



LEVEL-PRO

Patented Gauging Solutions

Standard Stationary Tank Installation Guide



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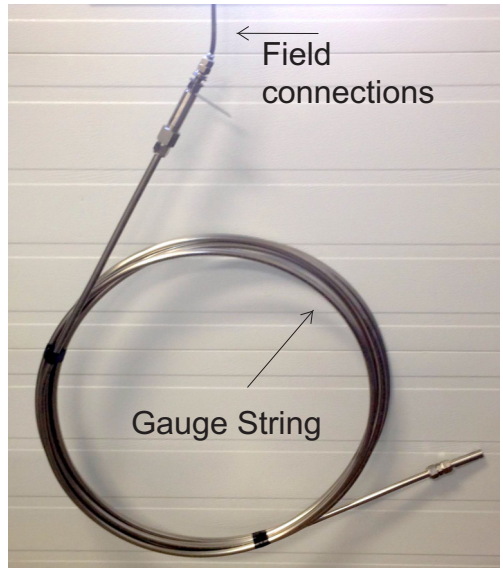
LEVEL-PRO Introduction

The LEVEL-PRO Fluid Measurement System consists of a controller, Gauge String and Float.

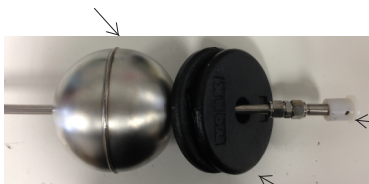
The controller's integral barrier allows use of the Gauge in hazardous locations (see ratings). Modbus RS-485 and 4-20ma interfaces are provided.

Weights anchor the Gauge String and retain the Float at its lower end.

DIN Rail mounted
LP-511 Controller



6" diameter
316 Stainless Steel Float



Bottom end of Gauge String
with Nylon plug and pin

Weights

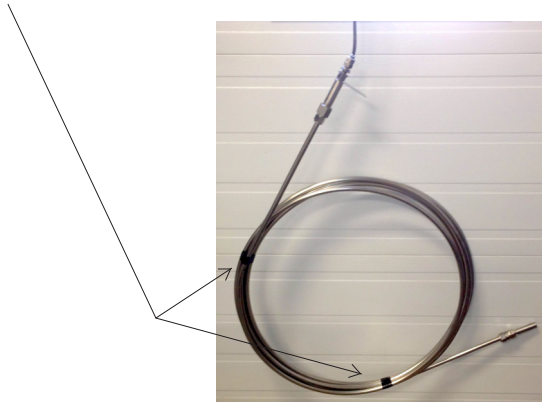
LEVEL-PRO Installation

Parts list	Qty	Part number
1. Controller	1	LP-511/LP-511i
2. Gauge String	1	LPS-xx
3. Float	1	F-316
4. Weights	2	W-5
5. Nylon plug	1	NP-1
6. Pin	1	P-1

LEVEL-PRO Installation

Straightening the Gauge

Step 1. Remove all ties securing the coiled Level Pro gauge.



Step 2. Secure tubing straightener to a truck or bench vice.



Step 3. Place bottom end of the Level Pro into the secured straightener and close the top pulleys over the tubing.

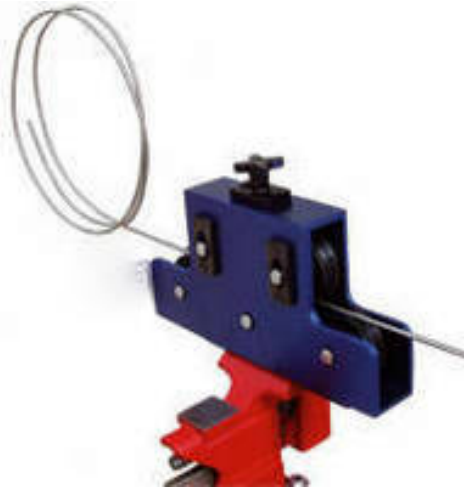
Step 4. Tighten the knob on the straightener until it is snug and holding the Level Pro firmly in place.

LEVEL-PRO Installation

Straightening the Gauge

Step 5. Begin uncoiling the Level Pro and feed it through the straightener until the entire length of the gauge is straight.

*Note: While straightening the gauge, it is important to prevent the connection leads from dragging on the ground. Connections should be kept clean and intact to ensure maximum reliability.



Step 6. Remove the Level Pro from the tubing straightener and proceed to adding the float and weights.

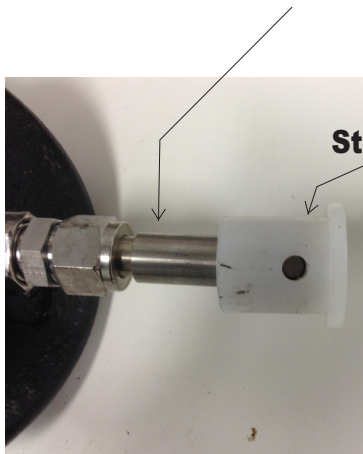
LEVEL-PRO Installation

Adding the Float and Weights

Step 1. Insert Tubing through float first and then weights. Look for the side of the float marked “T” or “Top”, and install it facing away from the bottom of the gauge string.



Step 2. Insert bottom end of tubing into nylon plug



Step 3. Insert pin through nylon plug.
(press fit may require the use of channel lock pliers).

LEVEL-PRO Installation

Adding the Float and Weights

Step 4. Slide the float and weights over nylon plug. Plug should be all of the way into weights to prevent the pin from working out of the plug (press fit may require hammering weights into place).



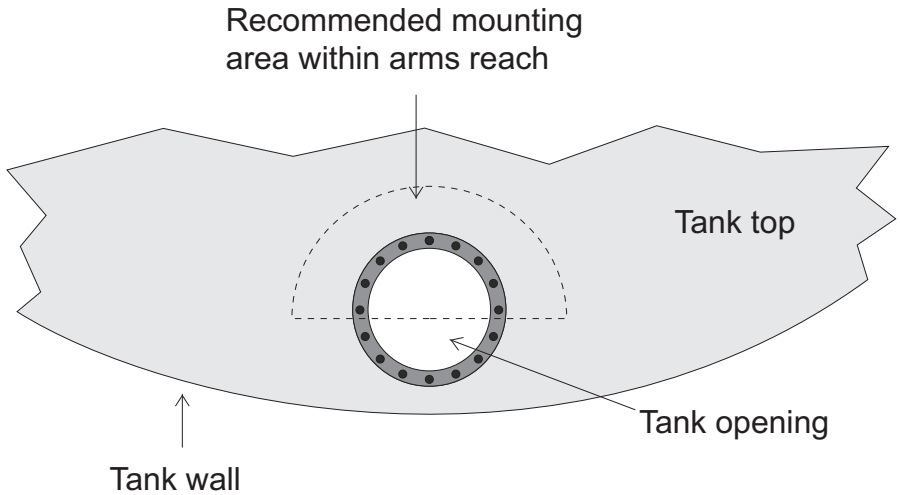
Nylon plug inserted
into weights

LEVEL-PRO Installation

Mounting the Gauge

Step 5. Remove ½" bolt from thief hatch or locate alternate ½" diameter hole in tank top.

