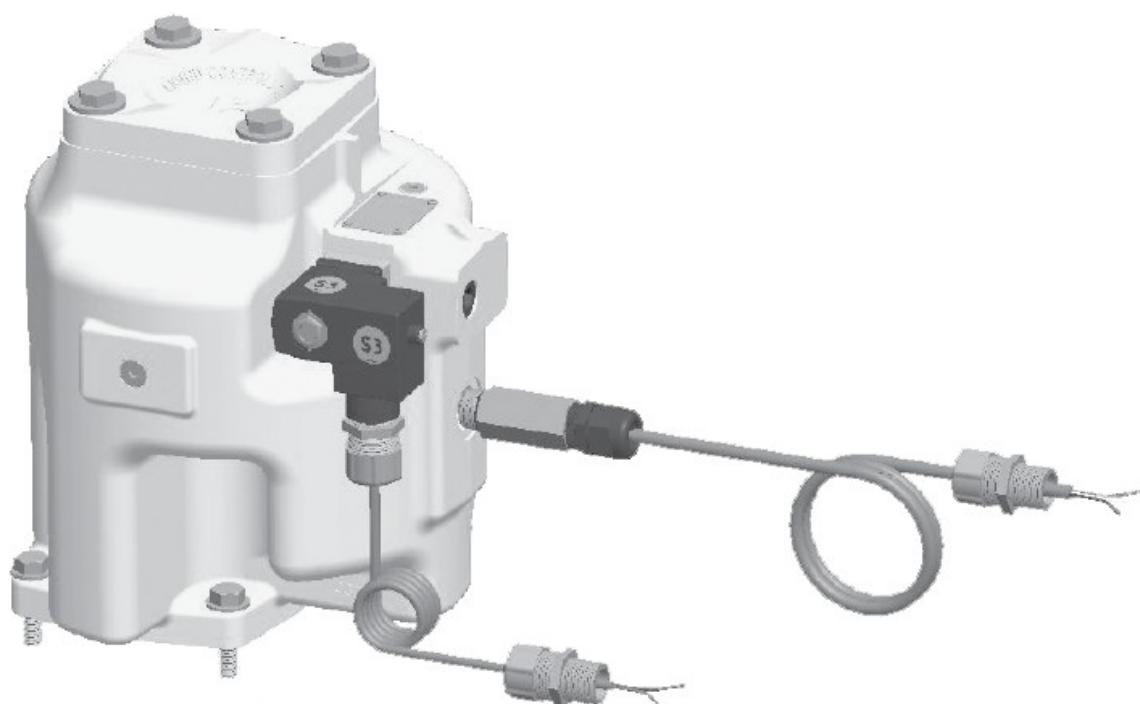


Optical Air Eliminator (US Patent #7000628) Installation & Parts

Refined Fuels Applications (A8981 & A8981A)



LIQUID CONTROLS®

An IDEX Energy & Fuels Business

M300-20

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Optical Air Eliminator

Congratulations on ownership of a Liquid Controls Optical Air Eliminator. This manual provides the technical details on installation, hardware, setup, operation, and regulatory information for your equipment.

Resources in this Guide

For convenience, you can easily download the [PDF edition of this guide](#). Liquid Controls recommends that you read through the introductory and safety information, and then proceed to the Installation chapter.

NOTICE

This manual provides warnings and procedures that are intended to inform the owner and/or operator of the hazards present when using the Liquid Controls Meter on LP gas and other products. The reading of these warnings and the avoidance of such hazards is strictly in the hands of the owner-operators of the equipment. Neglect of that responsibility is not within the control of the manufacturer.

Publication Updates

The most current versions of all Liquid Controls publications are available on the [Liquid Controls web site](#). If there are questions about the language or interpretation of any LC manuals, instructions, or specification sheets, please first contact your local distributor for help with your inquiry.

For service related issues that require further support from the Liquid Controls Service Team, please call the Liquid Controls Corporate Office:

Phone: +1 847 295-1050

Toll-free: 800 458 5262

Address: Liquid Controls LLC, 105 Albrecht Drive, Lake Bluff, IL 60044 USA

Website: www.LCmeter.com

Safety Procedures



BE PREPARED

- Before using this product, read and understand the instructions.
- All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of equipment and/or systems in accordance with all applicable codes and ordinances.
- When handling electronic components/boards, always use proper Electrostatic Discharge (ESD) equipment and follow proper procedures.
- Make sure that all necessary safety precautions have been taken.
- Provide for proper ventilation, temperature control, fire prevention, evacuation, and fire management.
- Provide easy access to appropriate fire extinguishers for your product.
- Consult with your local fire department, state, and local codes to ensure adequate preparation.
- Read this manual and all the literature provided in your owner's packet.
- Save these instructions for future reference.
- Failure to follow the instructions in this publication could result in, personal injury, or death from fire and/or explosion, property damage, or other hazards that may be associated with this type of equipment.



SAFELY EVACUATE PIPING SYSTEM

Before disassembly of any meter or accessory component: **ALL INTERNAL PRESSURES MUST BE RELIEVED AND ALL LIQUID DRAINED FROM THE SYSTEM IN ACCORDANCE WITH ALL APPLICABLE PROCEDURES.**

- Pressure must be 0 (zero) psi.
- Close all liquid and vapor lines between the meter and liquid source.

Failure to follow this warning could result in property damage, personal injury, or death from fire and/or explosion, or other hazards that may be associated with this type of equipment.



OBSERVE NATIONAL & LOCAL CODES

Power, input, and output (I/O) wiring must be in accordance with the area classification for which it is used (Class I, Div 2). For North America, installations must be per the U. S. National Electrical Code, NFPA 70, or the Canadian Electrical Code in order to maintain Class I, Division 2 ratings. This may require using connections or other adaptations in accordance with the requirements of the authority having jurisdiction.

