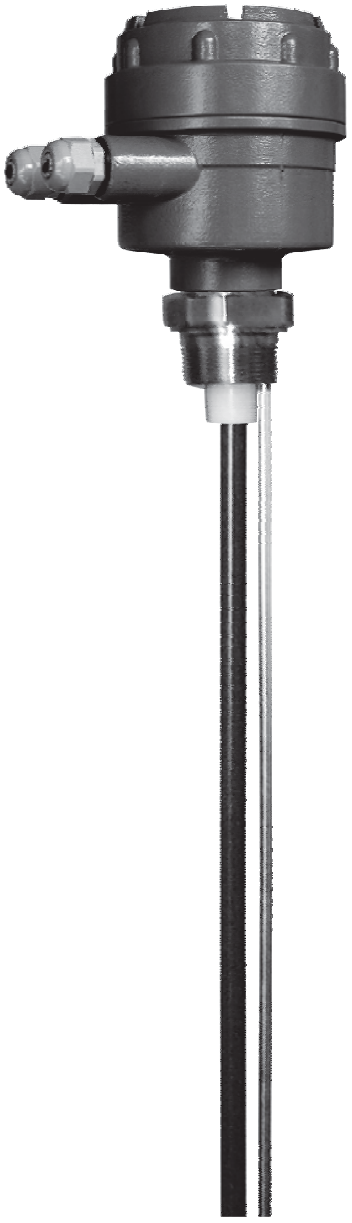
1 YEAR
WARRANTY

OMEGA®

User's Guide



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LV4000 Series Continuous Level Measurement Probe

OMEGA®

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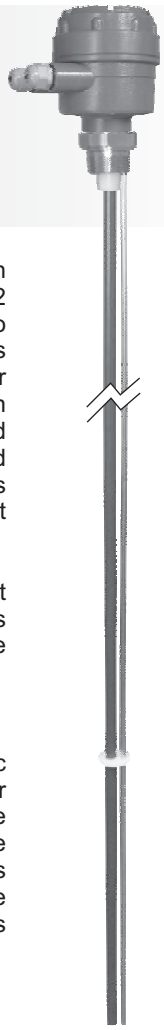
Contents

LV4000 - Capacitive Continuous Level Measurement Sensor



The LV4000 Series is a capacitance continuous level transmitter with an integrated electronics module mounted within the housing. This 2 wire loop powered unit provides a 4-20mA output and is designed to measure the level in most industrial applications. The LV4000 is available in 316SS rod and connection or with optional ETFE tubing or ECTFE coatings (required for conductive or aggressive mediums) on the rod. The LV4000 can also be made with a secondary reference rod or reference sheath built into the process connection. Set up and calibration is achieved with a zero and span adjustment which works best when starting with an empty tank to set the zero and then filling it to set the span.

The wide range of applications for RF analog level measurement probes (such as liquids, pastes, solids and granules), requires attention in selecting the correct configuration and installing it in the proper location.

How it works:

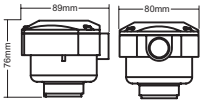
A capacitor consists of the probe's rod as one plate and the metallic wall of the vessel (or a secondary reference rod or sheath) as the other plate. As the medium rises and displaces the empty space within the vessel, the dielectric constant around the probe changes. This change is recorded and converted into a 4…20mA output signal which is proportional to the level within the vessel. By using this principle, the LV4000 Series can be applied in a wide range of products such as most liquids, powders, pastes and granular mediums.

Features

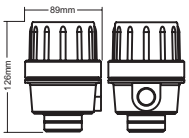
- Used in a wide range of application/industries
- Accurate and reliable measurement.
- No moving parts - Rugged construction.
- Can operate at hight temperatures and pressure.
- Functions on conductive as well as non-conductive medias.

Housing Types

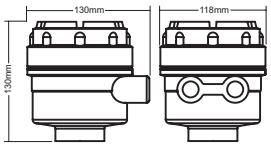
Nylon



Small Aluminum



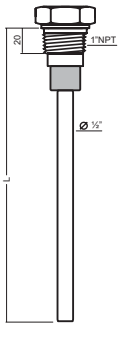
Large Aluminum



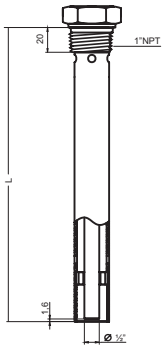
Mounting Options for LV4000

Extended necks for medium temperature (up to 120°C) and high temperature (up to 150°C)

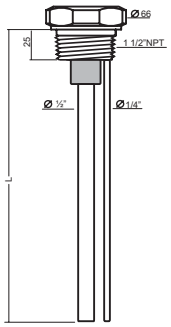
Standard



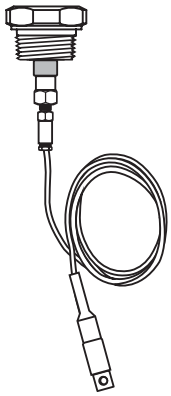
Reference Sheath



Reference Rod



Cable
(also w/ reference cable)

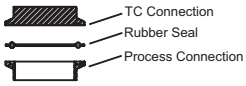


Note: Minimal insertion for the LV4000 is ½ meter

Process Connections

Threaded	
3/4"	NPT / BSP
1"	
1 ½"	
2"	

Tri-Clamp
1 ½"
2"
2 ½"
3"