Note: Installer should ensure a clear path below for the gauge string and float. Eg. No piping or internal tank equipment that could interfere with the float movement.

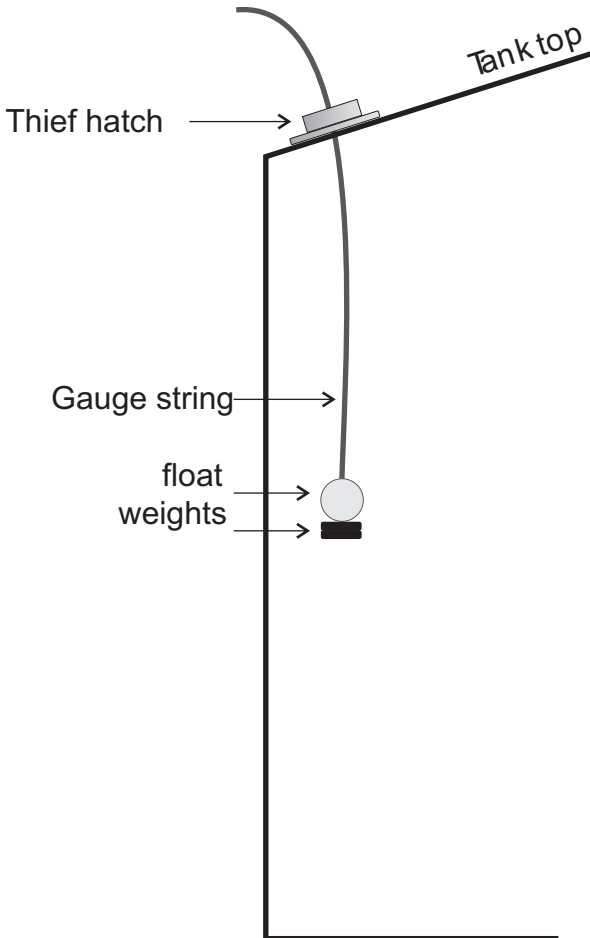


LEVEL-PRO Installation

Mounting the Gauge

Step 6. Carefully lift the Gauge String and insert it, weight end first, into the tank through the thief hatch.

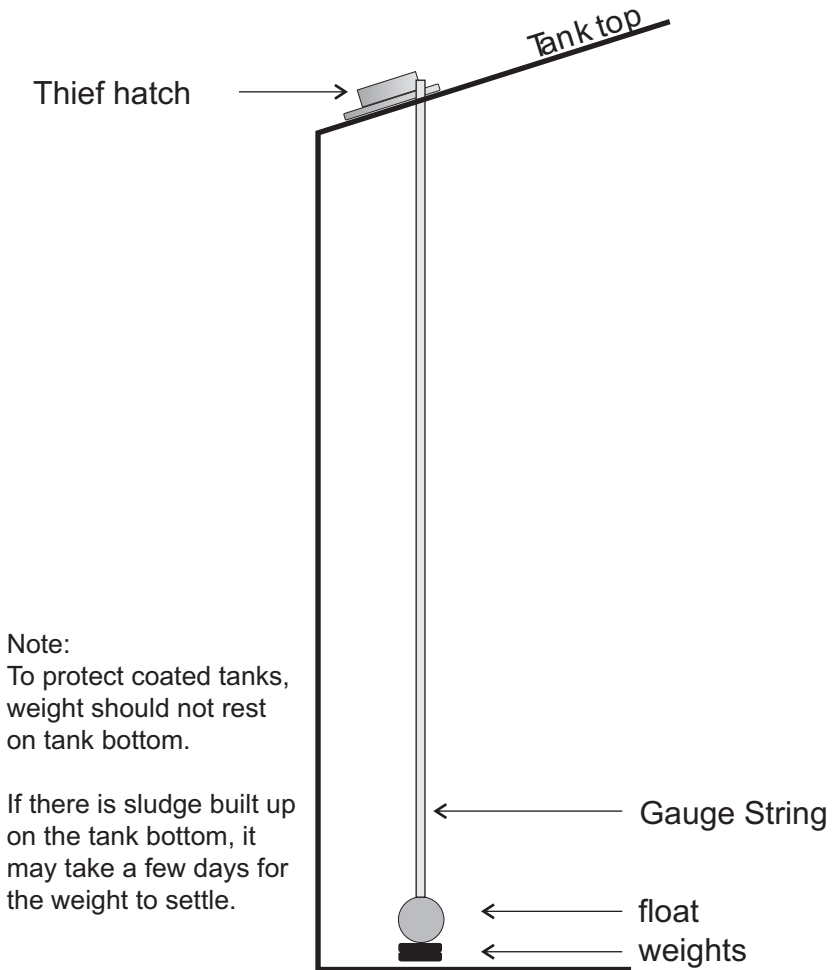
Do not kink the Gauge!
Do not hold the Sensor String by the wires!



LEVEL-PRO Installation

Step 7.