Peripheral equipment must be suitable for the hazardous location where it is installed. (L'équipement périphérique doit être adapté à la zone dangereux où il est installé.)

WARNING: Explosion Hazard

When in hazardous locations, turn power OFF before replacing or wiring modules. (Lorsque dans des endroits dangereux, coupler le courant avant de remplacer ou de câbler des modules.)

DO NOT disconnect equipment unless power has been switched OFF or the area is known to be Non-Hazardous. (NE PAS déconnecter l'équipement sans coupler l'alimentation ou sans s'assurer que la zone est non dangereuse.)

WARNING: Use 3.5 in • lb (0.4 N • m) torque when tightening terminal block screws.



IN THE EVENT OF A GAS FIRE

IN THE EVENT OF A LARGE FIRE OR FIRES THAT ARE SPREADING

- Evacuate the building and notify your local fire department.
- Stop the leakage only if you can safely reach the equipment.

IN THE EVENT OF SMALL, CONTAINED FIRES THAT YOU CAN SAFELY CONTROL

- Stop the leakage, if you can safely reach the equipment.
- Use the appropriate extinguisher for the materials that have caught fire, such a Class B fire extinguisher, water, or fog extinguisher.
- If in doubt, call your local fire department.



IN THE EVENT OF A GAS LEAK

IN THE EVENT OF A LARGE GAS LEAK

- Evacuate the building and notify your local fire department.

IN THE EVENT OF A SMALL, CONTAINED GAS LEAK

- Stop the leak and prevent accidental ignition.
- Prevent the entrance of gas into other portions of the buildings. Some gases such as LPG seek lower levels, while other gases seek higher levels.
- Evacuate all people from the danger zone.
- Ensure that the gas is dispersed before resuming business and operating motors.
- If in doubt, notify your local fire department.

General Information

The Liquid Controls Optical Air Eliminator is designed for use with LectroCount® Electronic Registers. With placement in the wall of the air eliminator housing, an optical sensor monitors the liquid level. The presence or absence of liquid at the sensor level activates or deactivates a solenoid valve located at the top of the air eliminator to vent air or vapor from the system.

The optical air eliminator is designed to work with Liquid Controls M5, M7, M10, M15, and M25 meters, for applications measuring refined petroleum products. Designed with the same mounting dimensions as Liquid Controls mechanical air eliminators, the optical air eliminator does not require plumbing changes to retrofit to existing meter installations. However, electronic registers do require CPU board part number 81920 for LCR and LCR-II, or CPU board part number 81924 for LC³. The optical air eliminator also requires the use of a solenoid-operated control valve, such as the E-7 or A2848-11, on the outlet side of the meter.

Class 2

The Liquid Controls Optical Air Eliminator can be manufactured for Class 2 aviation applications. The Class 2 optical air eliminator (Part #A8981A) is made with an anodized aluminum housing and a stainless steel solenoid valve.

How the Optical Air Eliminator Works

A solenoid valve, located at the top of the air eliminator, is either open or closed. When the liquid level is below the optical sensor (Figure 1), and a delivery is initiated, the solenoid valve opens and vents air and vapor to atmospheric pressure. At the same time, a solenoid-actuated control valve (A2982-11 or A2848-11) closes at the meter outlet.

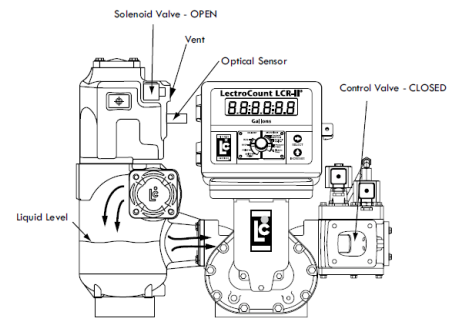


Figure 1: Liquid Level below Optical Sensor

When liquid rises to the optical sensor level and the air is exhausted (Figure 2), the optical air eliminator solenoid valve closes and prevents continued venting to atmospheric pressure. At the same instant, the control valve at the meter outlet opens so that a delivery may begin or continue. This functionality ensures that only liquid passes through the meter for measurement.

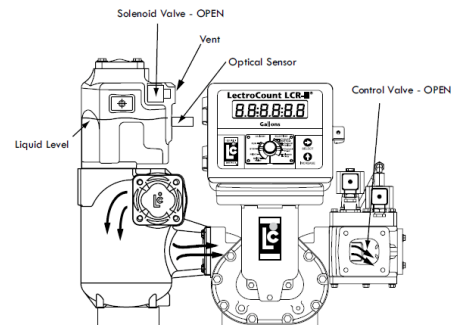


Figure 2: Liquid Level at or above Optical Sensor

As long as a delivery is active and the liquid level remains at or above the optical sensor, the optical air eliminator solenoid valve remains closed and the control valve remains open. If the liquid level should drop below the optical sensor, the optical air eliminator solenoid valve opens and the control valve closes. When the delivery is complete, the control valve closes and the printer prints a delivery ticket. The optical air eliminator solenoid valve is not active between deliveries and remains OFF or closed.

The figures to the left show a cutaway view of the vent port through the solenoid valve. This port has been designed to optimize the venting of air and vapor from the optical air eliminator.

When the liquid level is below the sensor, the S3 solenoid valve is open and allows air and vapor to vent through the solenoid valve as shown in Figure 3.

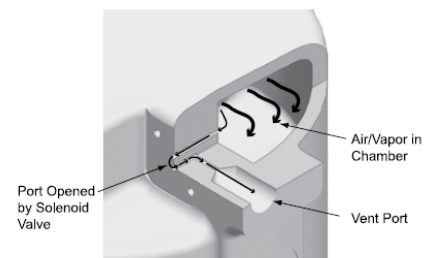


Figure 3: Solenoid and Port Open

When the liquid level is at or above the optical sensor, the S3 solenoid valve closes the vent path as shown in Figure 4.