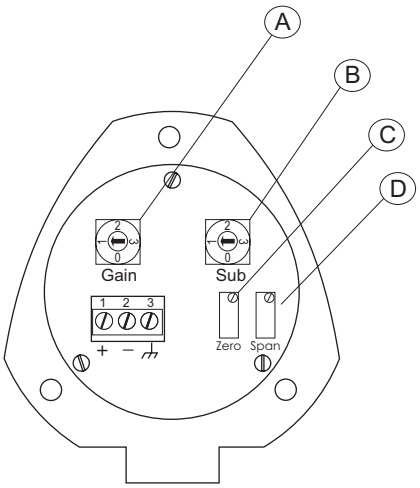
Flange	ANSI 150# ANSI 300#
1"	FF
1 ½"	
2"	RF
2 ½"	

Wiring Diagram

LV4000 Nylon Housing

A- Adjust Sensibility (Gain)
B- Adjust Sensibility (Sub Gain)
C- Adjust Zero (begin scale)
D- Adjust de span (end of scale)

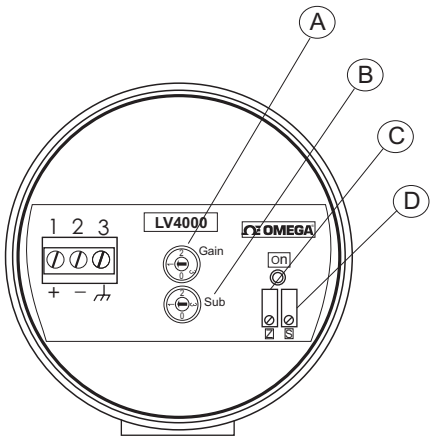
1- Power Supply (+)
2- Power Supply (–) 12...30Vdc / 4...20mA
3- Ground



LV4000 Aluminium Housing

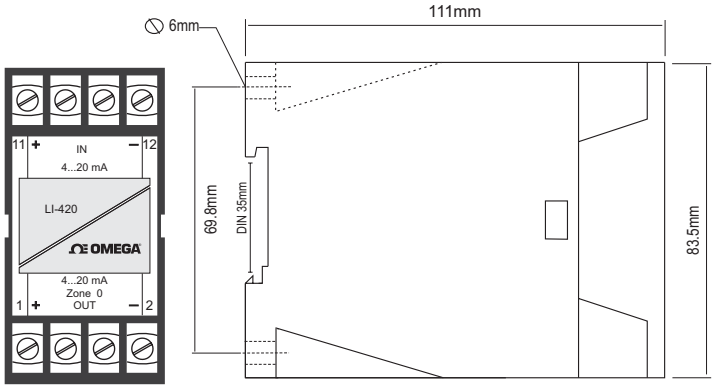
A- Adjust Sensibility (Gain)
B- Adjust Sensibility (Sub Gain)
C- Adjust Zero (begin scale)
D- Adjust de span (end of scale)

1- Power Supply (+)
2- Power Supply (–) 12...30Vdc / 4...20mA
3- Ground



Galvanic Isolator LI-420

1- Probe (+)
2- Probe(–)
11- Power Supply (+)
12- Power Supply (–)

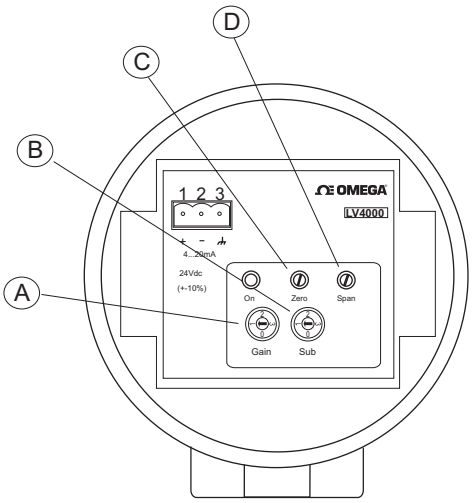


LV4000 Alumium Housing with internal LI-420

A- Adjust Sensibility (Gain)
B- Adjust Sensibility (Sub gain)
C- Adjust Zero (begin scale)
D- Adjust de span (end of scale)

