DeltaSpan™

External Pressure Level Transmitter

FLOWLINE™
LEVEL BEST

LD30 and LD37 Series Manual

CE RoHS Compliant

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The LD30 & LD37 Series Industrial Pressure Transmitter converts a single positive pressure into a standard 4-20 mA output signal. The transmitter an be used to accurately measure compatible liquids with full scale accuracy of 0.25%. Designed for industrial environments with NEMA 4X (IP66) housing, this transmitter resists most effects of shock and vibration.

NEW FEATURES

- 316 SS or corrosion resistant PTFE transducer with threaded mount
- Available with polyurethane cable or junction box termination
- Lightning and surge protection on all models
- Automatic temperature compensation for accurate measurement

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SPECIFICATIONS

Range:	-S0X1: 0 to 5 psi (0.34 bar), 0 to 11’ (0 to 3.4m) water column (WC)
	-S2X1: 0 to 15 psi (1.0 bar), 0 to 34’ (0 to 10.4m) water column (WC)
	-S4X1: 0 to 30 psi (2.0 bar), 0 to 69’ (0 to 21.1m) water column (WC)
Accuracy:	± 0.25% of full scale
Configuration:	None, fixed span
Supply voltage:	11 to 28 VDC
Loop resist.:	900 Ohms @ 30 VDC
Signal output:	4-20 mA, two-wire
Process temp.:	F: 14° to 176°, C: -10° to 80°
Storage Temp.:	F: -40 to 212°, C: -40 to 100°
Proof pressure:	LD30: 1.5 x full scale
	LD37: 2 x full scale
Response time:	50 ms
Weight:	LD30: 0.55 lb. (0.25 kg)
	LD37: 0.50 lb. (0.23 kg)

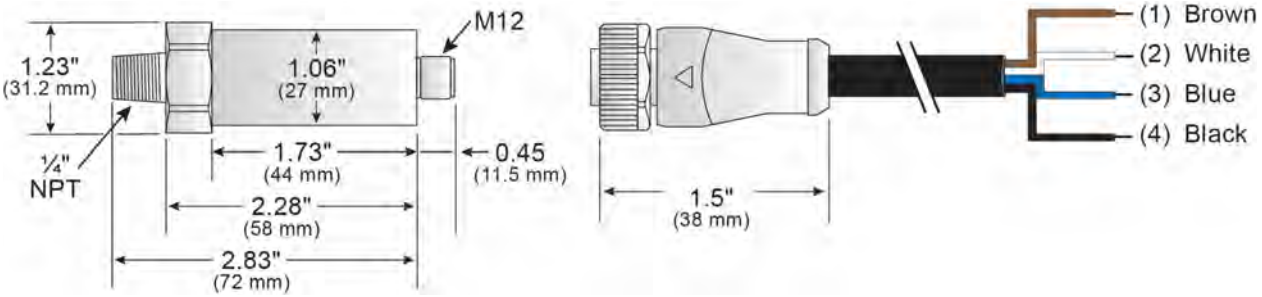
Construction mat’l:

Series	Diaphragm	Pressure Port	Housing
LD30:	316L SS	316L SS	316L SS
LD37:	Ceramic	PTFE	304 SS

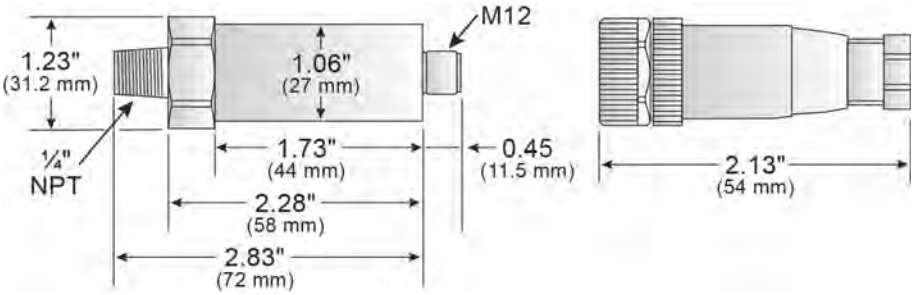
Sensor thread:	1/4” NPT
Termination:	-SX01: Cable
	-SX21: M12 Connector
Cable type:	-SX01: 4-conductor
Cable length:	-S0X1: 9’ (2.7m)
Cable material:	-SX01: PUR (Polyurethane)
Classification:	General purpose
Compliance:	CE

DIMENSIONS

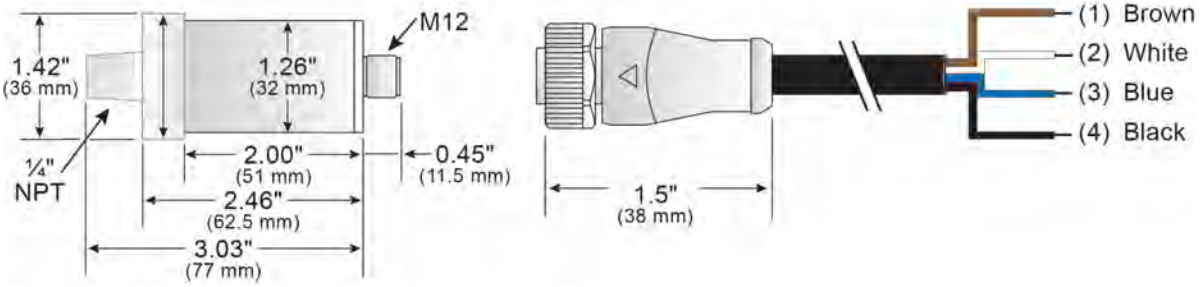
LD30 Series (Cable)



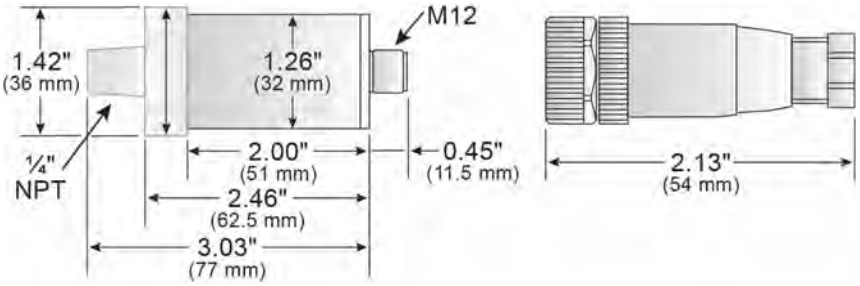
LD30 Series (Connection)



