flowline; models LD30-____. Please refer to the part number located on the transmitter label to verify the exact model which you have purchased.

⚠ **User's Responsibility for Safety:** Flowline manufactures a wide range of liquid level sensors and technologies. While each of these technologies are designed to operate in a wide variety of applications, it is the user's responsibility to select a technology that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

⚠ **Proper Installation and Handling:** Only properly-trained staff should install and/or repair this product. Use a proper sealant with all installations. Always check for leaks prior to system start-up.

⚠ **Wiring and Electrical:** ***CAUTION:*** A supply voltage of 13 to 30 VDC is used to power the LD30 series transmitter. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

⚠ **Temperature and Pressure:** The LD30 series is designed for use in application temperatures from -18° to 93°C (0° to 200°F), and for use at pressures up to 2 x the full span of the LD30 series.

⚠ **Material Compatibility:** The Industrial pressure level transmitter, LD30 series, is made of 316 Stainless Steel (316 SS) and 316L Stainless Steel (316L SS). Make sure that the model which you have selected is chemically compatible with the application liquids.

⚠ **Flammable, Explosive and Hazardous Applications: DO NOT USE THE DELTASPAN, LD30 SERIES LEVEL TRANSMITTER IN HAZARDOUS LOCATIONS.**

⚠ **Make a Fail-Safe System:** Design a fail-safe system that accommodates the possibility of transmitter failure or battery power loss. In critical applications, Flowline recommends the use of redundant backup systems and alarms in addition to the primary system.

DeltaSpan is offered in six different models, based upon pressure rating and material. Depending on the model purchased, you may or may not have been shipped all the components shown below.

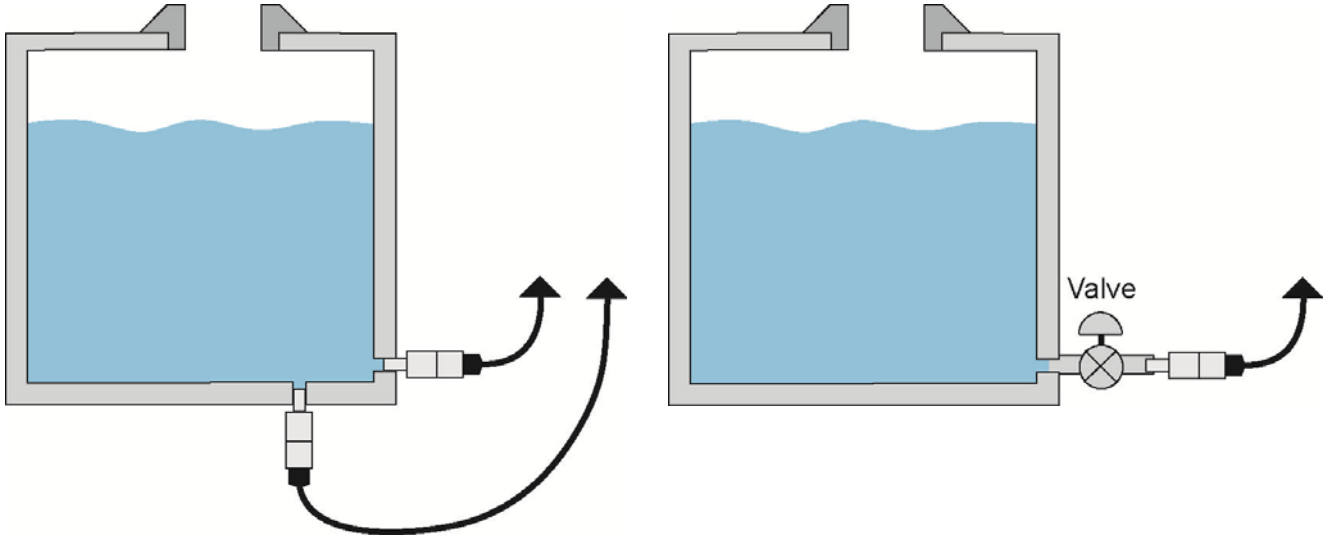
- DeltaSpan™ General Purpose External Mount Pressure Level Transmitter