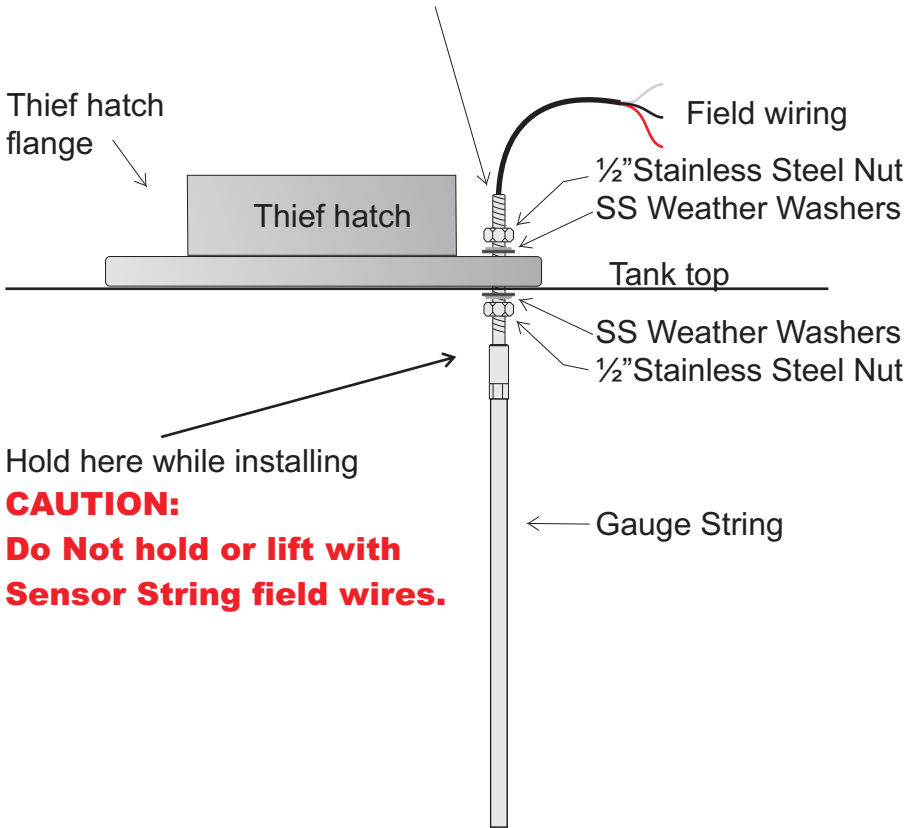
Slowly lower the Gauge assembly to the bottom of the tank.



LEVEL-PRO Installation

Step 8.

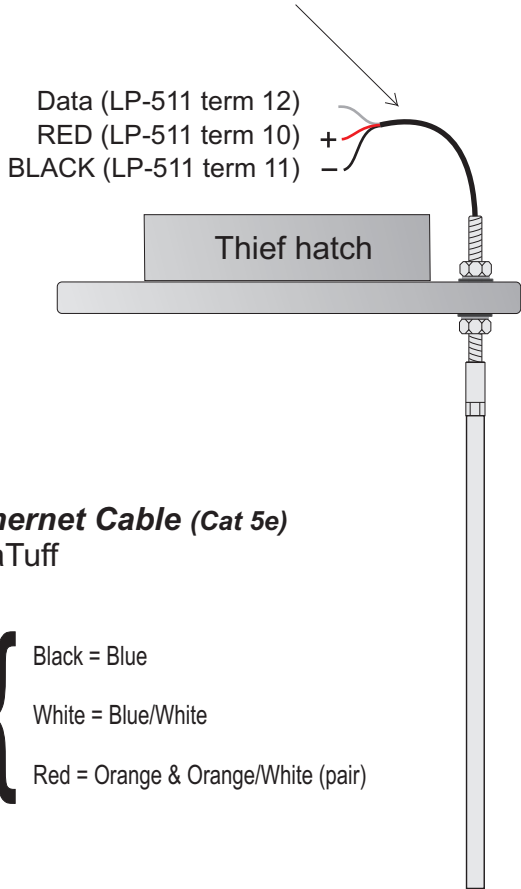
Insert Tank Top fitting up through $\frac{1}{2}$ " hole, attach washer and nut and adjust to suspend weights off of tank bottom.



LEVEL-PRO Installation

Gauge Electrical Connections

Make connection of field wiring back to LEVEL-PRO Controller.



Field Wiring:

Armored Industrial Ethernet Cable (Cat 5e)

eg. Belden 121700 DataTuff

Cat 5e Terminations: {
Black = Blue
White = Blue/White
Red = Orange & Orange/White (pair)

*Installation must comply with Canadian Electrical Code
(CEC) Part 1 Sec. 18 and/or NFPA National Electrical Code Article 504.*

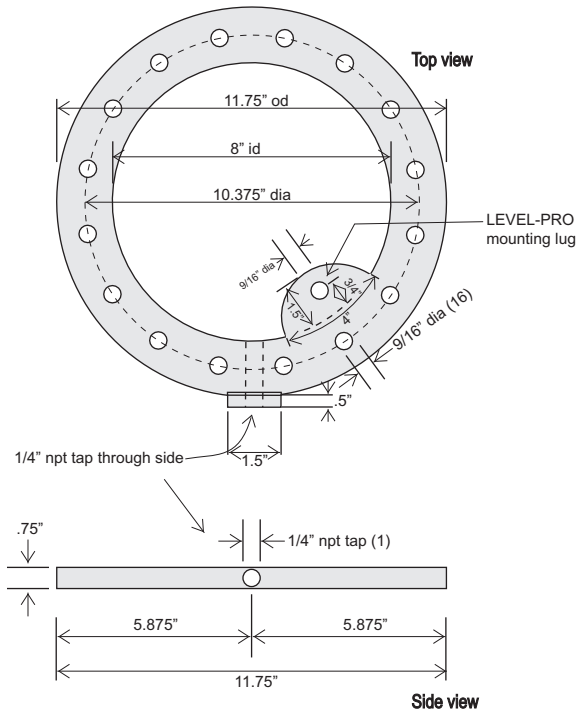
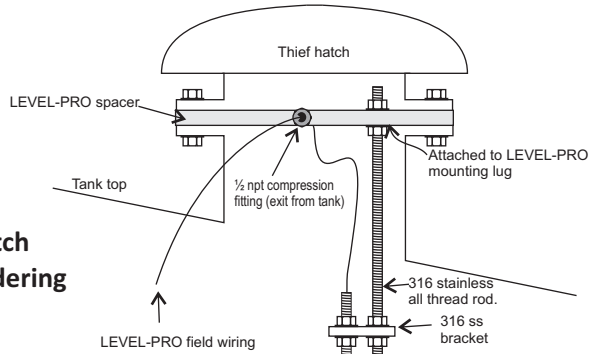
LEVEL-PRO Installation

Alternate Sensor Mounting Methods

LEVEL-PRO Installation Option #2

Theif Hatch Riser Plate Installation - Use When Thief Hatch is mounted on nozzle.

Note: Specify Thief Hatch model and size when ordering riser plate option.