1- Power Supply (+)
2- Power Supply (–)
3- Ground

24Vdc / 4...20mA

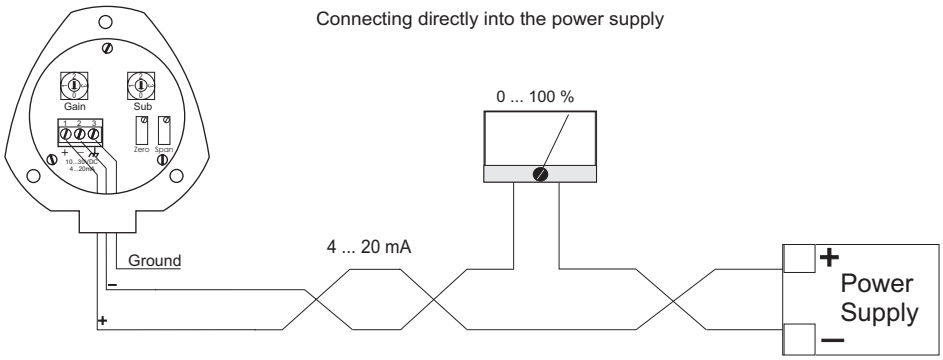


Wiring Diagram

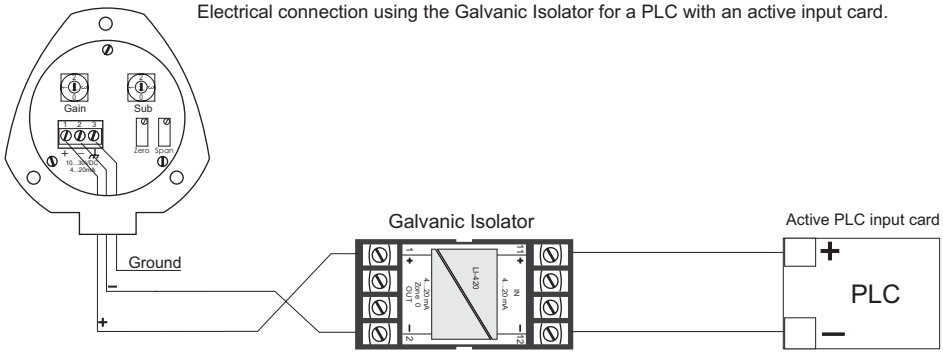
Different wiring scenarios for the Nylon Housing electronics

Important:
There are several types of PLC configurations and some of them have the negative terminal grounded internally. In this case, a galvanic isolator must be used along with the probe to distinguish both signals (negative and ground).

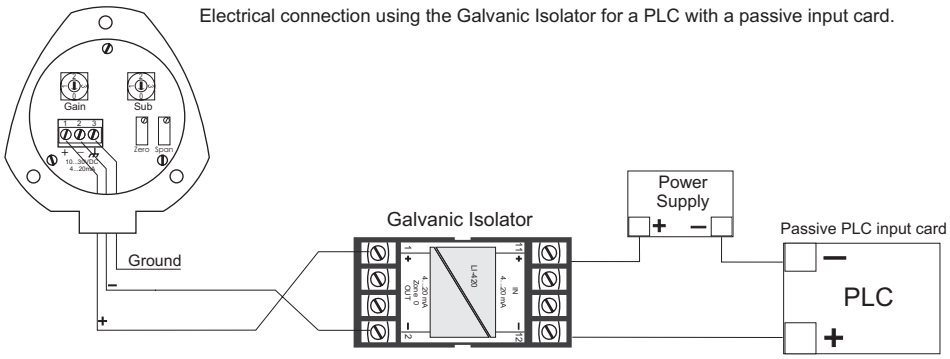
Connecting directly into the power supply



Electrical connection using the Galvanic Isolator for a PLC with an active input card.

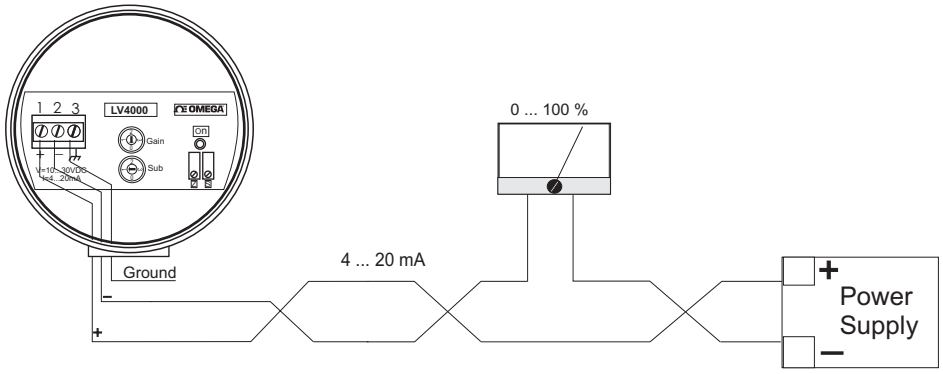


Electrical connection using the Galvanic Isolator for a PLC with a passive input card.