Part Number	Maximum Pressure	Range in Water Column	Interface/ Connection
LD30-S001 LD30-S011	05 psi	11.54 ft wc / 3.52 m wc	9’ (2.7 m) Cable Terminal Block in Housing
LD30-S201 LD30-S211	15 psi	34.63 ft wc / 10.56 m wc	9’ (2.7 m) Cable Terminal Block in Housing
LD30-S401 LD30-S411	30 psi	69.30 ft wc / 21.12 m wc	9’ (2.7 m) Cable Terminal Block in Housing

- Quick Start Guide

The LD30 series will be installed near the bottom of the vessel. The switch can be installed through the side wall or through the bottom. Please note that the physical location of the level transmitter will indicate the lowest level of measurement within the tank. For example: mounting the transmitter 1 foot from the bottom of the tank, then the lowest reading of liquid will be 1 foot from the bottom.

Note: *When installing the LD30 series, design an installation method where the unit can be removed without having to remove the fluid from the vessel. The use of valves between the transmitter and the vessel can allow transmitter removal without draining the fluid.*



How to convert Pressure into Liquid Height?

Pressure transmitters are all defined by the pressure range and not by Liquid Height. To convert pressure to ***Liquid Height***, use the following ratio:

1 psi = 2.31 feet of water

or

1 psi = 0.704 meters of water

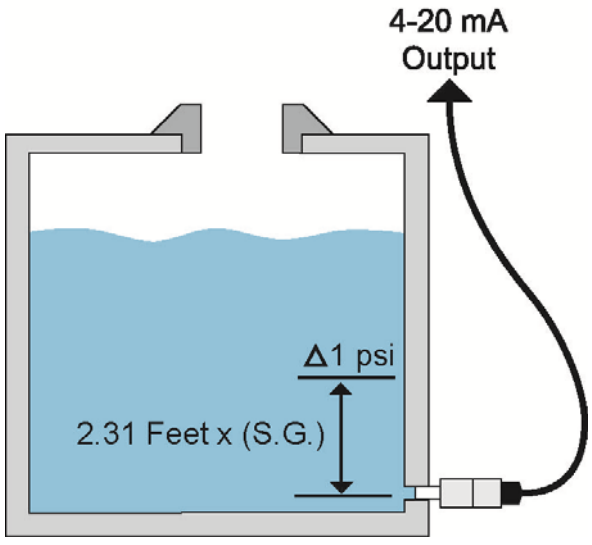
- Therefore, a ***15 psi*** transmitter will have a ***Liquid Height = 34.65 feet (10.56m)***:

15 psi x 2.31'/psi = 34.65'

or

15 psi x 0.704 m/psi = 10.56m

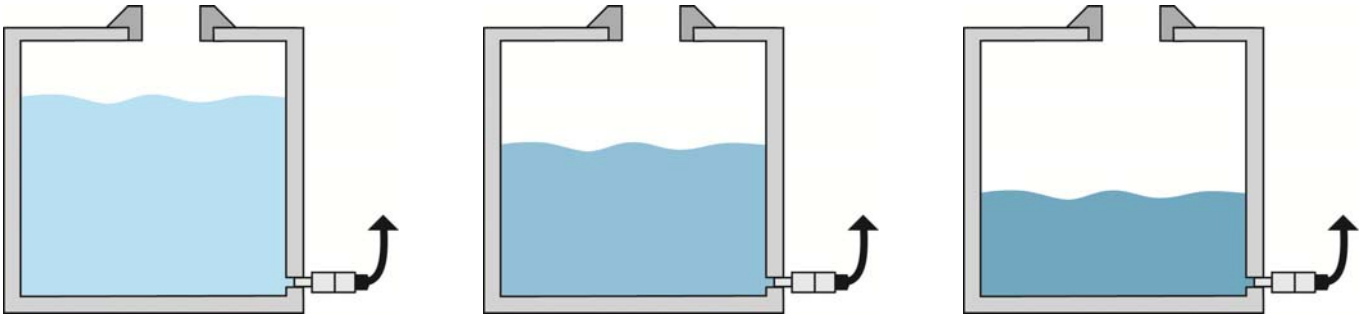
With the above ratio, you can always find the Liquid Height or water column (wc) of any pressure transmitter.



How does Specific Gravity affect pressure transmitters?