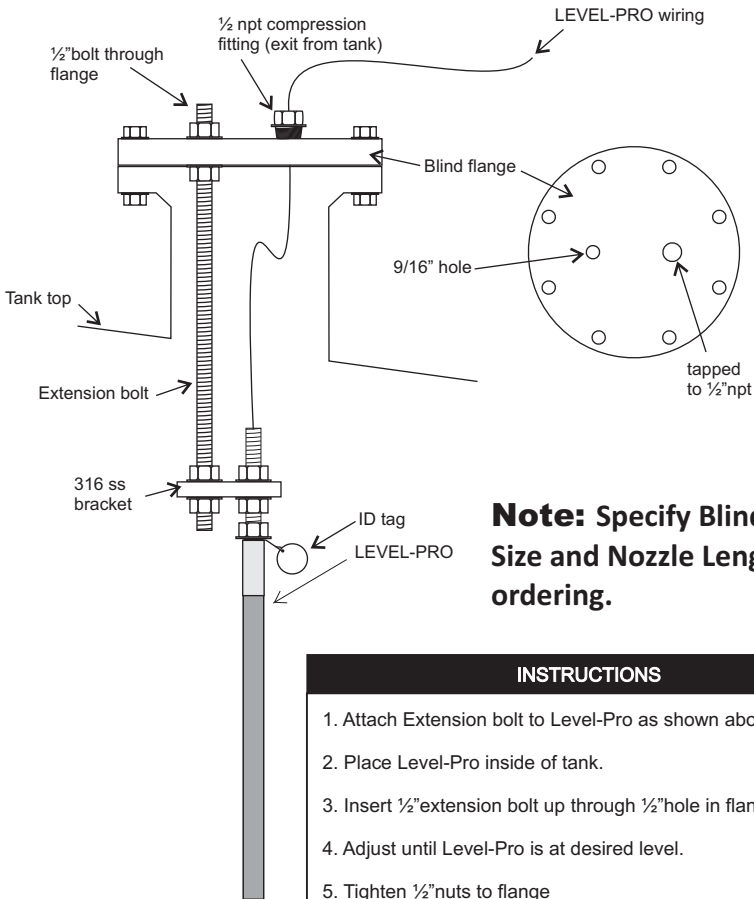
LEVEL-PRO Installation

Alternate Sensor Mounting Methods

LEVEL-PRO Installation Option #3

Blind Flange Nozzle Installation - Use if Requested or if Thief Hatch is not Available

LEVEL-PRO installation through blind flange installation



Note: Specify Blind Flange Size and Nozzle Length when ordering.

INSTRUCTIONS

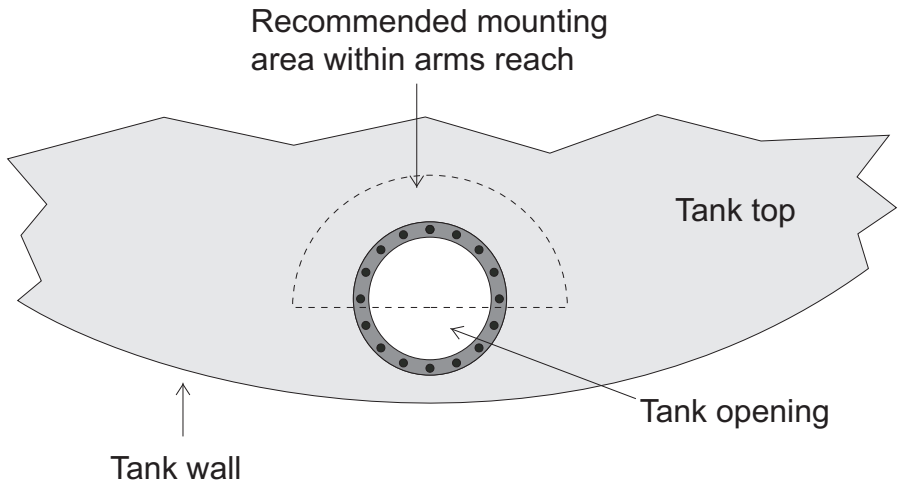
1. Attach Extension bolt to Level-Pro as shown above.
2. Place Level-Pro inside of tank.
3. Insert 1/2" extension bolt up through 1/2" hole in flange.
4. Adjust until Level-Pro is at desired level.
5. Tighten 1/2" nuts to flange
6. Insert wire up through compression fitting and tighten fitting.
WARNING!! DO NOT LIFT GAUGE OR SUPPORT GAUGE WITH LEVEL-PRO WIRING.

LEVEL-PRO Installation

Alternate Sensor Mounting Methods

LEVEL-PRO Installation Option #4

Direct Tank Top Installation - Use when requested or fittings/holes are available on tank top direct from tank manufacturer or previous gauge system removal.



Remember! *Where permitted, hand drilling a 1/2" hole in the mounting area is often the easiest solution.*

Note: Contact Quest Measurement for Alternate Installation Methods or Rigid Gauge Models.

LEVEL-PRO Installation

Electrical Installation Requirements

- 1)** Installation must comply with Canadian Electrical Code (CEC) Part 1 Sec. 18 and/or NFPA National Electrical Code Article 504.
- 2)** The controller must not be connected to any device that uses or generates internally any voltage in excess of 250 volts RMS AC or DC unless the device has been determined to adequately isolate the voltage from the controller.
- 3)** This controller is rated “Non-incendive”. Use in Division 2 locations requires mounting within an enclosure meeting the requirements of ANSI/ISA S82. The enclosure may be installed in Class I, Division 2 Groups C, D locations.
- 4)** The I.S. Ground requires redundant connections to a suitable ground electrode. The resistance of the ground path must be less than 1 ohm.
- 5)** Field wiring between the controller and Sensor must not be greater than 150 meters or have a total cable inductance greater than 0.7mH.