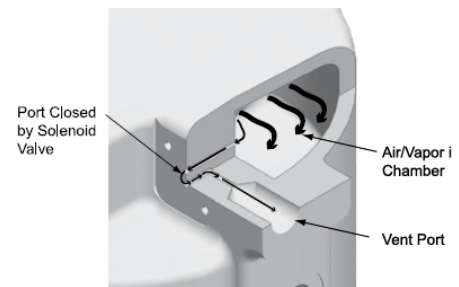


Figure 4: Solenoid and Port Closed

The diagram in Figure 5 shows the Lectro-Count register logic for a preset delivery. In order to function properly, the optical air eliminator must be used together with a solenoid-actuated control valve at the meter outlet, such as the A2982-11 or A2848-11.

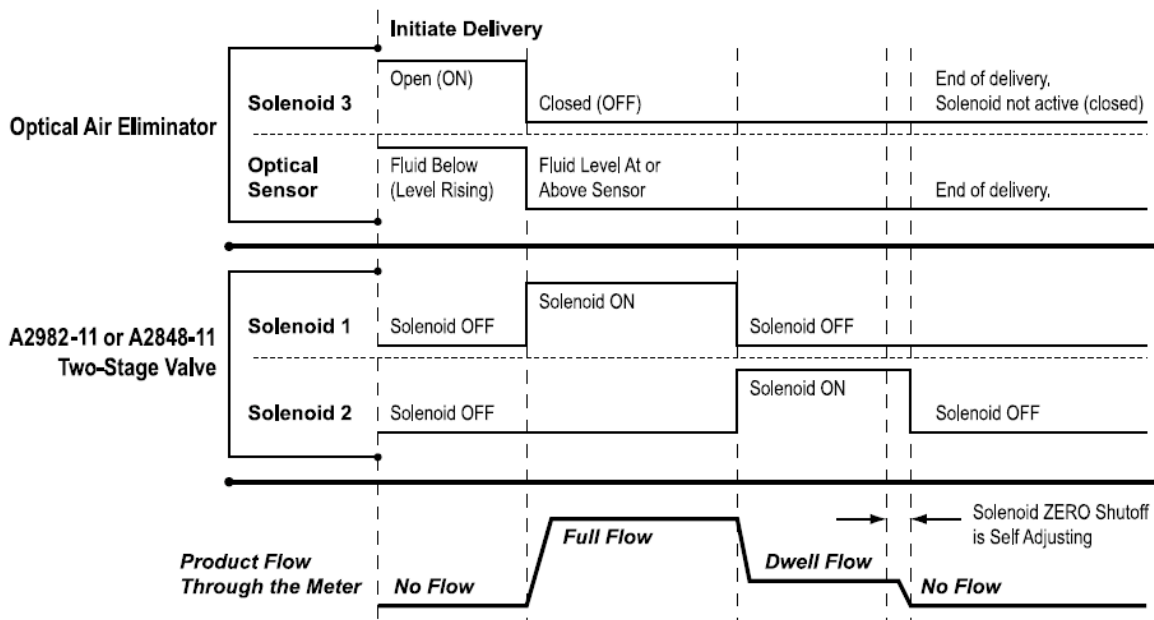


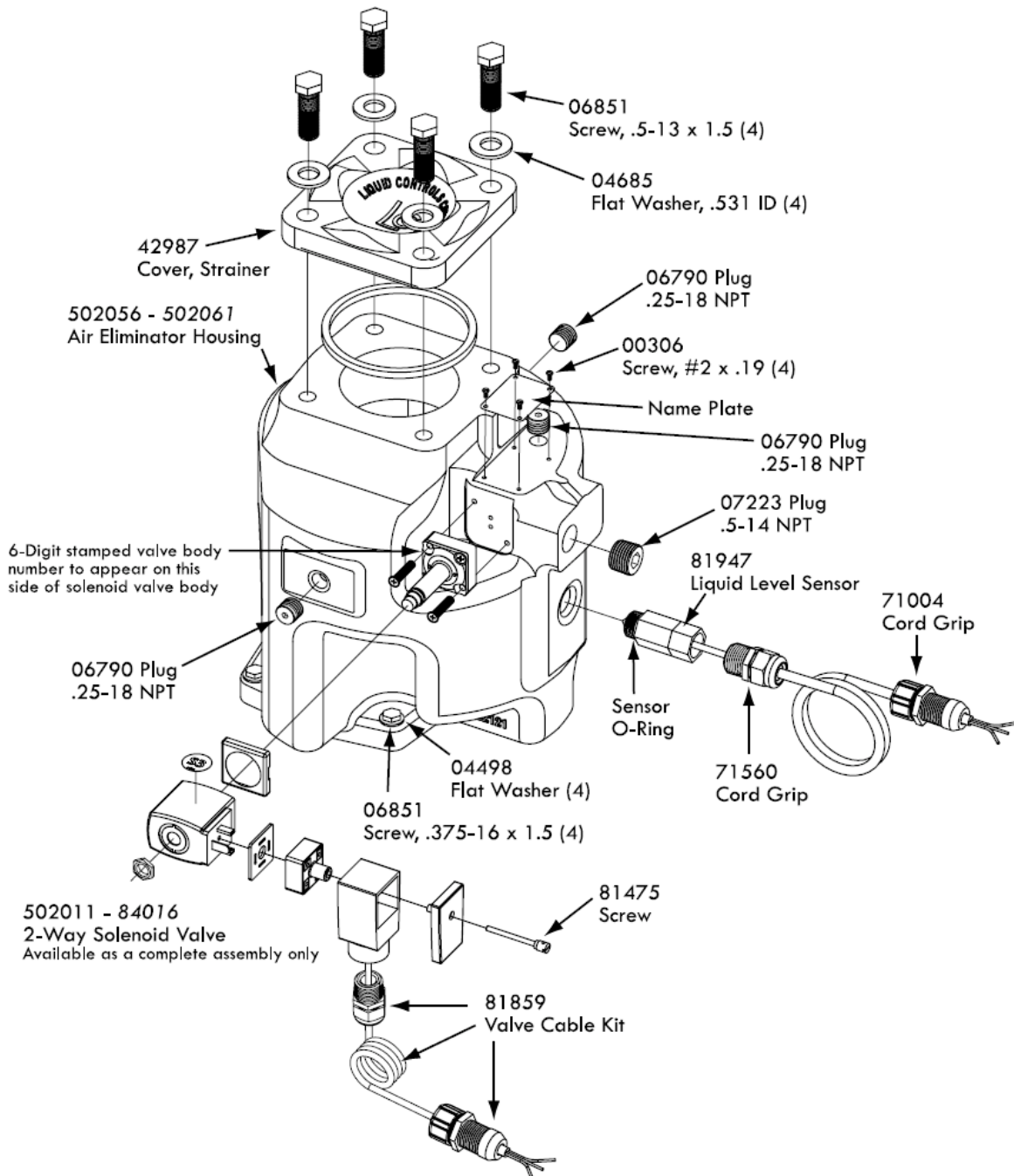
Figure 5: Optical Air Eliminator operating sequence