The Specific Gravity (SG) of a liquid will not change the pressure of the transmitter, but will affect how the transmitter reads the liquid height. Remember, liquids with a SQ < 1.0 are lighter than water and liquids with a SG > 1.0 are heavier than water.

- Water has a SG = 1.0.
- A SG < 1.0 requires more liquid (a taller water column) to equal the same pressure as with water.
- A SG > 1.0 requires less liquid (shorter water column) to equal the same pressure as with water.



SG = 0.9 SG = 1.0 SG = 1.2

To calculate the ***Maximum Liquid Height*** of a sensor, use the following formula:

Maximum Liquid Height (feet) = (Pressure Range x 2.31) / SG

Maximum Liquid Height (meters) = (Pressure Range x 0.704) / SG

Example: ***15 psi*** transmitter installed in a liquid with a ***SG=0.9*** will have a

Maximum Liquid Height = 38.5 feet (11.73 m) or ***[(15 psi x 2.31'/psi)/ 0.9 = 38.5']***.

Note: *The above formula will always provide the* ***Maximum Liquid Height*** *for any pressure transmitter.*

Example: Compare the ***Maximum Liquid Height*** of a liquid with a SG = 0.9 to one with a SG = 1.0.

- SG = 0.9: a 15 psi transmitter will have a ***Maximum Liquid Height = 38.5' (11.73 m)***
- SG = 1.0: a 15 psi transmitter will have a ***Maximum Liquid Height = 34.65' (10.56 m)***

A change in SG of 0.1 will increase the ***Maximum Liquid Height*** of a transmitter by ***3.83' (1.2 m)***. Thus, when the Specific Gravity is less than 1.0, the ***Maximum Liquid Height*** of the transmitter will increase.

The reverse is true by increasing the Specific Gravity. With a SG = 1.2, the ***Maximum Liquid Height = 28.88' (8.80 m)*** with a 15 psi transmitter.

Maximum Liquid Height (28.88') = (Pressure Range (15 psi) x 2.31) / SG (1.2)

Compare to a liquid with a SG = 1.0, the Maximum Liquid Height will decrease by 5.77' (1.8 m). When the Specific Gravity is greater than 1.0, the ***Maximum Liquid Height*** of the transmitter will decrease.

Note: *Identifying the correct specific gravity for the fluid is critical in understanding the operational range of the pressure transmitter.*

How to select the correct pressure transmitter?

The objective is to select a sensor with an operational range that will cover the entire application span. If the liquid height of the tank is above the sensor's ***Maximum Liquid Height***, then the sensor will not be able to read a full tank level. Compare the tank's ***Pressure @ Full*** against the sensor's pressure range to select a sensor.

To calculate the tank's ***Pressure @ Full***, use the following formula:

Pressure @ Full = [Height @ Full Tank (feet) x SG] / 2.31 (feet/psi)

Pressure @ Full = [Height @ Full Tank (meters) x SG] / 0.704 (m/psi)

To select the correct pressure transmitter, follow the steps below:

1. Measure the Height @ Full Tank (in feet or meters).
2. Determine the SG for the liquid (if the customer does not know, check the MSDS sheet).
3. Use the formula above to calculate the ***Pressure @ Full***.
    a. Example: A 16' tank with a liquid media SG of 0.9 has a ***Pressure @ Full*** of 6.23 psi.
    b. [(16' x 0.9) / 2.31'/psi] = 6.23 psi
4. Select a pressure transmitter with a pressure greater than or equal to the ***Pressure @ Full***.
    a. In the example above for a 16' tall tank with a SG=0.9, you need a pressure range greater than or equal to 6.23 psi.
    b. Using a sensor with a pressure range of 15 psi provides a Maximum Liquid Height of 38.5', which will read the entire range of the 16' tall tank.
    c. Using a sensor with a pressure range of 5 psi provides a Maximum Liquid Height of 12.83', which is short by 3.17'.
        i. This means that the sensor will output 20 mA at 12.83' of liquid and the top 3.17' of liquid will not be measured.

How to configure a panel meter when a pressure transmitter is used?