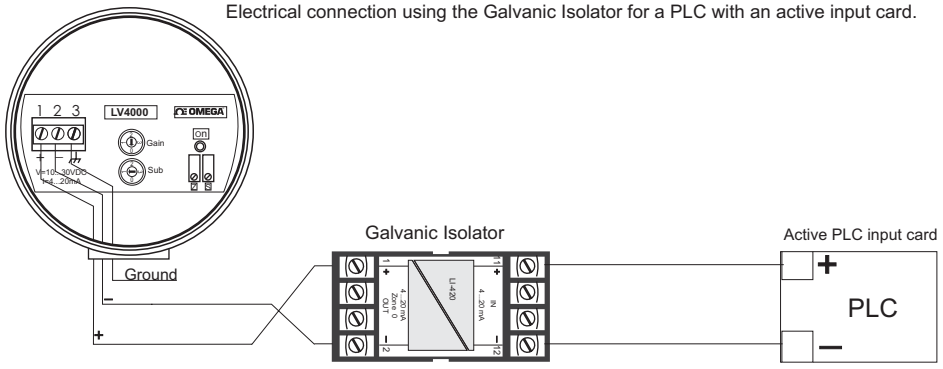


Different wiring scenarios for the Small Aluminum Housing electronics

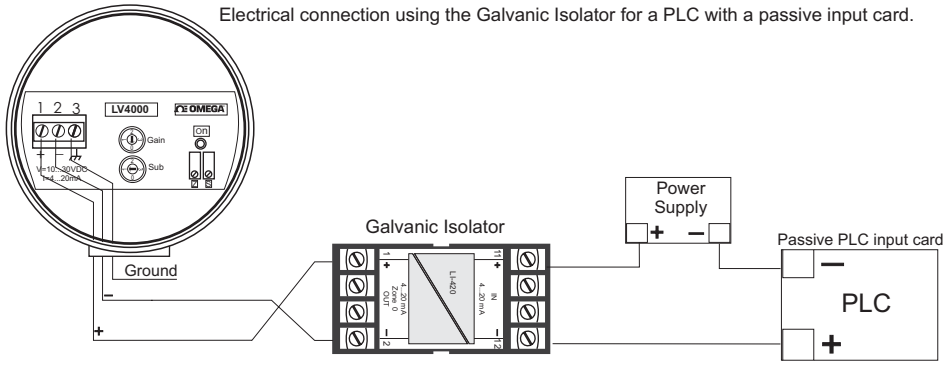
Connecting directly into the power supply



Electrical connection using the Galvanic Isolator for a PLC with an active input card.



Electrical connection using the Galvanic Isolator for a PLC with a passive input card.

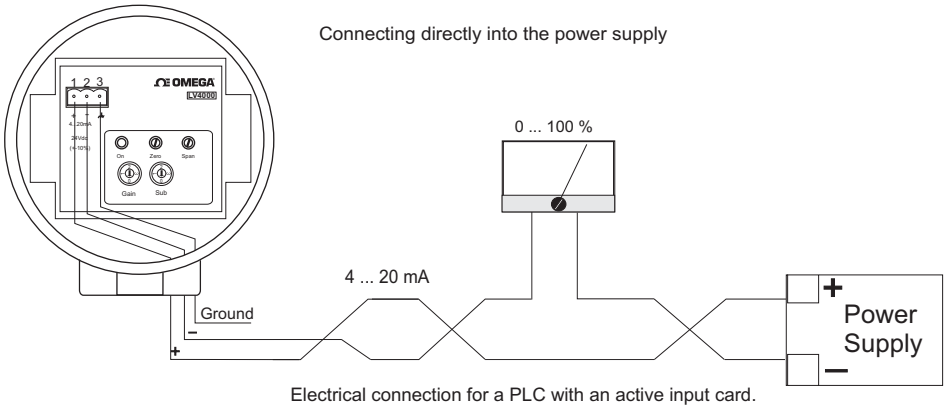


Wiring Diagram

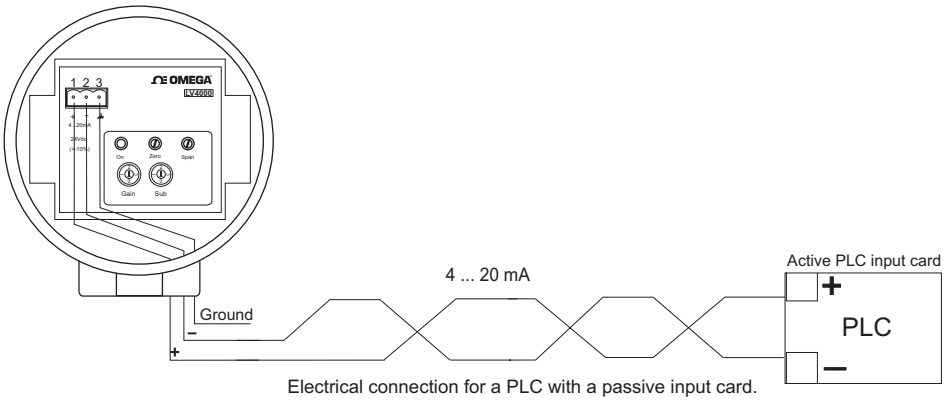
Different wiring scenarios for the Large Aluminum Housing electronics

The large aluminum housing offers a built in galvanic isolator. In this case a separate one is not necessary.

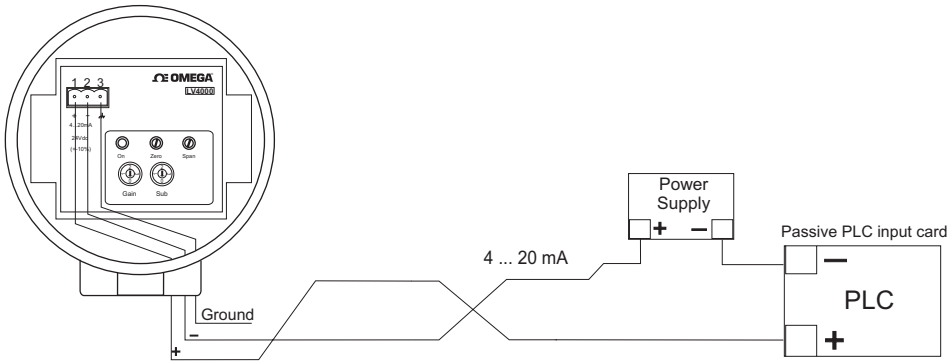
Connecting directly into the power supply



Electrical connection for a PLC with an active input card.



Electrical connection for a PLC with a passive input card.