Specifications

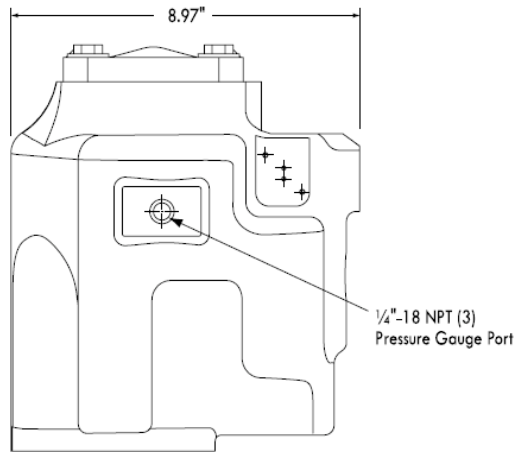
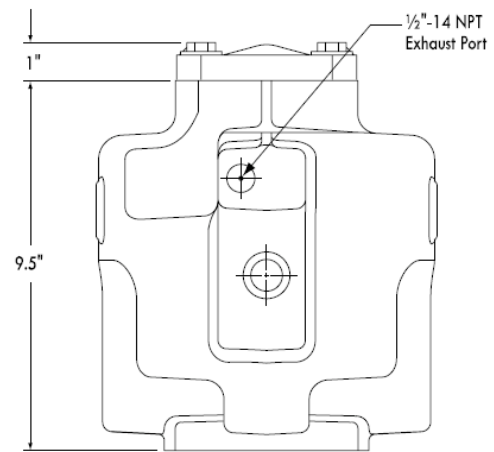
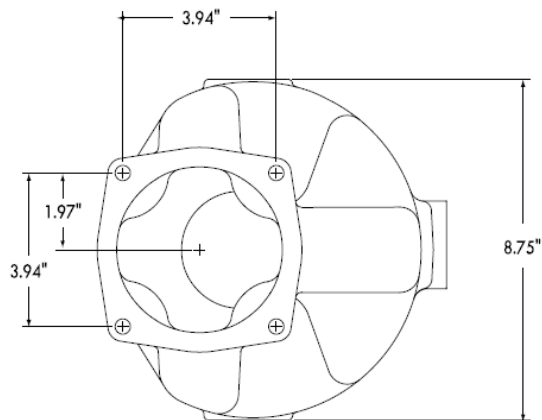
Environmental Rating	<ul style="list-style-type: none"> • NEMA 4X
Safety	<ul style="list-style-type: none"> • Designed to meet Class I, Division 2 requirements
Materials of Construction, Class 1	<ul style="list-style-type: none"> • Body: Aluminum • Solenoid: Brass
Materials of Construction, Class 2	<ul style="list-style-type: none"> • Body: Anodized Aluminum • Solenoid: Stainless Steel
Pressure Rating	<ul style="list-style-type: none"> • Maximum non-shock working pressure = 150 PSI (10.3 BAR) • Maximum differential pressure = 100 PSI (6.9 BAR)
Temperature Rating	<ul style="list-style-type: none"> • -40° to 160°F (-40° to 71°C)
Products - Class 1, Refined Fuels	<ul style="list-style-type: none"> • Gasoline, Gasohol, Diesel fuel, and Fuel Oil
Products - Class 2, Aviation	<ul style="list-style-type: none"> • Av-Gas and Jet Fuel
Solenoid (S3)	<ul style="list-style-type: none"> • Voltage: +12 (± 2)VDC • Optional: +24 (± 4)VDC • Current: 1A maximum
Optical Sensor	<ul style="list-style-type: none"> • Voltage: +10 to +28VDC • Current: 0.5A maximum

Bill of Materials

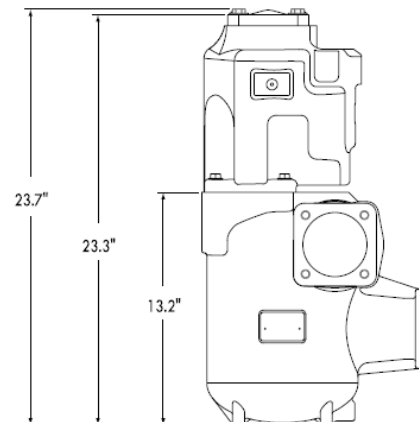
Model Number: A8981 & A8981A: Italicized part numbers indicate A8981A (Class 2) parts. If there is no italicized number, the listed part number applies to A8981 & A8981A.



Dimensions

FRONT**SIDE****BOTTOM**

OPTICAL AIR ELIMINATOR WITH HIGH CAPACITY STRAINER



Installation

New Installations

When ordered with a new meter, the optical air eliminator is mounted atop a strainer on the inlet side of the meter. An example is the meter with high-capacity strainer, two-stage valve, and Lectro-Count LCR-II® Electronic Register shown in the Figure 6.