LD37 Series (Cable)



LD37 Series (Connection)



- **About this Manual:** PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on the DeltaSpan™ Series Pressure Level Transmitter from FLOWLINE. Please refer to the part number located on the label to verify the exact model configuration which you have purchased.
- **User's Responsibility for Safety:** Flowline manufactures a broad range of level sensing technologies. While each of these sensors is designed to operate in a wide variety of applications, it is the user's responsibility to select a sensor model 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 professional 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:** A supply voltage of 11 to 28 VDC is used to power DeltaSpan™. Electrical wiring of the transmitter should be performed in accordance with all applicable national, state, and local codes.
- **Material Compatibility:** The LD30 series is made of Stainless Steel (316L) while the LD37 series is made of three materials, Polytetrafluoroethylene (PFTE), Ceramic and Stainless Steel (304). Make sure that the model which you have selected is chemically compatible with the application liquids.
- **Handling Static-Sensitive Circuits/Devices:** When handling the transmitter, the technician should follow these guidelines to reduce any possible electrostatic charge build-up on the technician's body and the electronic part.

    1. Always touch a known good ground source before handling the part. This should be repeated while handling the part and more frequently after sitting down from a standing position, sliding across the seat or walking a distance.
    2. Avoid touching electrical terminals of the part unless making connections.

- **Make a Fail-Safe System:** Design a fail-safe system that accommodates the possibility of power failure. FLOWLINE recommends the use of redundant backup systems and alarms in addition to the primary system.
- **Flammable, Explosive or Hazardous Applications:** DeltaSpan™ should not be used within classified hazardous environments.

COMPONENTS

DeltaSpan™ is offered in two different models. Depending on the model purchased, you may or may not have been shipped all the components shown below.

DeltaSpan™ General Purpose External (LD30 Series)

Part Number	Max. Pressure	Range in Water Column (WC)	Cable Length
LD30-S001	05 psi	11.54 ft WC (3.52 m WC)	9’ (2.7m) Cable
LD30-S011			M12 Connector
LD30-S201	15 psi	34.63 ft WC (10.56 m WC)	9’ (2.7m) Cable
LD30-S211			M12 Connector

DeltaSpan™ General Purpose Anti-Corrosion External (LD37 Series)

Part Number	Max. Pressure	Range in Water Column (WC)	Cable Length
LD37-S001	05 psi	11.54 ft WC (3.52 m WC)	9’ (2.7m) Cable
LD37-S011			M12 Connector

DeltaSpan™ M12 Connector Ordering Information (LD30 and LD37 series only)

LD90 - 2	_	_	**0**	
	Connector			
	2 - Female M12			
		Connection		
		0 - Connect with Terminals		
		1 - 1m of cable		
		3 - 3m of cable		
		5 - 5m of cable		

Note: LD30 and LD37 series include the following:

- LD30-S_01 series include LD90-2230 Female M12 connector with 3m of cable.
- LD30-S_11 series include LD90-2200 M12 Female Connector with Terminal.
- LD37-S001 series include LD90-2230 Female M12 connector with 3m of cable.
- LD37-S011 series include LD90-2200 M12 Female Connector with Terminal.

PRESSURE TRANSMITTER BASICS

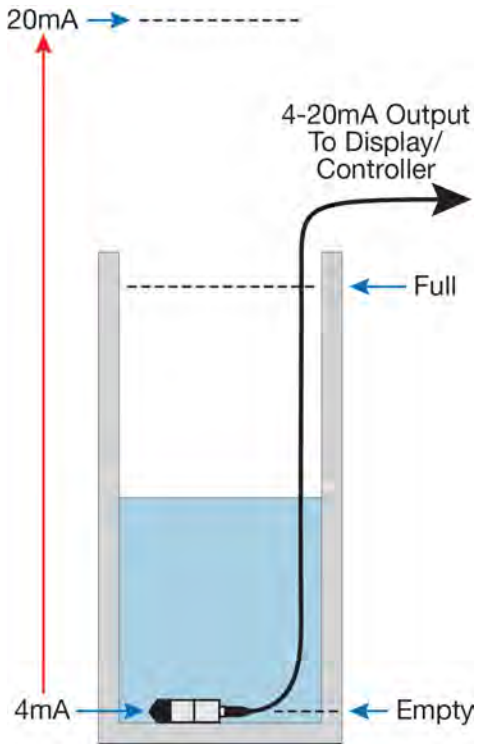
DeltaSpan™ pressure level transmitter's are all fixed span devices. The 4-20mA output cannot be changed or adjusted. Because of this fact, **ALL CONFIGURATIONS** are performed within the local display or controller and are designed to match the span of the pressure sensor. This document will assist in configuring the Flowline DataView™ (LI55 series) or DataLoop™ (LI23 and LI24 series) with a pressure transmitter.

DataView™ LI55 series

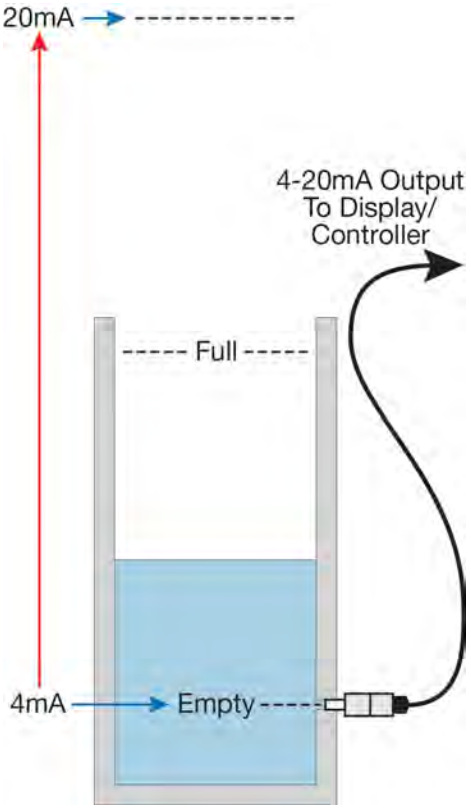
DataLoop™ LI23 or LI24 series

If a pressure transmitter is properly selected, then the 20mA output of the sensor will be above the Full liquid level (see below). 4mA will always be where the sensor is placed. If the sensor rests on the bottom of the tank, then the centerline of the sensor will be where the 4mA is located.