Materials that are conductive will cause a short circuit between a bare stainless steel probe and the tank wall. For that reason we recommend the use of ETFE or other types of insulating coatings on the rod's surface. (Fig. 1)

Material build-up also affects the accuracy of RF capacitive measurements, and therefore additional adjustment to the probe's sensitivity is recommended in applications where build-up is a concern. (Fig. 2)

Housings must also be compatible with the requirements for wash-down, wet, and/or dusty environments. Hazardous environments may require the housing to be certified. In addition, the active probe might need to be intrinsically safe or have an intrinsic safety barrier. (Fig. 3)

The electronic circuitry of the probe performs several functions such as rectifying and filtering the incoming power, generating the radio frequency signal, measuring the changes in current flow, analog signal generators and display meters. The circuitry is provided with potentiometer adjustments for setting sensitivity that is located in the housing of the probe. These adjustments give an added level of fine-tuning which enable our customers to control the probe's sensitivity with greater accuracy (Fig. 3).

Variation in current input (power supply) to the probe will affect the output. Therefore, a stable power supply should be available. (Fig. 4)

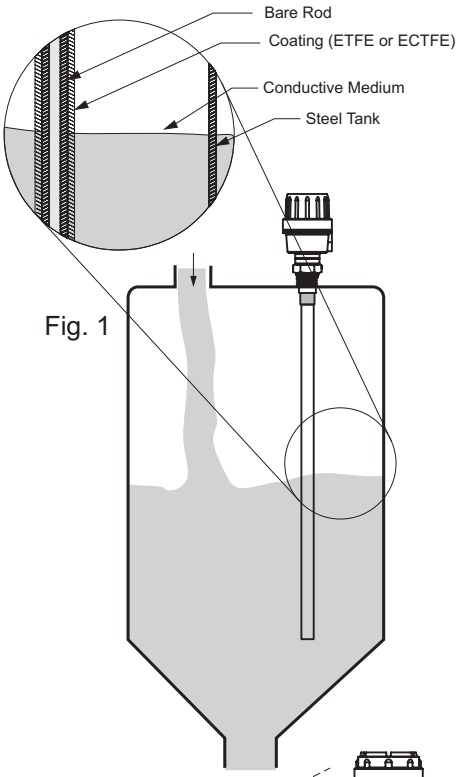
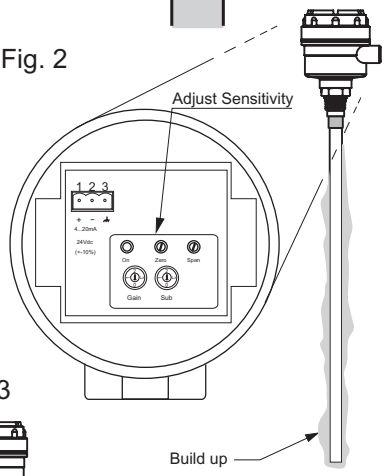


Fig. 1

Fig. 2



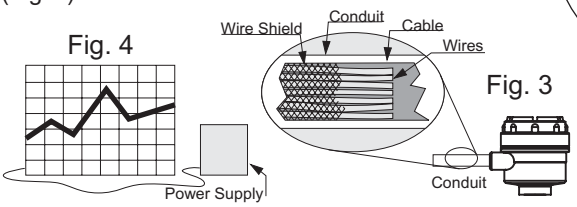


Fig. 3

Fig. 4

Installation

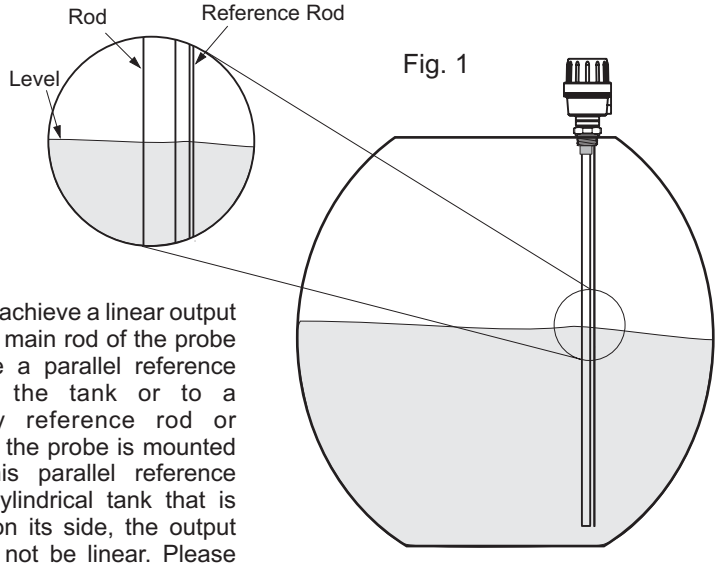


Fig. 1

In order to achieve a linear output signal, the main rod of the probe must have a parallel reference either to the tank or to a secondary reference rod or sheath. If the probe is mounted without this parallel reference within a cylindrical tank that is mounted on its side, the output signal will not be linear. Please consult one of our applications engineers if you have further questions. (Fig.1 correct Fig. 2 incorrect)