This method works with the LI55 series, LI25 Series, LI10 Series and LI50 Series. These panel meters are configured using the SCALE function. The SCALE function typically has four settings. These settings are as follows:

Settings	Default	Represents	Typical Setting
Input 1	04.000	Input current @ Empty	04.000 (mA)
Display 1 (Empty)	04.000	Display value @ Empty	Empty value
Input 2	20.000	Input current @ Full	20.000
Display 2 (Full)	20.000	Display value @ Full	Full Value (mA)

Remember, pressure transmitters are configured so 0 psi = 4 mA and the maximum psi = 20 mA. Most pressure transmitter applications will not use the full range of the transmitter and requires you to proportionally scale the current output of the pressure transmitter. Therefore, a full tank will typically have a current less than 20 mA. The goal in configuring the panel meter is to calculate the current when the tank is full. To do this, use the following formula:

(Full Tank Height / Maximum Liquid Height) x 16 + 4 = Current at Full

Example: A 16 foot tank with a SG = 0.9 will have a maximum pressure of 6.23 psi. A 15 psi sensor is selected for use. The ***Maximum Liquid Height = (15 psi x 2.31'/psi) / 0.9 = 38.5 feet.*** Using the above formula, the ***Current at Full = [(40 feet / 51.33 feet) x 16 + 4] = 10.649 mA.***

The ***Current at Full*** will be used as the Input 2 value. This means that when the display reads a current equal to ***Current at Full***, it will display the Full value (Display 2 value). The panel meter will be configured as follows:

Settings	Configured
Input 1	04.000
Display 1	Empty
Input 2	***10.649***
Display 2	Full

Note: *The values for empty and full represent what the display will show when the tank is either Empty or Full. Empty and Full must be the same units (example: Gallons, Inches, percent).*

- The default for the Input 1 is 4 mA and typically will never be changed.
- Typically, the Empty setting will be what is in the tank when it is empty (example: 000.0 Gallons, 000.0 inches, 000.0 feet etc.).
- The Full setting will be what is in the tank when it is full (example: 500.0 Gallons, 120.0 inches, 10.0 feet, etc.).

Wiring: An external power supply delivering 13-30 VDC with minimum current capability of 40 mA DC (per transmitter) is required to power the control loop. See Figure A below for connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistance (RL) for the DC power supply voltage available is expressed by the formula:

$$RLmax = (Vsup – 10V) / 20\ mA\ DC$$

- ***Shielded cable is recommended for control loop wiring.***
- ***Use the Red wire / (1) terminal as the (+) and the Black wire / (2) terminal as the (-).***

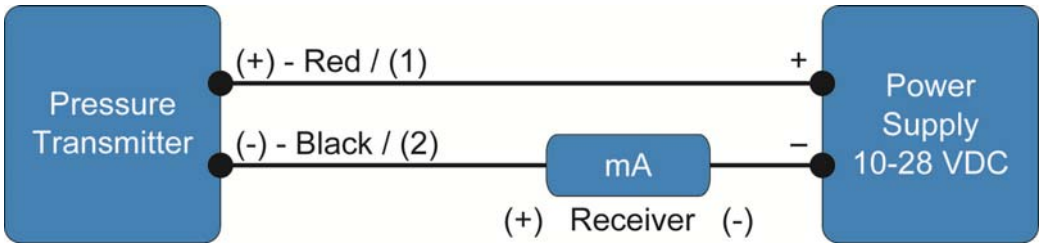


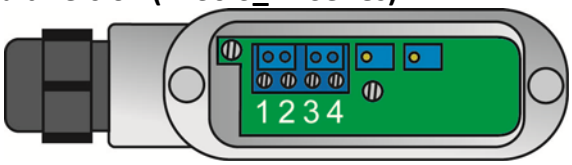
Fig. A

Connections

Cable Version (LD30-S_01 Series)

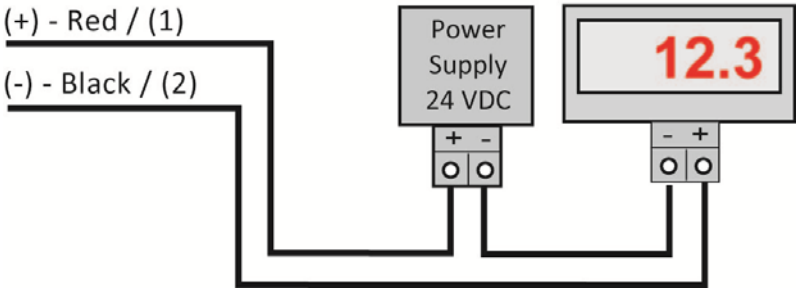
(+) = Red Wire & (-) = Black Wire

Conduit Version (LD30-S_11 Series)