A vent line must be connected from the output port of the optical air eliminator. This connection is ½" NPT. The vent line must be connected to an appropriate receptacle, such as an overflow tank on a truck.

The optical air eliminator solenoid valve and optical sensor are supplied pre-wired to the Lectro-Count Electronic Register.

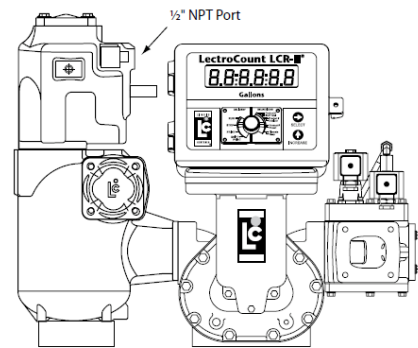


Figure 6: New Assembly

Retrofit Installations

Depending on the existing configuration, adding an optical air eliminator valve may require modification of the vent piping, modification or change of the outlet valve, and/or modification or change of the register.

The optical air eliminator requires the following components to operate:

- Lectro-Count LCR/LCR-II Electronic Register, with internal CPU board Part Number 81920 or LC³ with CPU board Part Number 81924.
- Electronically-controlled outlet valve such as the A2982-11 or A2848-11.

Refer to the manuals accompanying these items for proper installation and configuration. Read the warning below, and then continue on to the instructions for retrofitting an old air eliminator.



RELIEVING INTERNAL PRESSURE

All internal pressure must be relieved to zero pressure before disassembly or inspection of the strainer, vapor eliminator, any valves in the system, the packing gland, and the front or rear covers.

Serious injury or death from fire or explosion could result in performing maintenance on an improperly depressurized and evacuated system.

Strictly follow this procedure Relieving Internal Pressure Procedure for LPG and NH3 Meters:

1. Close the belly valve of the supply tank.
2. Close the valve on the vapor return line.
3. Close the manual valve in the supply line on the inlet side of the meter. If no manual valve exists on the inlet side, consult the truck manufacturer for procedures to depressurize the system.
4. Slowly open the valve/nozzle at the end of the supply line.
5. After product has bled off, close the valve/nozzle at the end of the supply line.
6. Slowly crack the fitting on top of the differential valve to relieve product pressure in the system. Product will drain from the meter system.
7. As product is bleeding from the differential valve, slowly reopen and close the valve/nozzle on the discharge line. Repeat this step until the product stops draining from the differential valve and discharge line valve/nozzle.
8. Leave the discharge line valve/nozzle open while working on the system.

These retrofit instructions will indicate a system using a Hi-Cap strainer/air eliminator. However, the optical air eliminator may also be installed on other LC strainer assemblies used for refined petroleum products.

Step 1 - Remove Old Air Eliminator and Baffel Cup

After the internal pressure has been relieved from the system and the assembly drained of liquid, remove the four bolts and washers used to fasten the old air eliminator to the top of the strainer. Inspect the O-ring and replace if necessary.

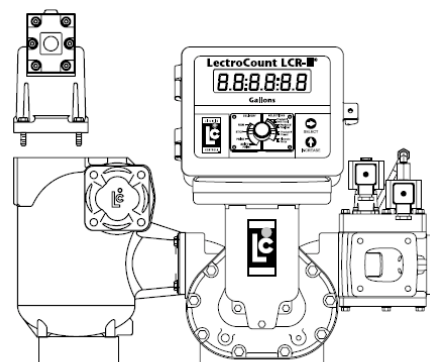


Figure 7: Remove Old Eliminator

Step 2 - Mount the Optical Air Eliminator

Depending on the strainer being used, the optical air eliminator may be fastened to the strainer/air eliminator in any of four 90° rotational increments. Select the most suitable orientation for ease of final installation of wiring and vent piping.

Fasten the optical air eliminator to the strainer using the four bolts and washers. Tighten the bolts to a torque of 27 lbf-ft (37 Nm).

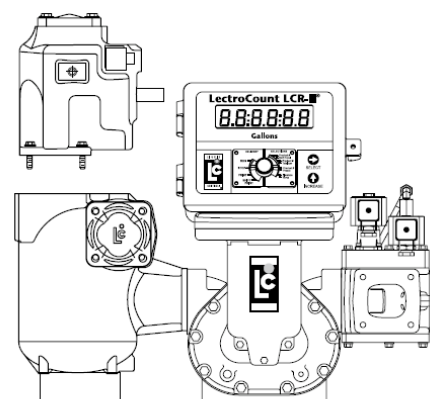


Figure 8: Orient the Optical Eliminator

Step 3 - Connect the Vent Piping/Tubing

This connection is 1/2" NPT. Remove the pipe thread protector and then connect the piping/tubing to the vent port. This piping typically connects directly to an overflow tank on a truck.

Step 4 - Wire the Solenoid and Sensor to the Register

The wiring instructions are given in below.

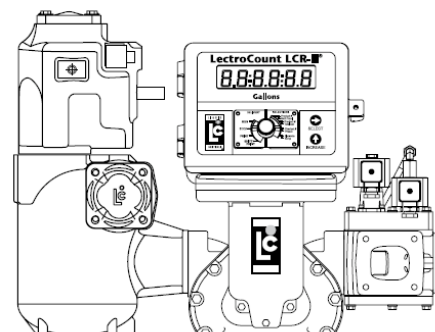


Figure 9: Fasten the Optical Eliminator

Wiring



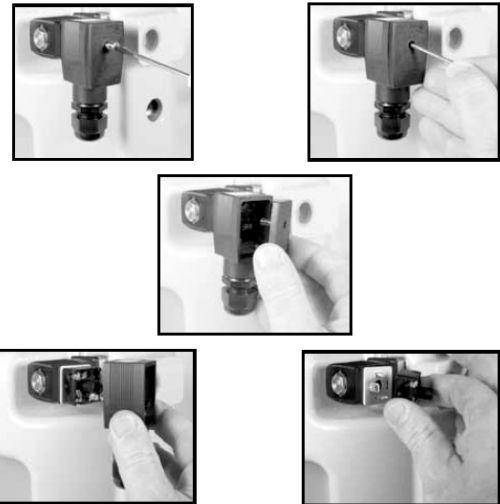
WARNING

Incorrect wiring can damage the optical sensor.