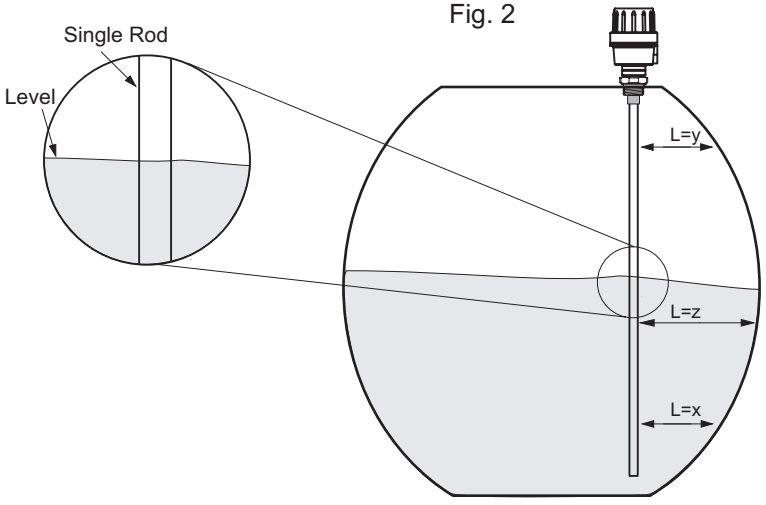


Fig. 2

When installing the probe either directly to the tank, or utilizing a connection, the capacitance probe should be mounted on the top of the tank, never on the side or angle, so that the rod stays parallel to the tank wall. (Fig. 1 correct Fig. 2 Incorrect)

The mounting location of the probe should stay clear away from the point where the medium enters, this will avoid false reading from the sensor while being filled. (Fig. 1 correct Fig. 2 Incorrect)

The recommended distance of installation of the probe from the internal wall is a minimum of 500mm, and from the tip of the rod to the bottom of the tank is 100mm, this will prevent a false signal and possible build up between the wall and probe. (Fig. 1 correct Fig. 2 Incorrect)

Fig. 1

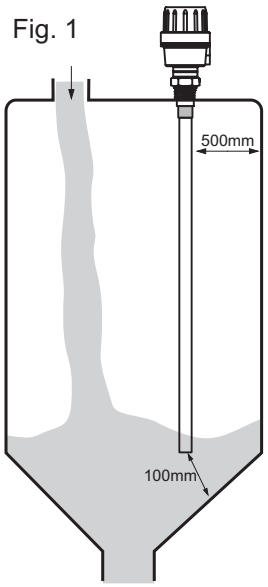
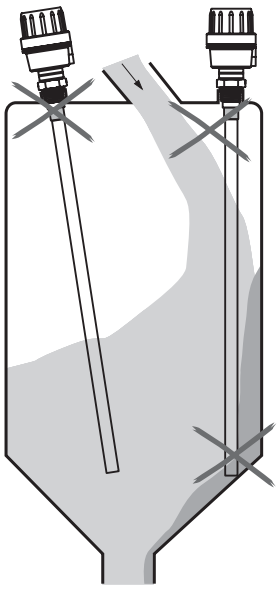


Fig. 2



Installation

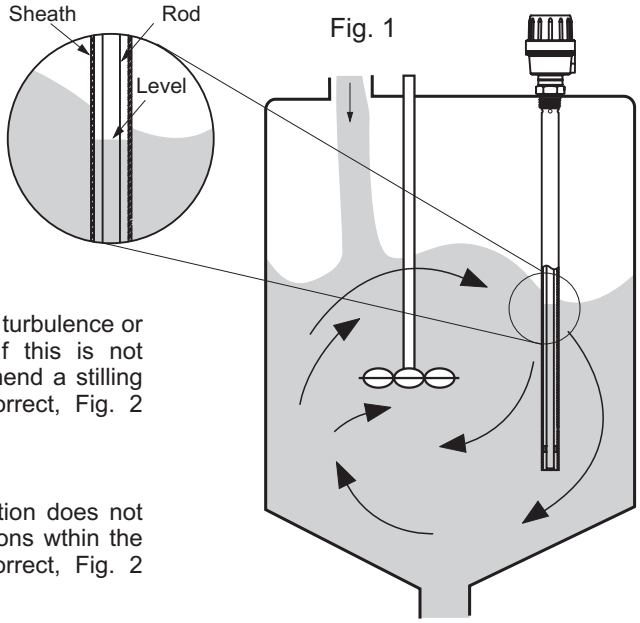
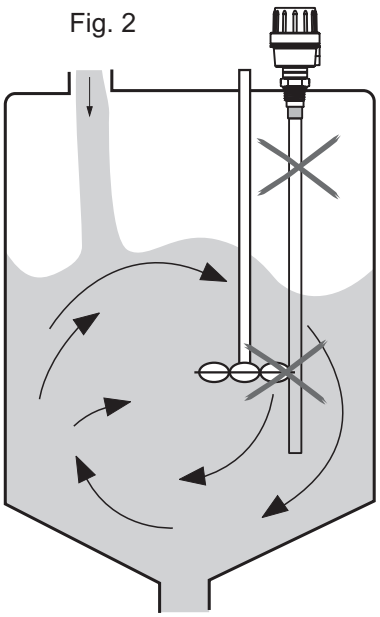


Fig. 1

The tank must be free from turbulence or vortices throughout use. If this is not possible we highly recommend a stilling well or sheath. (Fig. 1 correct, Fig. 2 incorrect)

Ensure that mounting position does not interfere with any obstructions wthin the vessel or tank. (Fig. 1 correct, Fig. 2 incorrect)

Fig. 2



When installing the LV4000 with cable and reference be sure that they are well connected to the bottom of the tank and that it has no slack. (Fig. 1 correct Fig. 2 Incorrect)

The mounting location of the probe should stay clear away from the point where the medium enters, this will avoid false reading from the sensor while being filled. (Fig. 1 correct Fig. 2 Incorrect)

The recommended distance of installation of the probe from the internal wall is a minimum of 500mm, and from the tip of the pendulum to the bottom of the tank is 100mm, this will prevent a false signal and possible build up between the wall and probe. (Fig. 1 correct Fig. 2 Incorrect)

If the cable is secure to the bottom of the vessel it must be isolated and the vessel is steel it must be isolated so that it does not create a short circuit.