Sensor Resting on Bottom of Tank



Sensor offset from Botton of Tank

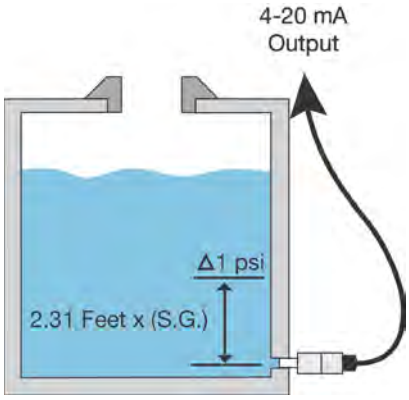


HOW TO CONVERT PRESSURE INTO LIQUID HEIGHT?

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	*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'	***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 TO CALCULATE MAXIMUM LIQUID HEIGHT (MLH)?

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

Feet	*Maximum Liquid Height (**MLH**) = (Pressure Range x 2.31) / SG*
Meters	*Maximum Liquid Height (**MLH**) = (Pressure Range x 0.704) / SG*

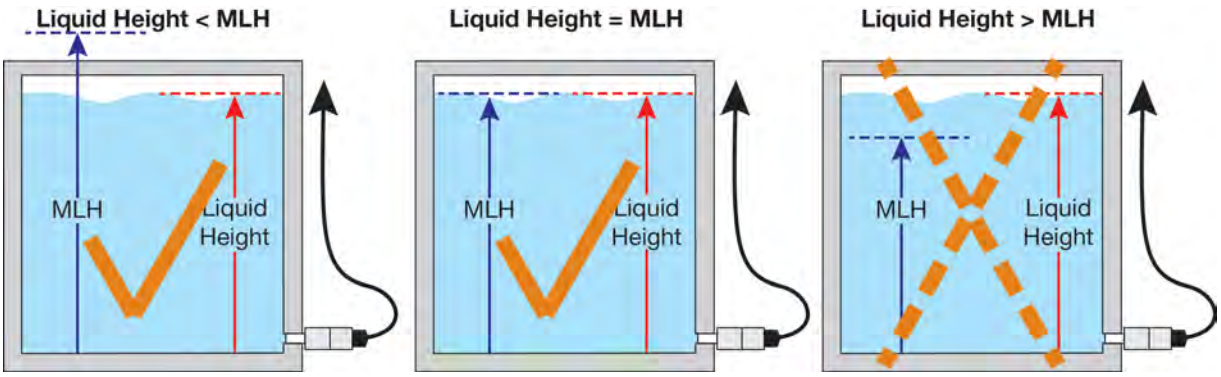
Example: ***15 psi*** transmitter installed in a liquid with a ***SG=0.9*** will have the following value(s):

Feet	***MLH** = (**15 psi** x 2.31'/psi) / **0.9** = **38.5'***
Meters	***MLH** = (**15 psi** x 0.704m/psi) / **0.9** = **11.73m***

Note: *The above formulas will always provide the **MLH** for any pressure transmitter.*

HOW TO SELECT THE CORRECT PRESSURE TRANSMITTER?

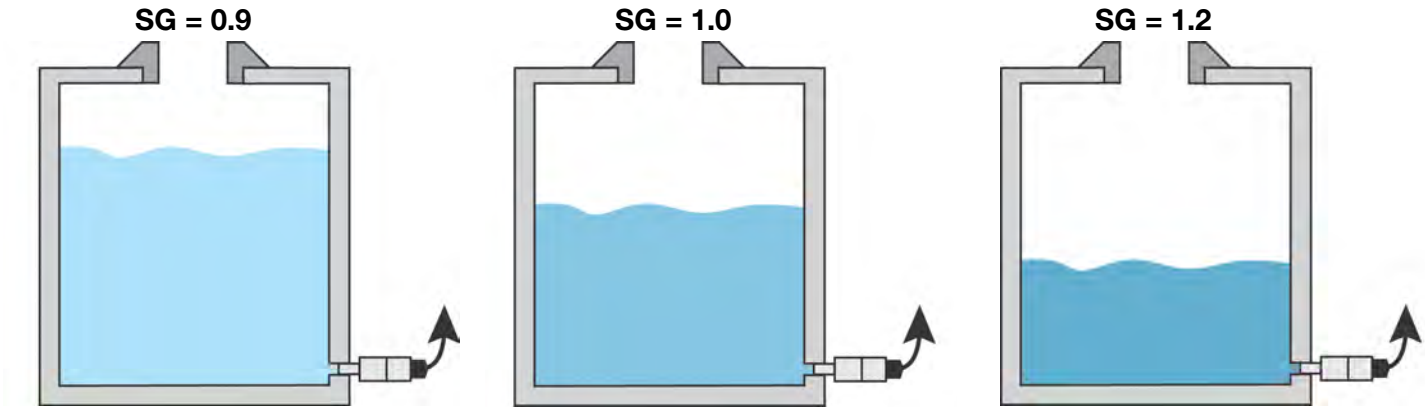
The objective is to select a sensor with a **MLH** that will cover the entire application span. If the liquid height of the tank is greater than the sensor's ***MLH***, then the sensor will not be able to read a full tank level. The **MLH** does not have to equate to the liquid height, it just needs to be greater than the liquid height (never less than).



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.