For North American Installations, the installation must be fully in accordance with the National Electrical Code (US) or the Canadian Electrical Code respectively to maintain the hazardous location ratings on the product. This may involve using rigid conduit for all connections.

The optical air eliminator requires a Lectro-Count LCR/ LCR-II Electronic Register with CPU board part number 81920 (LC³ with 81924). If the LectroCount does not contain an 81920 CPU board (LC³ with 81924), this board must be ordered as a replacement to the existing CPU board.

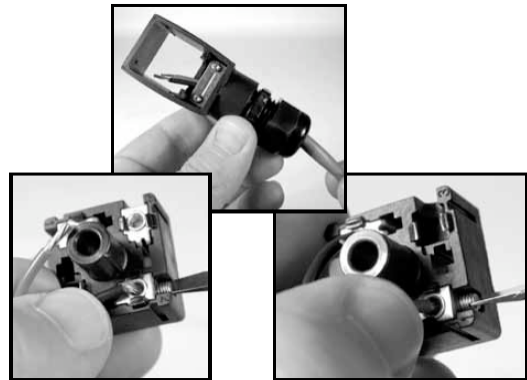
The 81920 CPU board has an additional connector, connector J15, not present on other board models. On the LC³ 81924 CPU board, it is connector J11.



To make the connection to a Lectro-Count Register, the optical sensor comes supplied with a 24-inch cable. The cable is potted in the optical sensor assembly at one end. A threaded cord grip is included to fasten the other end of the cable into the back of the Lectro-Count Register. The solenoid requires a 12 AWG, two-wire, braided cable, approximately 24 to 36" in length.

Step 1 - Remove Cable Plug

Loosen and remove the screw from the cover of the S3 solenoid valve cable plug. Remove the cable plug from the solenoid valve coil. Remove the cover from the cable plug housing and then remove the terminal block. Be sure to note its orientation in the housing. Leave the flat gasket in place on the coil.



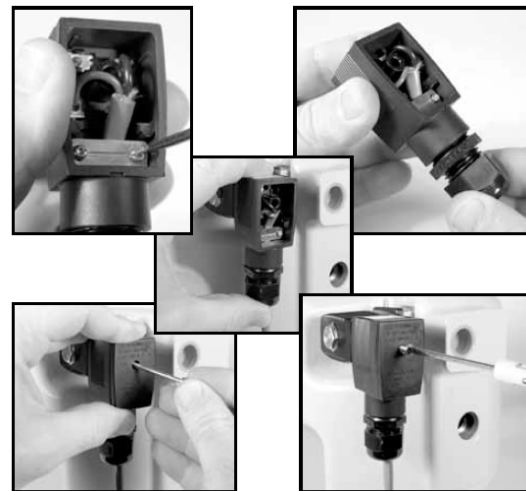
Step 2 - Connect Cable to Cable Plug

Route one end of the cable through the conduit fitting and into the cable plug housing. Connect the cable wires to the terminal block. Connect the BLACK wire to Terminal 2 and the RED wire to Terminal 1. These indicators are marked on the terminal block.

Step 3 - Reassemble Cable Plug

Reinstall the terminal block into the cable plug housing in the same orientation you found it. Tighten the strain relief strap inside the cable plug using the two screws. Tighten the cable gland on the bottom of the cable plug so that it seals around the cable.

Reconnect the cable plug to the coil. Place the cover over the cable plug and fasten with the screw to a torque of 8.8 in-lbs (1 Nm).



Step 4 - Connect to Lectro-Count Electronic Register

Route the cables from the optical sensor and solenoid valve to the back of the Lectro-Count register. Connect these to two open ports on the back of the register using the appropriate connectors.

LCR-II Connections

Connect the wires to terminal block J15 on the Lectro-Count CPU board. Refer to Figure 11a for additional clarification.

Optical Sensor Connection	
Wire Color	J15 Pin Connection
Red	56
White	55
Black	54

S3 Solenoid Connection	
Terminal	J15 Pin Connection
1 (Red)	52
2 (Black)	53

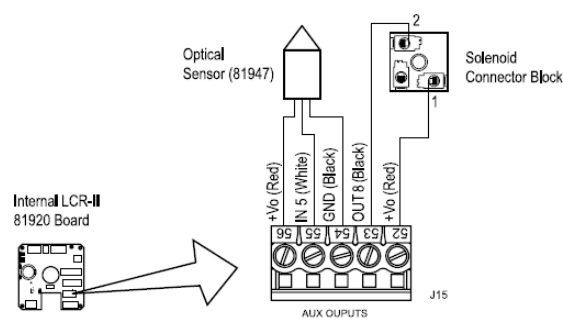


Figure 11: LCR-II to Optical Air Eliminator Wiring

LC³ Connections

Connect the wires to terminal block J11 on the Lectro-Count CPU board. Refer to Figure 11b for additional clarification.