Fig. 1

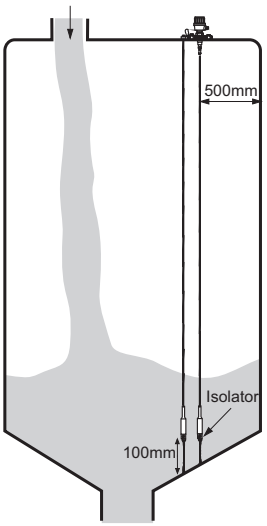
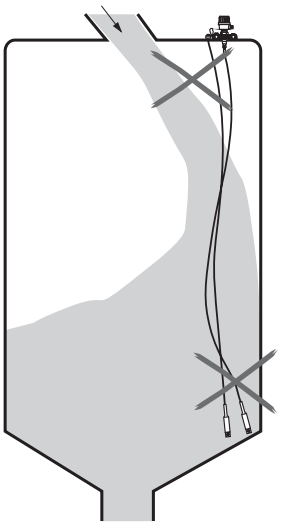


Fig. 2



Calibration

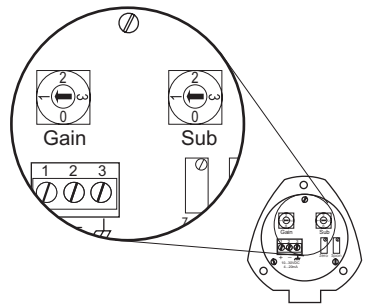
The dielectric value varies according to the product, temperature, pressure, rod's length and shape of the tank. Because of these variations, the parameters of the capacitive probe need to be adjusted according to each application as well as each tank. While the LV4000 can be tested on a bench, the results of calibrating it will not be the same as calibrating the unit within the actual tank that you plan on installing it in.

The LV4000 has 3 stages of sensitivity and that can be adjusted by a selective switch. Each stage has 3 subdivisions (1, 2, 3) for the LV4000 and 4 subdivisions (1, 2, 3, 4) for the LV4000 with Aluminum housing to be combined with the selective switch. Check the values on the chart below according to your application.

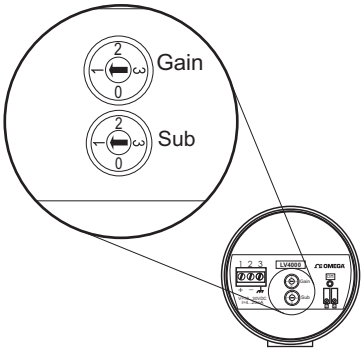
Capacitive Range for the LV4000:

Gain	Sub
1) 1600pF to 5500pF	1 - 3750 to 5500pF 2 - 2500 to 3750pF 3 - 1600 to 2500pF
2) 400pF to 1500pF	1 - 900 to 1500pF 2 - 600 to 900pF 3 - 400 to 600pF
3) 100pF to 330pF	1 - 225 to 330pF 2 -150 to 225pF 3 -100 to 150pF
4) 25pF to 150pF	1 - 150 to 100pF 2 -100 to 70pF 3 - 70 to 25pF

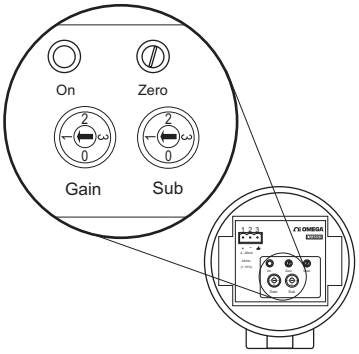
Nylon



Aluminum



Aluminum



Adjustment (4-20mA):
It is recommended that a multimeter be connected according to the figure below (fig.5) to monitor the current value during the calibration. Prior to calibration it is recommended that both potentiometers are reset. Turn both potentiometers counter-clockwise until they stop (or approximately 20 turns). (Fig. 1)

1) Drain the tank to minimum level (Zero% or 4mA).

2) Select the Gain switch 1,2,3 and Sub positions 1,2 or 3. It is recommended to begin with Gain switch 1 and Sub position 1. (Fig. 2)

3) Use the Zero potentiometer to set the current value for the actual level to 4mA. Turn the potentiometer clockwise to increase current. Turn the potentiometer counter-clockwise to decrease current (If the adjustment wasn't possible, alter the Sub and Gain position and try in adjust the minimum value (4mA) through the Zero Potentiometer)(Fig.3)

4) After calibrating the minimum value (4mA), fill up the tank to maximum level. (100% - level)

5) The Sub and Gain switches should be in the same position as adjusted to 4mA.

6) Use the Span potentiometer to set the current value for the actual level to 20mA. Turn the potentiometer clockwise to increase current. Turn the potentiometer counter-clockwise to decrease current. (Fig.4)

7) If the current is lower than 20mA after fully turning the Span Potentiometer clockwise, it is necessary to increase the sensitivity by selecting the next level of the switch (Sub and Gain). If the current still remains lower than 20mA, continue on to the next level until you achieve 20mA.