WARNING – EXPLOSION HAZARD:

DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS

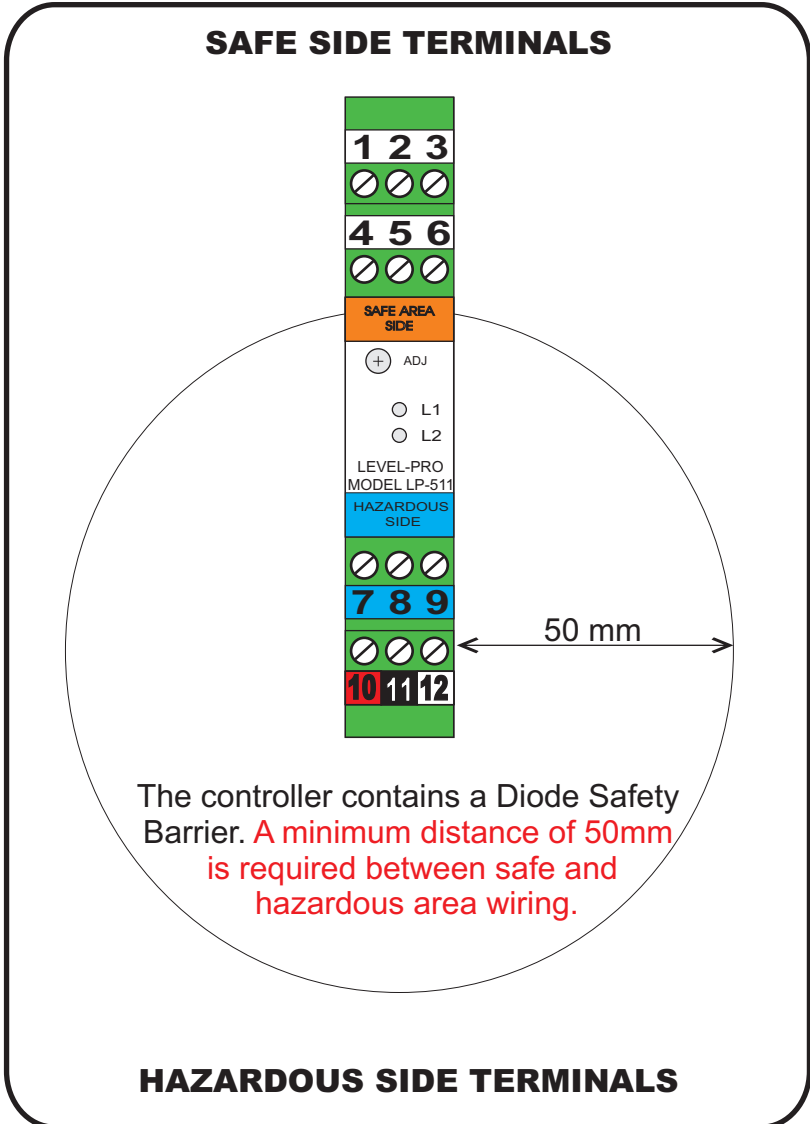
GROUND LOOP PREVENTION:

Keep Site Safety Ground separate from the DC and I.S. Grounds. Reference all DC Grounds and I.S. Grounds to the Site’s main Safety Ground Bus (**Earth**) at a common/single point.

LEVEL-PRO Installation

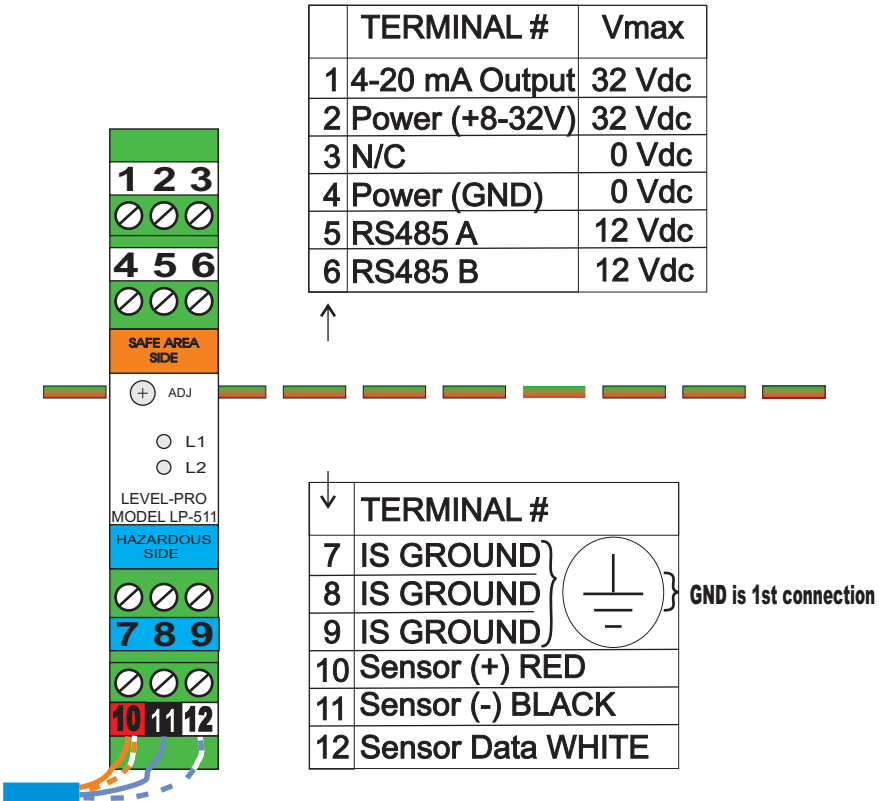
Controller Location

The equipment enclosure should be located as close as possible to the tank. A maximum cable distance of 75m is recommended.