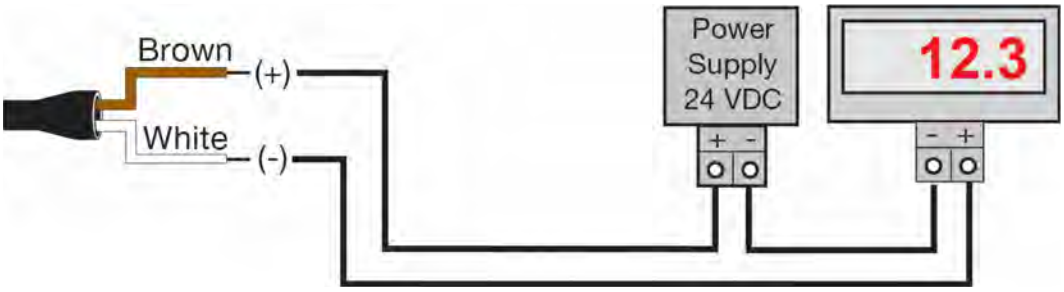
Example: Compare the ***Maximum Liquid Height*** of a liquid with SG = 0.9, 1.0 and 1.2 using a transmitter with 15 psi pressure range (PR).

SG	Feet	Meters
0.9	**MLH** = (PR x 2.31) / SG = (15 psi x 2.31'/psi) / 0.9 = **38.5'**	**MLH** = (PR x 0.704) / SG = (15 psi x 0.704m/psi) / 0.9 = **11.73 m**
1.0	**MLH** = (PR x 2.31) / SG = (15 psi x 2.31'/psi) / 1.0 = **34.65'**	**MLH** = (PR x 0.704) / SG = (15 psi x 0.704m/psi) / 1.0 = **10.56 m**
1.2	**MLH** = (PR x 2.31) / SG = (15 psi x 2.31'/psi) / 1.2 = **28.88'**	**MLH** = (PR x 0.704) / SG = (15 psi x 0.704m/psi) / 1.2 = **8.80 m**

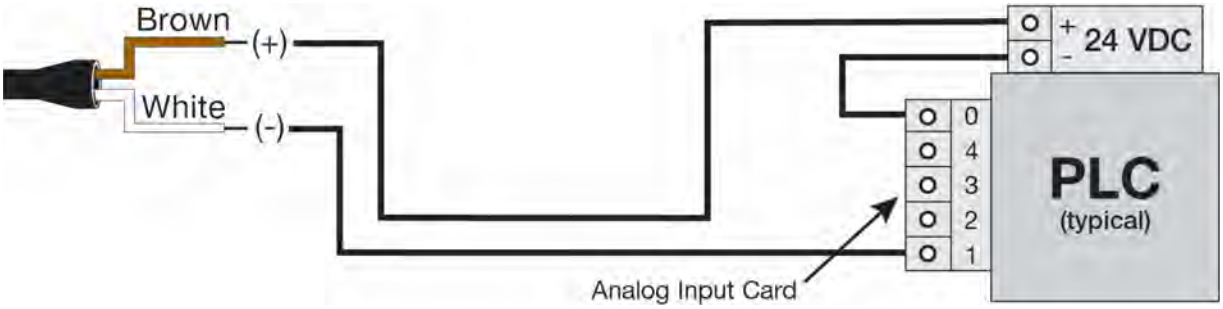
Note: *Identifying the correct specific gravity for the fluid is critical in understanding the operational range of the pressure transmitter.*

COMMON WIRING TO DISPLAY, CONTROLLERS AND PLCS:

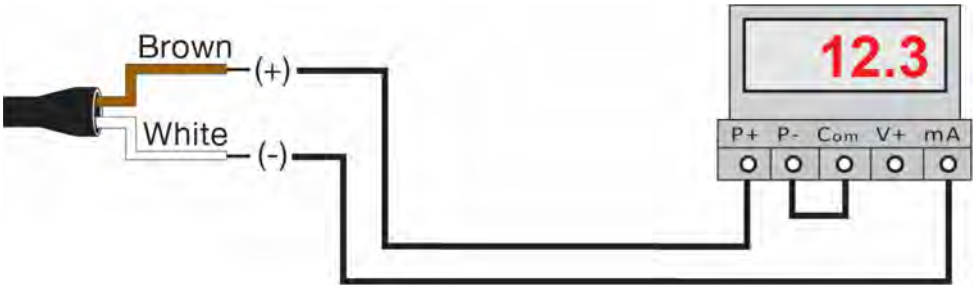
Wiring to a Loop Powered Display:



Wiring to a Generic PLC:

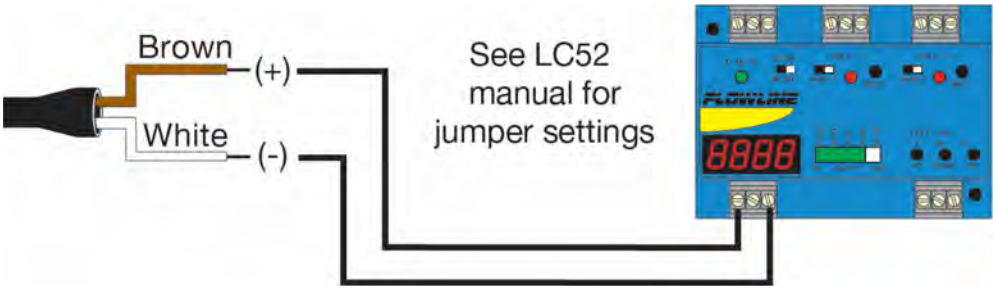


Wiring to the DataView™ LI55 Series Level Controller:



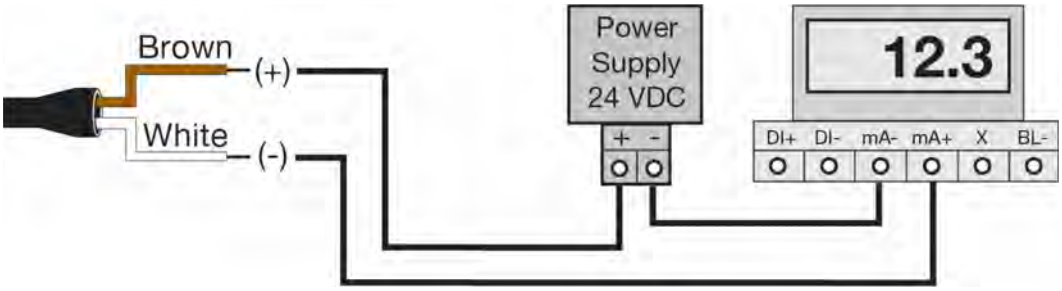
COMMON WIRING TO DISPLAY, CONTROLLERS AND PLCS:

Wiring to the DataPoint™ LC52 Series Level Controller:



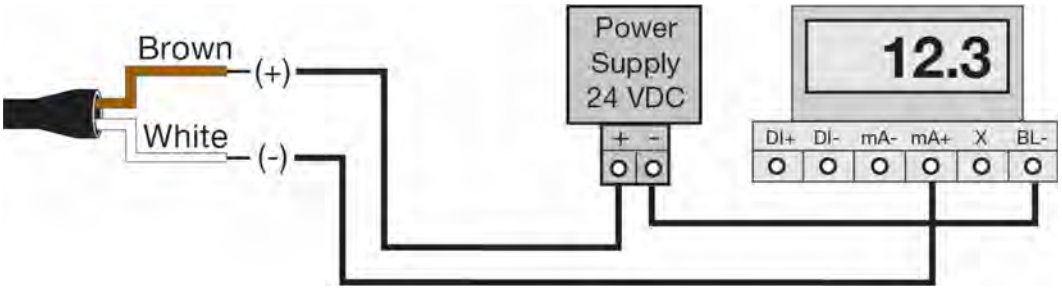
JWA mode (Factory Setting)

Wiring to a DataLoop™ LI23 Series Level Indicator without the Backlight:

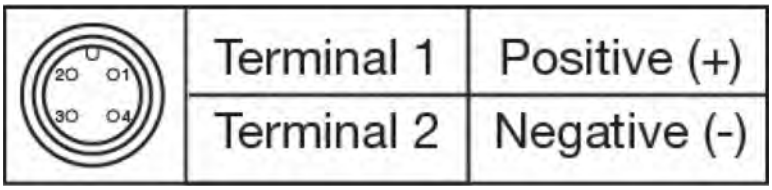


(Note: the LI23 Series without backlight will have an added 1.5 VDC voltage drop)

Wiring to a DataLoop™ LI23 Series Level Indicator with the Backlight:



(Note: the LI23 Series with backlight will have an added 4.5 VDC voltage drop)



ELECTRICAL INSTALLATION:

Wiring: An external power supply delivering 11-28 VDC for the LD30 and LD37 series with minimum current capability of 40 mA DC (per transmitter) is required to power the control loop. See Fig. A 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:

LD30:	RLmax = (Vsup – 12V) / 20 mA DC
LD37:	RLmax = (Vsup – 11V) / 20 mA DC

- ***Shielded cable is recommended for control loop wiring.***
- ***Use the Red wire as the (+) and the Green wire as the (-).***

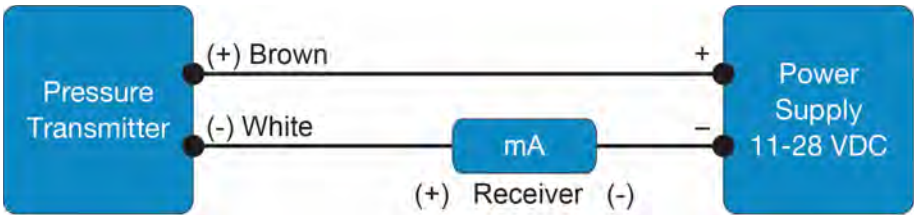
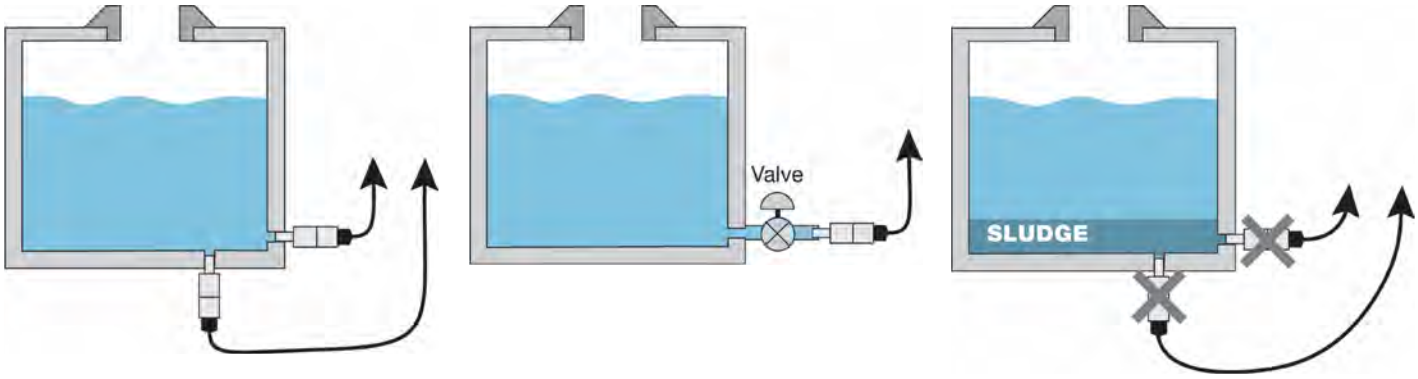


Fig. A

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 or LD37 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.*



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 within the specification of the sensor (see specification page). Distance from the receiver is limited only by total loop resistance.
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 sideways. 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 1,000 feet. Where wiring length is under 100 feet, wire as small as 22 AWG can be used.