8) With the 20mA signal adjusted it is best to re-adjust the Zero. Drain the tank back down to the starting level and re-adjust (if necessary) the minimum level to 4mA one more time. After this stage, set-up is complete.

Fig.1

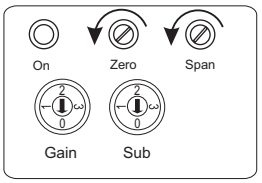


Fig.2

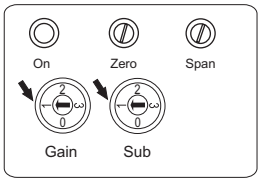


Fig.3

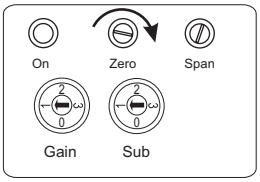


Fig.4

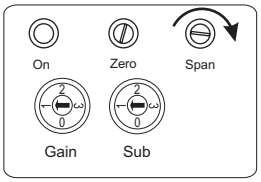
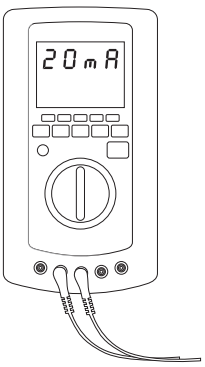


Fig.5

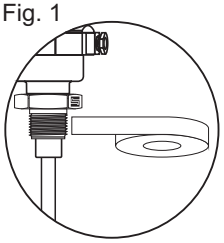


Handling

Probes:

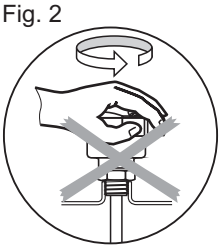
Seal the thread with Teflon tape before installation (Fig. 1).

Fig. 1



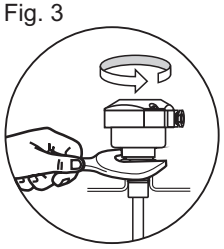
Do not turn or handle by the housing (Fig. 2).

Fig. 2



When tightening the sensor, use only use the 316S.S. hexagon fitting to achieve a seal, do not twist with the body of the sensor. (Fig. 3)

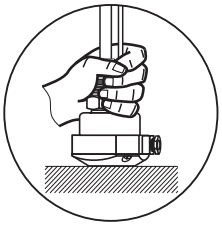
Fig. 3



The probe should not be dropped or suffer any impact or fall that could damage the electronics or the coating of the probe (Fig. 4 and 5).

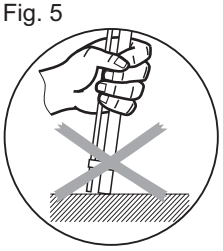
Periodic visual inspection of the probe is required to check for corrosion or deposit build-up. If deposits are found, clean the sensor to ensure optimum performance.

Fig. 4

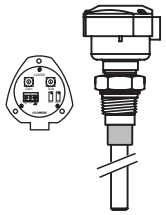
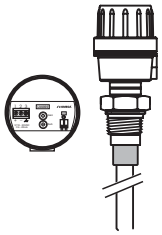
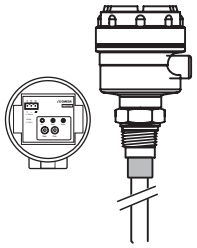


Care should be taken when handling and installing probes with coated rods to avoid scratching them. Scratching the coating could interfere with the probe performance.

Fig. 5



When cleaning the rod use a soft brush or any other similar object.

LV4000		
Housing Nylon	**Small Housing Aluminum**	**Large Housing Aluminum**
		

Application	Continuous Level Measurement for Liquids and Solids
Operating Voltage	12..30Vdc Housing (Small Nylon and Aluminum) 24Vdc (+/- 10%) / Large Housing & (Small Nylon/Alum. w/ LI-420)
Current Consumption	22mA max
Adjustment	Zero & Span Potentiometer
Sensitivity Range	100 to 5500pF
Frequency Oscillation	400 kHz
Output	4...20mA
Accuracy	0.5%
Repeatability	+/- 1mm
Level Indication	—
Electrical Connection	Cable gland - 1/2" NPT conduit entry or M12 connector
Process Connection	3/4" to 1 1/2" BSP or NPT Flange or Sanitary Connections
Wetted Parts	316 Stainless Steel, ETFE, ECTFE
Enclosure Material	Glass filled nylon, Aluminum
Max Pressure	290 PSI (20 Bar)
Operating Temperature	14 to 248º F (-10 to 120ºC)
Class Protection	(IP 65)

Trouble Shooting

Fault	Cause	Solution
No signal	No power supply	Verify power supply
	Inadequate connection	Verify the polarity of the power supply
Signal over 22mA	Probable short circuit	Verify that the rod is coated for conductive mediums
	Sensitivity to high	Adjust sensibility again
Signal Fluctuating	Lack of signal from referance rod	Verify the grounding
Signal under 20mA	Sensitivity to low	Adjust sensibility again
Lack of linearity	Reference is incorrect	Add a Reference
		Sheath the rod
	Coating on the rod is damaged	Send back for repair

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.
If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.
The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of theproduct, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.
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- Flexible Heaters
- Laboratory Heaters

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- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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