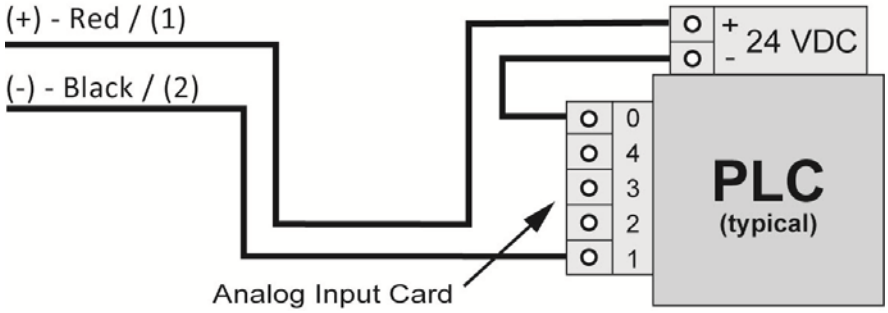


(+) = Terminal #1 & (-) = Terminal #2

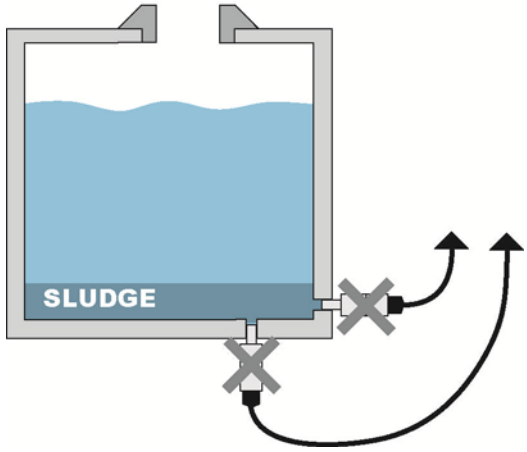
Wiring to a Loop Powered Display



Wiring to a Typical PLC



The LD30 series is designed to operate with only the installation thread being exposed to the fluid. Avoid installing the level transmitter along the bottom of the tank as materials such as sludge will build up and coat/cover the port.



1. **Location:** Select a location where the temperature of the transmitter will be between 0 and 175°F (-18 to 79°C). Distance from the receiver is limited only by total loop resistance. The tubing or piping supplying pressure to the unit can be practically any length required but long lengths will increase response time slightly.
2. **Position:** The transmitter is not position sensitive. However all standard models are originally calibrated with the unit in a position with the pressure connection downward. Although they can be used at other angles, for best accuracy it is recommended that units be installed in the position calibrated at the factory.
3. **Pressure Connection:** Use a small amount of plumber's tape or other suitable sealants to prevent leaks. Be sure the pressure passage inside the port is not blocked.
4. **Electrical Connections:** Wire Length - The maximum length of wire connecting the transmitter and receiver is a function of wire size and receiver resistance. Wiring should not contribute more than 10% of the receiver resistance to total loop resistance. For extremely long runs (over 1000 feet), choose receivers with higher resistance to minimize the size and cost of connecting leads. Where wiring length is under 100 feet, wire as small as 22 AWG can be used.

Maintenance should consist of inspection to see that the transmitter is free from debris and not coated with any substance, which would prevent liquid from freely entering and leaving the transmitter. If this occurs, the transmitter should be cleaned.