LEVEL-PRO Installation

Electrical Connections: LP-511



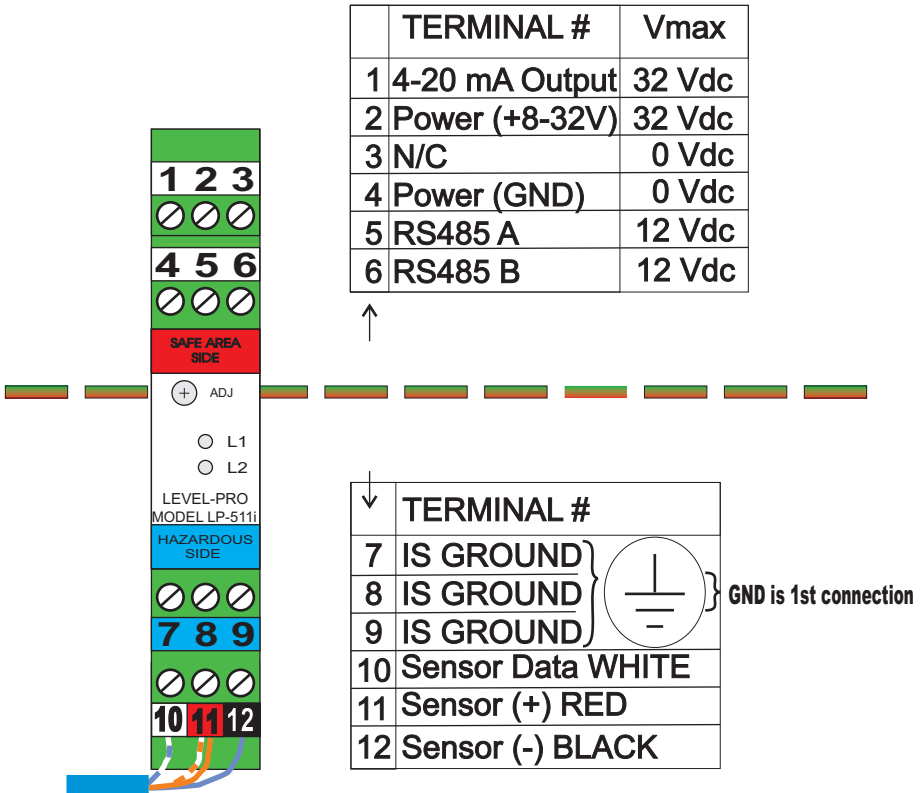
CAUTION



**Make connection to
I.S. GROUND FIRST!**

LEVEL-PRO Installation

Electrical Connections: LP-511i



CAUTION

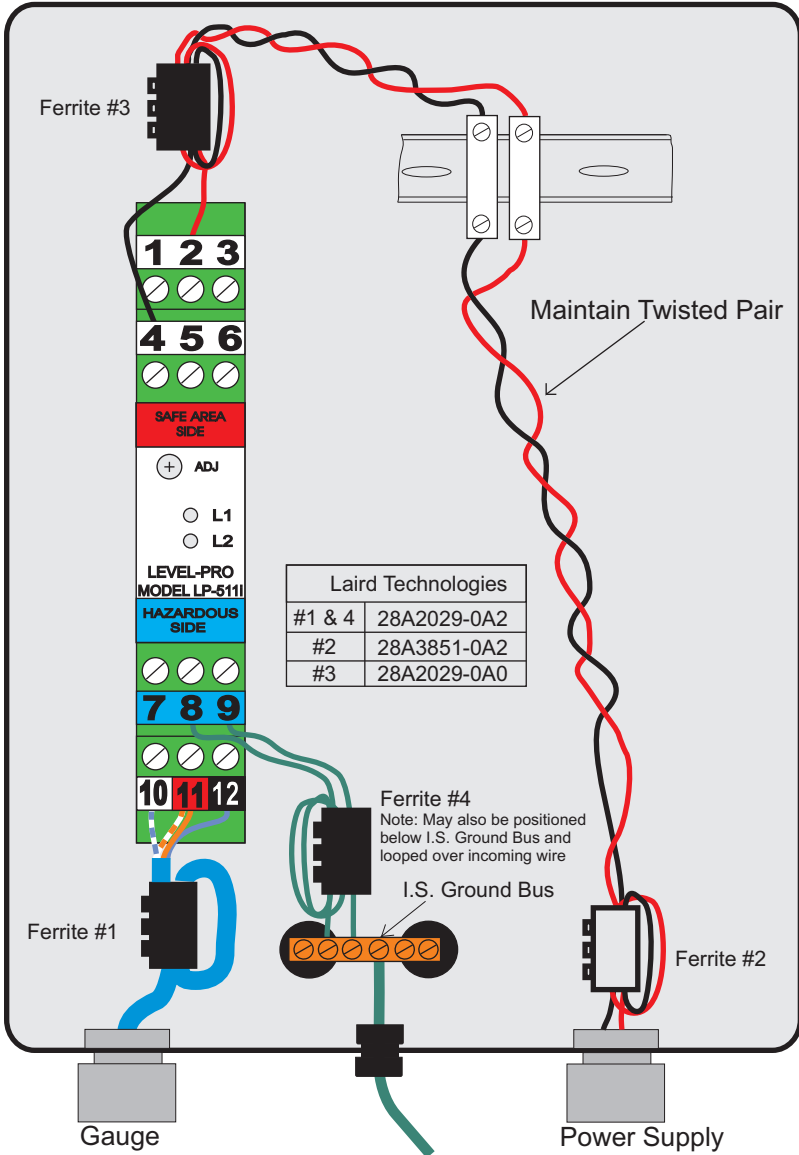


**Make connection to
I.S. GROUND FIRST!**

LEVEL-PRO Installation

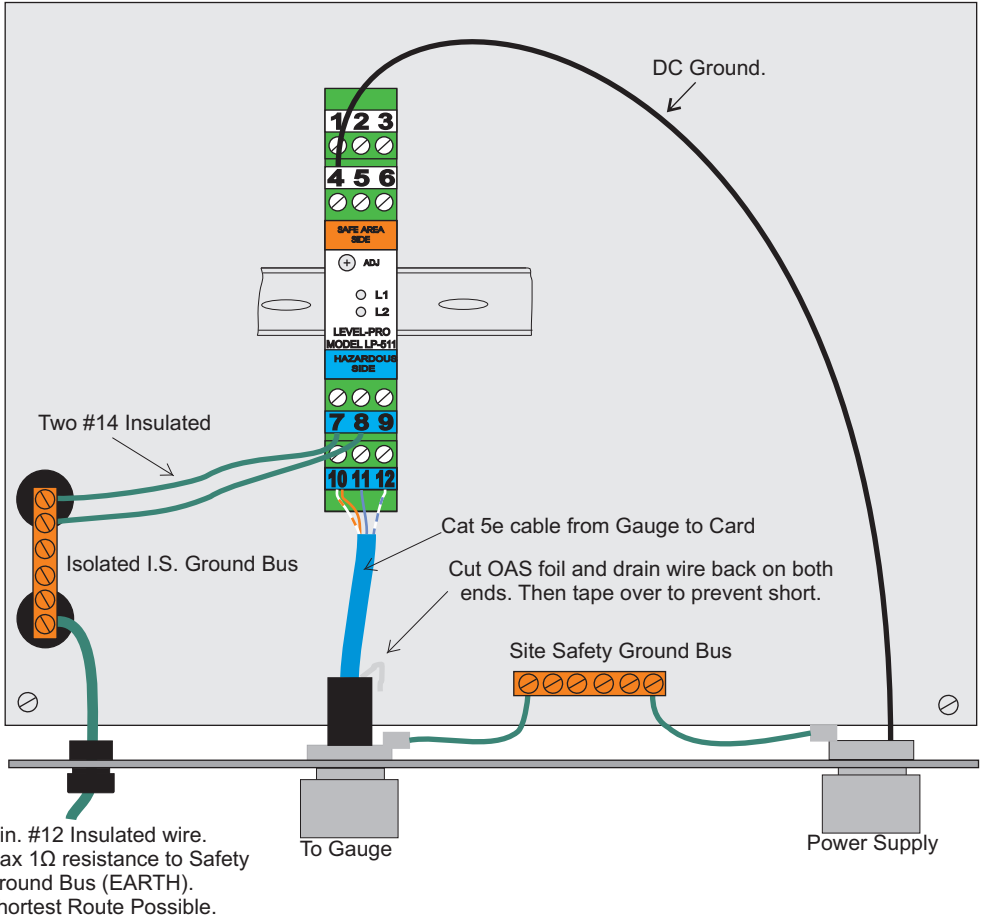
EMI Suppression:

Position the Ferrite Cores as shown below.



LEVEL-PRO Installation

Field Wiring Example



GROUND LOOP PREVENTION:

Keep Site Safety Ground separate from the DC and I.S. Grounds. Reference all DC Grounds and I.S. Grounds to the Site's main Safety Ground Bus (Earth) at a common/single point.

Installation must comply with Canadian Electrical Code (CEC) Part 1 Sec. 18 and/or NFPA National Electrical Code Article 504.

LEVEL-PRO Installation

Power Up

After making all wiring connections, activate the controller power. The controller will automatically detect the gauge and measure the liquid level every 20 seconds. The liquid level is then scaled against the size of the gauge string and output on the 4-20ma output. The level is also available using RS-485 and Modbus communications.

LED Status

POWER UP / REBOOT

LED 1 & 2

⚡ flash RED and GREEN to indicate LED functionality

NORMAL OPERATION

LED 1 - Gauge Status

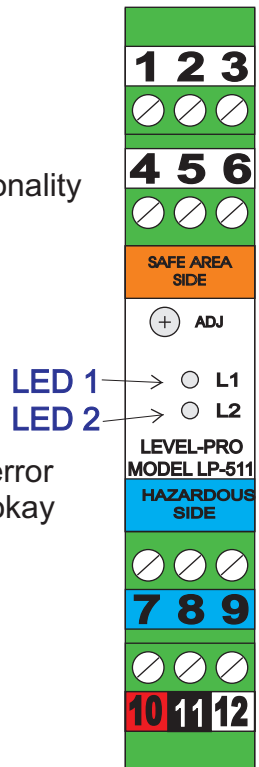
⚡ flash RED when failed

⚡ flash GREEN when Okay

LED 2 - Gauge Communications.

⚡ flash RED rapidly if previous reading was an error

⚡ flash GREEN rapidly if previous reading was okay



If LED 1 or 2 continues to flash red see the trouble shooting guide at the end of this manual.

LEVEL-PRO Installation

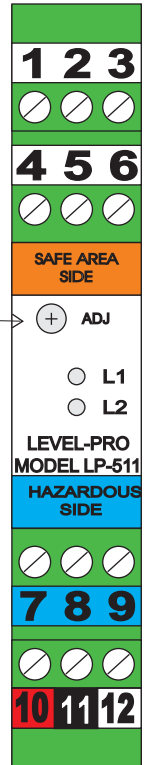
Trim Pot Adjustment

The Trim Pot is used to adjust the gauge reading until it matches a manually taken fluid level measurement (tank bottom to surface of fluid level).

The Trim Pot does this by mathematically lengthening the gauge (extends the gauge until it reaches the bottom of the tank). Because the gauge cannot measure below the physical end of the gauge string, **readings will never be lower than the adjusted pot value.**

The pot is read continuously and will change the previous float reading (4-20ma output) immediately. However, depending on inflow/outflow rates a step change in output may be observed between gauge readings. **Therefore, tank inflow should be temporarily shut in when calibrating.**

Trim pot



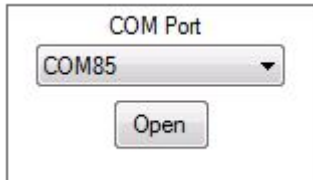
***For more information, see the Gauge Calibration Procedure further on in this manual.**

LEVEL-PRO Installation

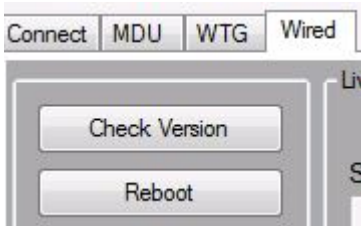
LEVEL-PRO Communicator (LPC)

The LPC program is required for controller setup and configuration. A USB to RS-485 adapter is required. Only one controller can be connected during setup.

To begin: Start the program and click the down arrow to identify the communication port associated with your adapter. Then click **Open**.



Next, select the **Wired** tab and verify the firmware version by clicking **Check Version**. Observe a response occurs similar to what is shown in the image below. If no response occurs you may have the RS-485 communication wires reversed.



Contact Quest Measurement Inc. to obtain a link to download and install the latest version of LPC program.

LEVEL-PRO Installation

Modbus Communications

Click the **LOAD** button (setup boxes will go green).
Click the **READ** button to get live data via modbus.

The screenshot displays a software interface for Modbus communications. It is divided into two main sections: 'Live Data (Modbus)' and 'Modbus Setup Values'.

Live Data (Modbus): This section shows the current status of the system. At the top, it displays 'VER:008 REV:43f'. Below this, there are four data fields: 'Size (cm)' with a value of 697.5, 'Float (cm)' with 630.7, 'Temp (C)' with 19, and 'Volume' with 107.7. A 'Read' button is located to the right of these fields. Below the data fields, there are two radio buttons: 'Metric' (which is selected) and 'Imperial'.

Modbus Setup Values: This section allows for configuration of the Modbus parameters. It includes two rows of settings. The first row is for 'Tank Volume', with two input fields: one for '(m3)' containing the value 119.2 and one for '(bbl)' containing 750. The second row is for 'Slave Address', with an input field containing 005. Each row has a 'Set' button to its right. A 'Load' button is positioned at the bottom right of the setup section.

To change a Modbus configuration Setting:

Click inside the window, type the new value and click **Set**. The window will go green to verify the change was successful.

After setting **a unique Slave Address**, the controller can be daisy chained onto an existing RS-485 network for communication with a Master device such as a PLC or one of Quest's Multi-Tank Displays (MTD).