Optical Sensor Connection	
Wire Color	J11 Pin Connection
Red	33
White	34
Black	35

S3 Solenoid Connection	
Terminal	J11 Pin Connection
1 (Red)	31
2 (Black)	32

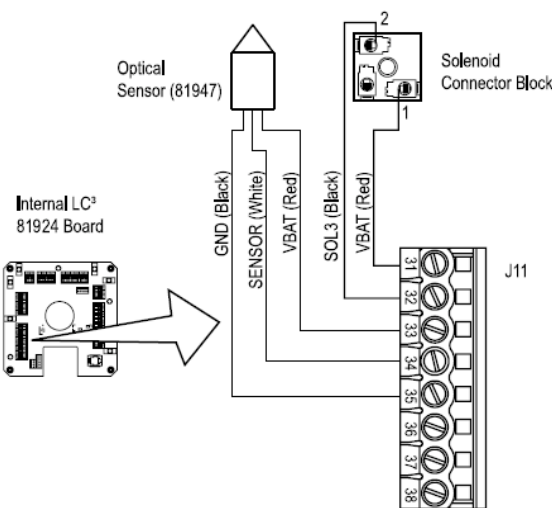


Figure 12: LC³ to Optical Air Eliminator Wiring

Maintenance



RELIEVING INTERNAL PRESSURE

All internal pressure must be relieved to zero pressure before disassembly or inspection of the strainer, vapor eliminator, any valves in the system, the packing gland, and the front or rear covers.

Serious injury or death from fire or explosion could result in performing maintenance on an improperly depressurized and evacuated system.

Strictly follow this procedure Relieving Internal Pressure Procedure for LPG and NH3 Meters:

1. Close the belly valve of the supply tank.
2. Close the valve on the vapor return line.
3. Close the manual valve in the supply line on the inlet side of the meter. If no manual valve exists on the inlet side, consult the truck manufacturer for procedures to depressurize the system.
4. Slowly open the valve/nozzle at the end of the supply line.
5. After product has bled off, close the valve/nozzle at the end of the supply line.
6. Slowly crack the fitting on top of the differential valve to relieve product pressure in the system. Product will drain from the meter system.
7. As product is bleeding from the differential valve, slowly reopen and close the valve/nozzle on the discharge line. Repeat this step until the product stops draining from the differential valve and discharge line valve/nozzle.
8. Leave the discharge line valve/nozzle open while working on the system.

Disassembly

The optical air eliminator consists of a housing, optical sensor, and control solenoid valve. Of these three components, only the solenoid valve is serviceable. However, if any part of the solenoid is damaged, a new solenoid assembly (Part Number 502011) must be ordered. The optical sensor contains no serviceable parts because the internal components are potted. If the optical sensor fails, the complete assembly must be replaced (Part Number 81947).

Tools necessary for disassembly:

- Flat blade screwdriver
- 14mm box end or open end wrench

Follow the steps below.

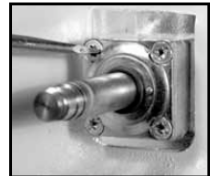
Step 1

Loosen the thin hex nut holding the solenoid in place using a 14mm wrench. Remove the nut and coil from of the armature guide post.



Step 2

Remove the plastic bonnet from the armature guide post. This should be easy to remove without tools.



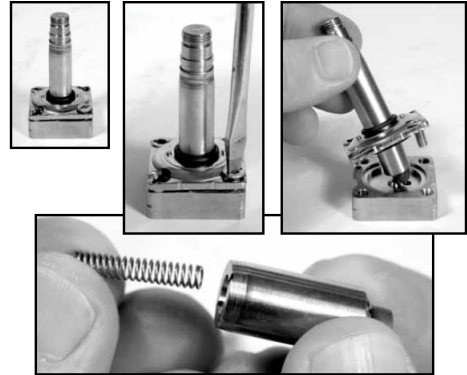
Step 3

Using a screwdriver, loosen the upper-left and lower-right screws of the valve body. These are the only two screws which hold the valve body in place. The upper right and lower left screws fasten the armature guide post and valve body together. Remove the valve body from the optical air eliminator housing.



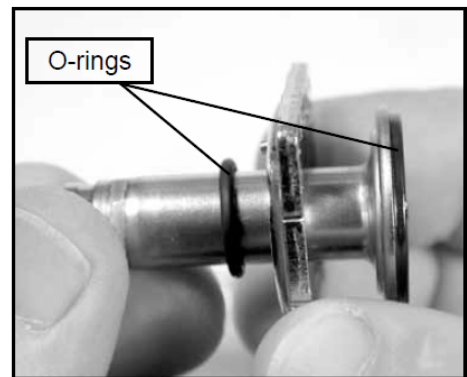
Step 4

Place the valve body on a flat surface. Using a flat blade screwdriver, remove the two screws which hold the armature guide post and valve body together. Lift the armature guide post off of the valve body. The internal components consist of a plunger and a spring. Inspect the spring for damage.



Step 5

The armature guide post consists of four components: two O-rings, the guide post, and the flange. Inspect these components for damage.



Reassembly

Step 1

Place the spring inside the plunger and insert the plunger, spring end first, into the armature guide post. Place the armature guide post assembly on the valve body.

Fasten the armature guide post to the valve body using the two screws removed earlier. Two holes of the valve body are threaded and two are not. Ensure the screws insert properly into the threaded holes.



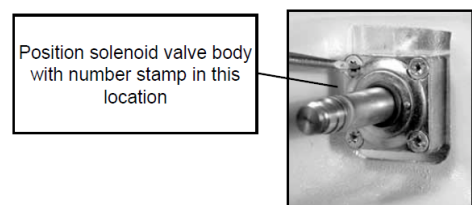
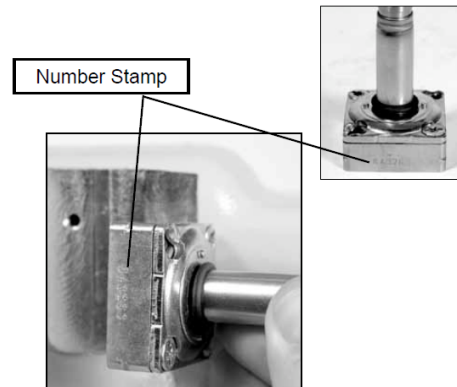
Look closely to see that the valve body has a number stamped into it. This will be used to set the proper orientation of the solenoid valve body with respect to the optical air eliminator housing assembly.