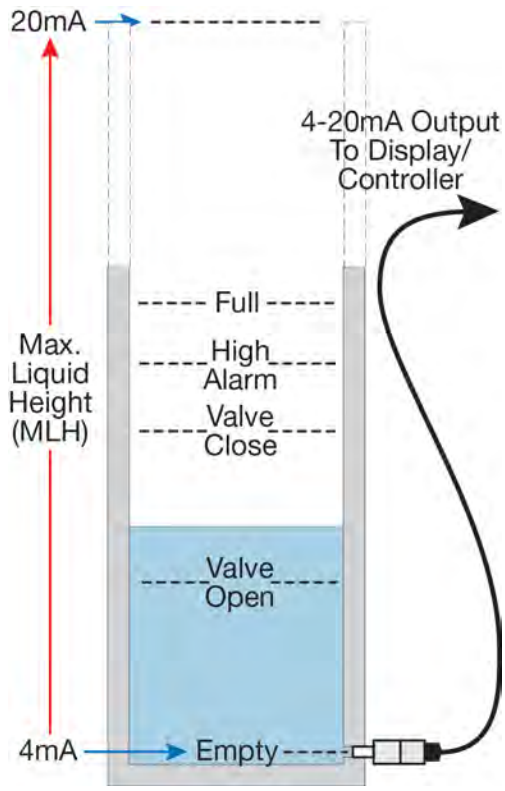
METHODS TO CONFIGURE WITH DISPLAY/CONTOLLER:

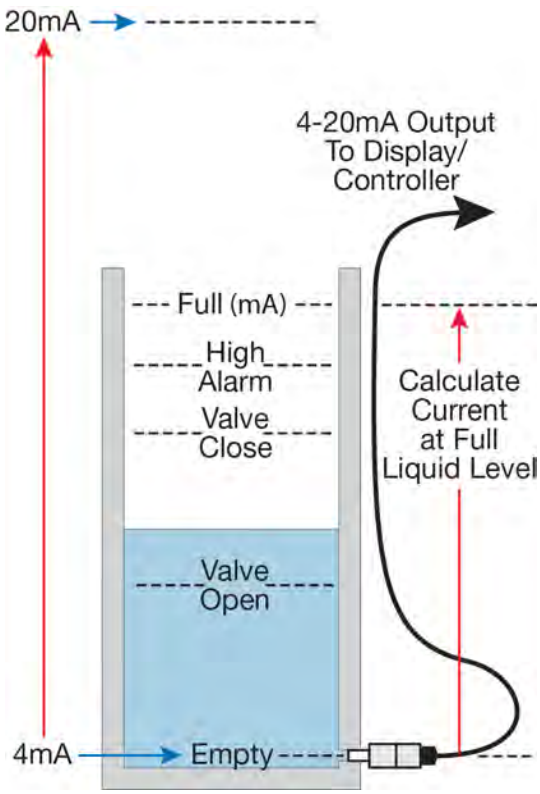
There are two methods to configure the DeltaSpan™ to a local Display or local Controller

Method #1 – Use the existing span of the Pressure Transmitter to match a virtual tank that extends above a Full Tank. Even though this implies a much taller tank, as long as all of your controls for any pumps, valves or alarms are set within the actual Full level of the tank, then you will not see any difference in tank level performance.

This Method is the easiest to configure.

Method #2 – Ignore the fixed 4-20mA span of the Pressure Transmitter and Calculate the Current at a Full Liquid Level. This current will be the new full span for the Display or Controller. All controls for any pumps, valves or alarms are also set within the actual Full level of the tank. You will not loose any accuracy when spaning to a smaller current range.

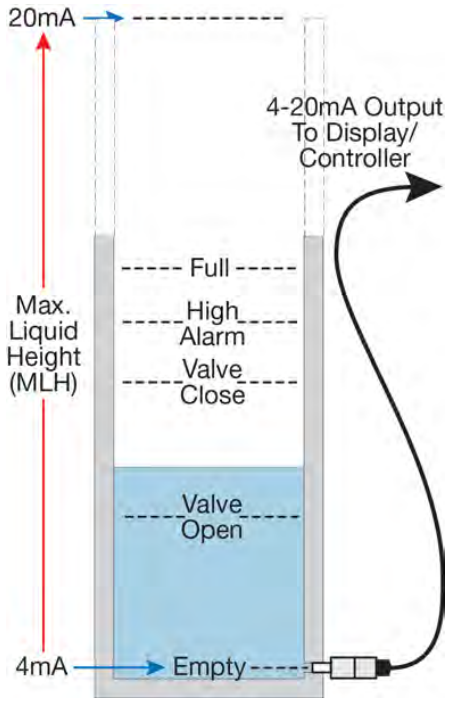




HOW TO CONFIGURE TO A DATAVIEW™ OR DATALOOP™ (METHOD #1):

To span DataView™ or DataLoop™ to the full span of the pressure sensor, you need the following information:

- Pressure Range (**PR**) of the sensor in psi
- Specific Gravity (**SG**) of the liquid
- Units of operation (**Feet** or **Meters**)
- Maximum Liquid Height (**MLH**)
    - This is the equivalent height of liquid (in a virtual tank) at the full span of the transmitters (at 20mA)



To calculate the ***Maximum Liquid Height (MLH)*** of a sensor, use the following formulas:

Feet	***MLH*** *= (* ***PR*** *x 2.31) /* ***SG***
Meters	***MLH*** *= (* ***PR*** *x 0.704) /* ***SG***

Example: ***15 psi*** transmitter installed in a liquid with a ***SG=0.9*** will have the following value(s):

Feet	***MLH*** *= (* ***15 psi*** *x 2.31'/psi) /* ***0.9*** *=* ***38.5'***
Meters	***MLH*** *= (* ***15 psi*** *x 0.704m/psi) /* ***0.9*** *=* ***11.73m***

- Pump, Valve and Alarm setpoints
    - All set points are in either Feet of Meters of liquid and are measure from the location of the Pressure Transmitter.

CONFIGURE THE DATAVIEW™ LI55 SERIES (METHOD #1):

Use the following steps to configure the DataView™ to match the DeltaSpan™ transmitter:

1. Set UNITS (**unitS**) to Feet or Meters
2. Set DECIMAL POINT (**dEc Pt**) to dddd.dd
3. Set SCALE to the following:
    a. Set Empty (**EmPtY**) to 0 feet (or 0 meters) of liquid.
    b. Set Full (**FuLL**) to the Maximum Liquid Height (**MLH**).
4. Set RELAYS (**rELAY**) to liquid levels where the relay will close and open
    a. Each relay will have a setting where the relay will energize (**SEt 1** for relay 1, etc.) and a setting where the relay will de-energize (**RSt 1** for relay 1, etc.).
        i. High alarms – Set **SEt #** at the level for the high alarm and set **RSt #** to a level slightly below the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 2 = 8.00‘ and RSt 2 = 7.90‘...this creates a 0.10‘ hysteresis).
        ii. Low alarms – Set **SEt #** at the level for the low alarm and set **RSt #** to a level slightly above the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 3 = 2.00‘ and RSt 3 = 2.15‘...this creates a 0.15‘ hysteresis).
        iii. Valve or Pump Fill - Set **SEt #** at the level for the Valve to Open or the Pump to Start Filling and set **RSt #** at the level above where the valve will Close or the pump will Stop Filling. This will create a unique ON and OFF span (i.e. SEt 4 = 3.00‘ and RSt 3 = 7.50‘...this creates a fill span of 4.50‘).
        iv. Valve or Pump Empty - Set **SEt #** at the level for the Valve to Open or the Pump to Start Emptying and set **RSt #** at the level below where the valve will Close or the pump will Stop Emptying. This will create a unique ON and OFF span (i.e. SEt 1 = 7.00‘ and RSt 1 = 4.00‘...this creates a empty span of 3.00‘).

CONFIGURE THE DATALOOP™ LI23/LI24 SERIES (METHOD #1):

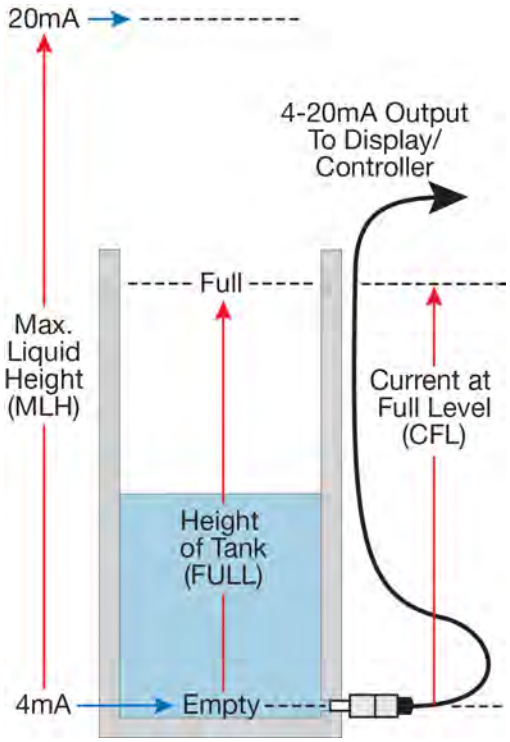
Use the following steps to configure the DataLoop™ to match the DeltaSpan™ transmitter:

1. Set UNITS (**unitS**) to Feet or Meters
2. Set DECIMAL POINT (**dEc Pt**) to dddd.dd
3. Set SCALE to the following:
    a. Set Input 1 (**InPt 1**) to 04.000 mA (*default is 04.000, so no changes are required*).
    b. Set Display 1 (**DSPY 1**) to +00,000.00 (*default is +00,000.00, so no changes are required*).
    c. Set Input 2 (**InPt 2**) to 20.000 mA (*default is 20.000, so a change is required*).
    d. Set Display 2 (**DSPY 2**) to Maximum Liquid Height **(MLH)** value (*default is +00,100.00, so a change is required*).
4. Set RELAYS (**rELAY**) to liquid levels where the relay will close and open
    a. Each relay will have a setting where the relay will energize (**SEt 1** for relay 1, etc.) and a setting where the relay will de-energize (**RSt 1** for relay 1, etc.).
        i. High alarms – Set **SEt #** at the level for the high alarm and set **RSt #** to a level slightly below the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 2 = 8.00‘ and RSt 2 = 7.90‘...this creates a 0.10‘ hysteresis).
        ii. Low alarms – Set **SEt #** at the level for the low alarm and set **RSt #** to a level slightly above the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 3 = 2.00‘ and RSt 3 = 2.15‘...this creates a 0.15‘ hysteresis).
        iii. Valve or Pump Fill - Set **SEt #** at the level for the Valve to Open or the Pump to Start Filling and set **RSt #** at the level above where the valve will Close or the pump will Stop Filling. This will create a unique ON and OFF span (i.e. SEt 4 = 3.00‘ and RSt 3 = 7.50‘...this creates a fill span of 4.50‘).
        iv. Valve or Pump Empty - Set **SEt #** at the level for the Valve to Open or the Pump to Start Emptying and set **RSt #** at the level below where the valve will Close or the pump will Stop Emptying. This will create a unique ON and OFF span (i.e. SEt 1 = 7.00‘ and RSt 1 = 4.00‘...this creates a empty span of 3.00‘).

HOW TO CONFIGURE TO A DATAVIEW™ LI55 SERIES (METHOD #2):

To span DataView™ to match the physical span of tank, you will need the following information:

- Pressure Range (**PR**) of the sensor in psi
- Hight of Tank (**FULL**) in feet or meters
- Specific Gravity (**SG**) of the liquid
- Units of operation (**Feet** or **Meters**)
- Maximum Liquid Height (**MLH**)
    - This is the equivalent height of liquid (in a virtual tank) at the full span of the transmitters (at 20mA).



To calculate the ***Maximum Liquid Height (MLH)*** of a sensor, use the following formulas:

Feet	***MLH** = (**PR** x 2.31) / **SG***
Meters	***MLH** = (**PR** x 0.704) / **SG***

Example: ***15 psi*** transmitter installed in a liquid with a ***SG=0.9*** will have the following value(s):

Feet	***MLH** = (**15 psi** x 2.31'/psi) / **0.9** = **38.5'***
Meters	***MLH** = (**15 psi** x 0.704m/psi) / **0.9** = **11.73m***

- Height of the Tank (**FULL**).
    - For best results, select the highest level of liquid possible in the tank even though you may never reach this level in the tank.
- Current at FULL Level (**CFL**)
    - To calculate the Current at FULL level (**CFL**)
        - **CFL** = (**FULL** / **MLH**) x 16mA + 4mA

Feet	Where FULL = 10' … ***CFL** = (10' / 38.5') x 16 mA + 4 mA = 8.1558 mA*
Meters	Where FULL = 3m … ***CFL** = (3m / 11.73m) x 16 mA + 4 mA = 8.0920 mA*

The difference in output above is due to the slight difference between 10‘ and 3m.