Notes:

- ✍ Default Slave Address is 5
- ✍ Baud rate is fixed at 9600, N, 8, 1.
- ✍ Modbus values are always read in metric from the controller.
- ✍ Debug **must be disabled** (reboot / cycle power to clear).

LEVEL-PRO Installation

Modbus Register Map (Code Revision: 043f and up)

Register (Decimal)	Type	Description
4000	U16	Float Position (mm from bottom of tank)
4004	U16	Unsigned Temperature (°C, offset by +127)
4032	U16	Calibrated Gauge Size (mm)
4034	U16	Current Volume (m3 x 10)
4036	U16	Total Tank Volume (m3 x 10)
8000	FP2	Tank Volume (m3)

Register Definitions:

U16: Unsigned Integer 16bit (read only)

FP2: Floating Point - 2 register 32 bit (read only)

LEVEL-PRO Installation

Historical Information

Data is collected and stored in non-volatile memory. This diagnostic information can be saved to a file and sent to Quest for review.

Click **Current Comm Stats** to view gauge operation since the beginning of the current hourly interval.

Click **Saved Comm Stats** to download the previously saved hourly intervals.

Click **System Event History** to view the series of events that occurred.

Click the **Debug On** button to observe the next gauge reading data.

Click the **Save** button to store the data to your computer for email to Quest.

Click the **Erase All History** to erase non-volatile memory thus marking all new data from the current moment. **(reboots controller)**



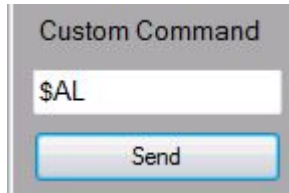
Notes:

- ✍ Stores 96 events and 46 hourly intervals.
- ✍ Events are only stored if unique to the previous one.
- ✍ The oldest data point is cleared as new data arrives.

LEVEL-PRO Installation

4-20mA Calibration Check

Send the Analog Low (\$AL) command to verify 4.0mA (zero).
Send the Analog High (\$AH) command to verify 20.0mA (max).



REMINDER

**The controller must be REBOOTED
to return to normal operation!**

Gauge Calibration Procedure:

- ✍ Shut in production to the tank.
- ✍ Measure the liquid level from the tank floor up.
- ✍ Connect a computer to the controller and read the modbus values using the LPC program.
- ✍ Turn the Trim Pot and then update the modbus values. Repeat until the Float reading matches the dipped/measured reading.
- ✍ Record the total gauge size as reported on the screen.
- ✍ Set the 4-20mA output to Zero using custom command \$AL
- ✍ Calibrate the process display/plc to zero.
- ✍ Set the 4-20mA output to full scale using custom command \$AH.
- ✍ Calibrate the process display/plc to the total string size or to the total tank volume.
- ✍ **Reboot** the controller (or cycle power)
- ✍ Verify gauge reading returns to dipped measurement on display.
- ✍ Open the tank to new production.

LEVEL-PRO Installation

Controller Output States

Power Reset (20 sec. to first reading)

- ✂ The 4-20mA is set to 1.0mA.
- ✂ Current Float Level is set to 22000. (modbus)
- ✂ Current Tank Volume is set to maximum. (modbus)

Reboot Command (20 sec. to first reading)

- ✂ Does not affect the 4-20mA output.
- ✂ Current Float Level (cm) is set to 22000. (modbus)
- ✂ Current Tank Volume is set to maximum. (modbus)

Sensor Failure (40 consecutive failures)

- ✂ The 4-20mA value is set high to 20mA.
- ✂ Current Float Level (cm) is set to 21500. (modbus)
- ✂ Current Tank Volume is set to maximum. (modbus)

NOTES:

- ✂ Total Tank Volume is stored in non-volatile memory.
- ✂ Default value is 636 (m3 x 10).

LEVEL-PRO Specifications

Controller Models: LP-511 and LP-511i

*Associated Electrical Equipment

Class I, Div. 2, Groups C & D T3 [Exia IIB]

$V_{in} = 8-32Vdc$, $P_{max} = 250mW$, $-40 < T_{amb.} < +70C$

Intrinsically Safe Output Terminals 10, 11, 12

for connection only with LEVEL-PRO Sensor Models LPS-xx
where xx = length of sensor up to 45 feet.

WARNING - EXPLOSION HAZARD

DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN
SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS

CAUTION:

This equipment is suitable for installation in:

Class I, Div. 2, Groups C & D or Non-Hazardous Locations only.

Substitution of components may impair suitability for DIVISION 2.

This unit is component piece of equipment and requires to be housed in an approved enclosure. Type 3R min., and is subject to investigation after the final assembly is completed.

Refer to control drawing 9800-002 for LP-511 installation.

Refer to control drawing 9800-005 for LP-511i installation.

Gauge String Models: LPS-xx

xx = sensor length to a maximum of 45 feet

Exia IIB, T3, Tamb. 85° C max.

Information to the User FCC/IC:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Model: LP-511

This Class B digital apparatus complies with Canadian ICES-003. Ce Classe B appareil numérique conformité avec les normes Canadiennes NMB-003.

Model: LP-511i

This Class A digital apparatus complies with Canadian ICES-003. Ce Classe S appareil numérique conformité avec les normes Canadiennes NMB-003.

LEVEL-PRO Installation

Site Issue:

Display is reading MAX tank value and all LED's are flashing RED.

Problem:

The controller is not communicating with the gauge string. After a number of consecutive communication failures, the controller automatically outputs 20mA.

Solution:

- 1.** Confirm proper wiring between the gauge and the controller. On older sites, verify that the connections at the tank are not corroded.
- 2.** Check both ends of the field wiring to verify the drain wire and/or the OAS Foil is not shorted to safety ground. This will negatively affect communications. If necessary, temporarily disassemble the conduit connector and insulate/tape off the end of the cable.
- 3.** Swap out the controller with a known good one to determine if the controller card is bad. If the issue persists, swap back the original controller and test it with a known good gauge string. eg. another tank or a spare gauge. If the alternate gauge string works, then replace the gauge string.

LEVEL-PRO Installation

Site Issue:

A fluid level is present but LED 2 is always red during communications.

Problem: A component within the gauge may have failed. In this case, the controller will continue to measure the fluid level. But the accuracy in the area of the failed component will be decreased.

Solution: Gauge String requires replacement.

Contact:

Quest Measurement Inc. (403) 487-3281

NOTES

NOTES