Step 2

Align the solenoid valve body such that the stamped number on the valve body faces the housing assembly, as shown in the image to the left. The valve body can physically be fastened to the housing assembly in one of two orientations. Only one orientation is correct.

IMPORTANT: If the stamped numbers face away from the housing, the optical air eliminator will not function properly. The port will be blocked and the air eliminator will fail.

With the valve body in the proper orientation, fasten it to the housing using the two screws removed previously. Tighten to a torque of 15 to 18 in-lbs (1.7 to 2.0 Nm).

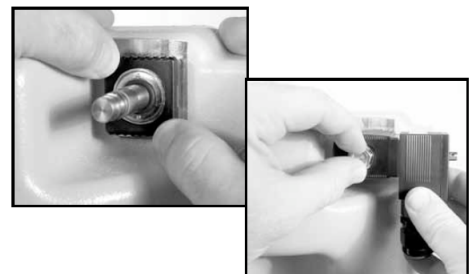


Step 3

Place the plastic bonnet over the valve body and snap in place.

Step 4

Place the coil over the armature guide post and fasten with the thin hex nut. Tighten the nut with a 14mm wrench to a torque of 4.5 in-lbs (0.5 Nm).



Optical Sensor



WARNING

Excessive torque may damage the sensor.

If the optical sensor ever needs replacement, use a 1" open end wrench to remove the optical sensor from the housing. When installing a new optical sensor, care should be taken not to exceed a torque of 75 in-lbs (8.5 Nm).

NOTE: A light coating of grease or anti-seize lubricant should be applied to the threads of the sensor prior to assembly.



Troubleshooting

PROBLEM	PROBABLE CAUSES & SOLUTIONS
<p>Excessive liquid flowing out of vent to spit tank.</p>	<p>CAUSE A – Solenoid not closing.</p> <p>Solutions:</p> <ul style="list-style-type: none"> • Check S3 solenoid wiring. • Measure resistance across S3 solenoid. Value should read approximately 15 ω. If not, replace S3 solenoid. • Inspect S3 solenoid for blockage. Refer to the Disassembly instructions in Maintenance¹⁸. • Lectro-Count CPU failure. Replace CPU board. <p>CAUSE B – Optical Sensor not functioning.</p> <p>Solutions:</p> <ul style="list-style-type: none"> • Check optical sensor wiring. • Measure resistance between the RED and WHITE wires. Value should be approximately 10kΩ. If not, replace optical sensor. • Lectro-Count CPU failure. Replace CPU board.
<p>No liquid flowing through meter during delivery.</p>	<p>CAUSE A – Liquid level not rising in optical air eliminator.</p> <p>Solutions:</p> <ul style="list-style-type: none"> • Check S3 solenoid wiring. • Measure resistance across S3 solenoid. Value should read approximately 15 ω. If not, replace S3 solenoid. • Inspect S3 solenoid for blockage. Refer to the Disassembly instructions in Maintenance¹⁸. • Lectro-Count CPU failure. Replace CPU board.

CAUSE B – Meter outlet valve not opening.

Solutions:

- Check wiring of the outlet valve S1 solenoid.
- Measure resistance across S1 solenoid. Value should read approximately 15 Ω . If not, replace S1 solenoid.
- Inspect S1 solenoid for blockage. Refer to the manual which accompanies the valve.
- Lectro-Count CPU failure. Replace CPU board.

Customer Service

Contacting the Factory

Before you contact the factory, note the model number and serial number of the component. The serial number directs Liquid Controls staff to a file containing all information on material specifications and test data applying to your specific component. When ordering parts, the Liquid Controls Group technical manual should be consulted for the proper part numbers. Always include the model number and serial number when ordering parts.

The model and serial numbers are shown on the nameplate of the unit. Record this information for future reference.

MODEL NO.	<input type="text"/>
SERIAL NO.	<input type="text"/>
DATE PURCHASED	<input type="text"/>
DATE INSTALLED	<input type="text"/>
PURCHASED FROM	<input type="text"/>
INSTALLED BY	<input type="text"/>

Liquid Controls Return Material Authorization Requests

When returning Liquid Controls products for repair, warranty evaluation or calibration, follow these directions:

1. Remove all residue from the Liquid Controls component(s) to be returned. Ensure that the grooves and corners around or inside seals and crevices are cleaned. This is especially important if the component was in contact with hazardous materials. See the Remove Hazardous Material Warning below.
2. Complete the Return Material Authorization request form.

3. If necessary, include special handling instructions, such as MSDS forms or certifications.
4. Attach the completed Return Material Authorization request form, the MSDS form, and the packing slip to the outside of the box.

RMA Forms

Return Material Authorization request forms are included in the red literature packet of every Liquid Controls product shipment. They are also available at www.lcmeter.com in the **Publications** menu selection.



REMOVE HAZARDOUS SUBSTANCES

Do not return a Liquid Controls component until all traces of hazardous substances have been removed. This includes, for example, substances that have diffused through plastic or remain in crevices.

Costs incurred for waste disposal and in injuries due to poor cleaning of returned Liquid Controls components will be charged to the originator of the return.

Returned Material Authorization Handling Procedure for Hazardous Materials

All returned parts must be cleaned by customers prior to return shipment. The person who actually cleaned the parts is required to complete the Return Material Authorization form. If the component has been contaminated, customers must include an M.S.D.S. sheet with the return shipment. If a part is returned without the proper paperwork, the service department will contact the sender and attempt to procure the correct documents. If the proper paperwork is not received within ten days of receipt, the parts will be sent back to the customer for correction. Many Liquid Controls employees handle returned components, and they are exposed to substances left behind on the components. It is our intention to make handling these parts as safe as possible. We regret any hardship these stipulations may cause, but because of the many different applications we service, it is a necessary precaution taken to protect our employees.



LIQUID CONTROLS®

An IDEX Energy & Fuels Business



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