- Pump, Valve and Alarm setpoints
    - All set points are in either Feet of Meters of liquid and are measure from the location of the Pressure Transmitter.

CONFIGURE THE DATAVIEW LI23/LI24 SERIES (METHOD #2):

Use the following steps to configure the DataView™ to match the DeltaSpan™ transmitter:

1. Set UNITS (**unitS**) to Feet or Meters
2. Set DECIMAL POINT (**dEc Pt**) to dddd.dd
3. Set PROGRAM / SCALE to the following:
    a. To access all functions for rescaling the current input, you will need to access the display's Full Menu.
    b. Set Input 1 (**InPt 1**) to 04.000 mA.
        i. *Default for Input 1 is 04.000, so no changes are required.*
    c. Set Display 1 (**DSPY 1**) to 0000.00.
        i. *Default for Display 1 is 0000.00, so no changes are required.*
    d. Set Input 2 (**InPt 2**) to **CFL** value (in mA).
        i. *Default for Input 2 is 20.000, so a change is required.*
    e. Set Display 2 (**DSPY 2**) to **FULL** value (in Feet or Meters).
        i. *Default for Display 2 is 0200.00, so a change is required.*
4. Set RELAYS (**rELAY**) to liquid levels where the relay will close and open
    a. Each relay will have a setting where the relay will energize (**SEt 1** for relay 1, etc.) and a setting where the relay will de-energize (**RSt 1** for relay 1, etc.).
        i. High alarms – Set **SEt #** at the level for the high alarm and set **RSt #** to a level slightly below the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 2 = 8.00‘ and RSt 2 = 7.90‘...this creates a 0.10‘ hysteresis).
        ii. Low alarms – Set **SEt #** at the level for the low alarm and set **RSt #** to a level slightly above the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 3 = 2.00‘ and RSt 3 = 2.15‘...this creates a 0.15‘ hysteresis).
        iii. Valve or Pump Fill - Set **SEt #** at the level for the Valve to Open or the Pump to Start Filling and set **RSt #** at the level above where the valve will Close or the pump will Stop Filling. This will create a unique ON and OFF span (i.e. SEt 4 = 3.00‘ and RSt 3 = 7.50‘...this creates a fill span of 4.50‘).
        iv. Valve or Pump Empty - Set **SEt #** at the level for the Valve to Open or the Pump to Start Emptying and set **RSt #** at the level below where the valve will Close or the pump will Stop Emptying. This will create a unique ON and OFF span (i.e. SEt 1 = 7.00‘ and RSt 1 = 4.00‘...this creates a empty span of 3.00‘).

CONFIGURE THE DATALOOP™

Use the following steps to configure the DataLoop™ to match the DeltaSpan™ transmitter:

1. Set UNITS (**unitS**) to Feet or Meters
2. Set DECIMAL POINT (**dEc Pt**) to dddd.dd
3. Set SCALE to the following:
    a. Set Input 1 (**InPt 1**) to 04.000 mA (*default is 04.000, so no changes are required*).
    b. Set Display 1 (**DSPY 1**) to +00,000.00 (*default is +00,000.00, so no changes are required*).
    c. Set Input 2 (**InPt 2**) to CFL Value in mA. (*default is 20.000, so a change is required*).
    d. Set Display 2 (**DSPY 2**) to Full value (*default is +00,100.00, so a change is required*).
4. Set RELAYS (**rELAY**) to liquid levels where the relay will close and open
    a. Each relay will have a setting where the relay will energize (**SEt 1** for relay 1, etc.) and a setting where the relay will de-energize (**RSt 1** for relay 1, etc.).
        i. High alarms – Set **SEt #** at the level for the high alarm and set **RSt #** to a level slightly below the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 2 = 8.00‘ and RSt 2 = 7.90‘...this creates a 0.10‘ hysteresis).
        ii. Low alarms – Set **SEt #** at the level for the low alarm and set **RSt #** to a level slightly above the SEt #. This will create a small hysteresis to prevent chatter (i.e. SEt 3 = 2.00‘ and RSt 3 = 2.15‘...this creates a 0.15‘ hysteresis).
        iii. Valve or Pump Fill - Set **SEt #** at the level for the Valve to Open or the Pump to Start Filling and set **RSt #** at the level above where the valve will Close or the pump will Stop Filling. This will create a unique ON and OFF span (i.e. SEt 4 = 3.00‘ and RSt 3 = 7.50‘...this creates a fill span of 4.50‘).
        iv. Valve or Pump Empty - Set **SEt #** at the level for the Valve to Open or the Pump to Start Emptying and set **RSt #** at the level below where the valve will Close or the pump will Stop Emptying. This will create a unique ON and OFF span (i.e. SEt 1 = 7.00‘ and RSt 1 = 4.00‘...this creates a empty span of 3.00‘).

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:

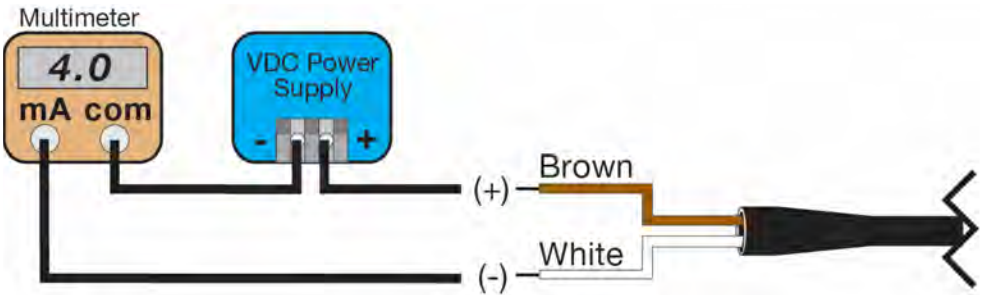
1. **Power:** Make sure that all power to the transmitter, controller and/or power supply is completely disconnected.
2. **Transmitter removal:** If necessary, make sure that the tank is drained well below the switch prior to removal. Carefully, remove the transmitter from the installation.
3. **Cleaning the transmitter:** Using a soft bristle brush and mild detergent, carefully wash the transmitter. 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 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.)