Cleaning procedure:

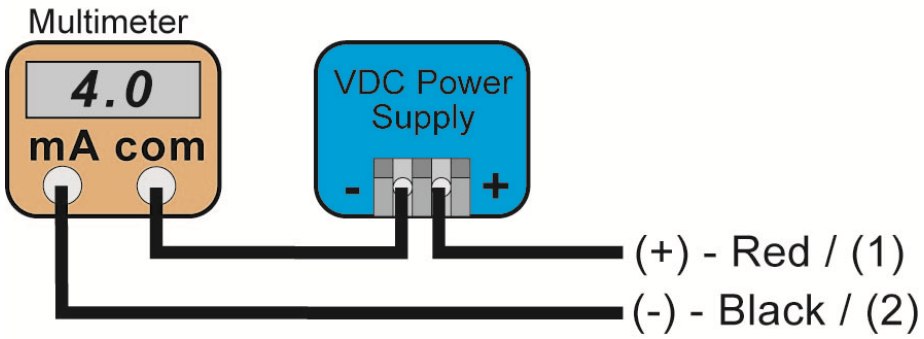
1. *Power:* Make sure that all power to the transmitter, controller and/or power supply is completely disconnected.
2. *Transmitter removal:* If necessary, make sure that the tank is drained well below the switch prior to removal. Carefully, remove the transmitter from the installation.
3. *Cleaning the switch:* Using a soft bristle brush and mild detergent, carefully wash the switch. Do not use harsh abrasives such as steel wool or sandpaper, which might damage the surface of the sensor. Do not use incompatible solvents, which may damage the sensor's stainless steel body. Take particular care to remove any scaling from the body and that there is no debris inside the inlet.

Transmitter installation: Follow the appropriate steps of installation as outlined in the Installation section of this manual.

Testing the transmitter:

- First, verify that the sensor is wired correctly.
- Next, check if the power supply is providing the required power.
- Finally confirm that the loop resistance is not exceeding the sensor's specification.

If transmitter is not functioning properly, isolate the transmitter from the system and wire as shown below. ***Be sure to remove the sensor from the classified area when performing this test.*** Multimeter should read 4 mA with the transmitter out of liquid.



Warranty

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service in accordance with instructions furnished by Flowline for a period of two years from the date of manufacture of such products. Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products or components, which Flowline's examination determines to its satisfaction to be defective in material or workmanship within the warranty period. Flowline must be notified pursuant to the instructions below of any claim under this warranty within thirty (30) days of any claimed lack of conformity of the product. Any product repaired under this warranty will be warranted only for the remainder of the original warranty period. Any product provided as a replacement under this warranty will be warranted for the full two years from the date of manufacture.

Returns

Products cannot be returned to Flowline without Flowline's prior authorization. To return a product that is thought to be defective, go to www.flowline.com, and submit a customer return (MRA) request form and follow the instructions therein. All warranty and non-warranty product returns to Flowline must be shipped prepaid and insured. Flowline will not be responsible for any products lost or damaged in shipment.

Limitations

This warranty does not apply to products which: 1) are beyond the warranty period or are products for which the original purchaser does not follow the warranty procedures outlined above; 2) have been subjected to electrical, mechanical or chemical damage due to improper, accidental or negligent use; 3) have been modified or altered; 4) anyone other than service personnel authorized by Flowline have attempted to repair; 5) have been involved in accidents or natural disasters; or 6) are damaged during return shipment to Flowline. Flowline reserves the right to unilaterally waive this warranty and dispose of any product returned to Flowline where: 1) there is evidence of a potentially hazardous material present with the product; or 2) the product has remained unclaimed at Flowline for more than 30 days after Flowline has dutifully requested disposition. This warranty contains the sole express warranty made by Flowline in connection with its products. ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED. The remedies of repair or replacement as stated above are the exclusive remedies for the breach of this warranty. IN NO EVENT SHALL FLOWLINE BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND INCLUDING PERSONAL OR REAL PROPERTY OR FOR INJURY TO ANY PERSON. THIS WARRANTY CONSTITUTES THE FINAL, COMPLETE AND EXCLUSIVE STATEMENT OF WARRANTY TERMS AND NO PERSON IS AUTHORIZED TO MAKE ANY OTHER WARRANTIES OR REPRESENTATIONS ON BEHALF OF FLOWLINE. This warranty will be interpreted pursuant to the laws of the State of California. If any portion of this warranty is held to be invalid or unenforceable for any reason, such finding will not invalidate any other provision of this warranty.

For complete product documentation, video training, and technical support, go to www.flowline.com.
For phone support, call 562-598-3015 from 8am to 5pm PST, Mon - Fri.
(Please make sure you have the Part and Serial number available.)