

LiquiCal/LiquiCal SP Water Treatment System

Installation and Operating Manual



PREFACE

This manual describes how to install, set up, operate and maintain the LiquiCal Water Treatment System for cooling towers.

Material in this manual is subject to change without notice. Manual revisions will be made on an as-needed basis. Special circumstances involving important design, operation or application information will be released via Equipment Technical Bulletins.

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INTRODUCTION

OVERVIEW

LiquiCal is a bleed-and-feed device designed to control chemical levels in cooling tower systems by:

- Bleeding water from the system
- Feeding chemical into the system

Bleed is accomplished by a normally-open/normally-closed relay on the printed circuit board (PCB) that is connected at installation to a bleed valve on the cooling tower sump. Feed is achieved by using either the optional integral pump or a user-selected external pump that is driven from the PCB.

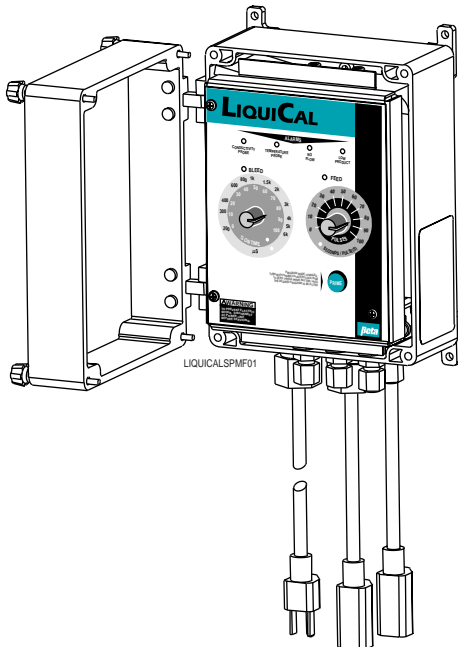


Figure 1. LiquiCal Unit without Pumps

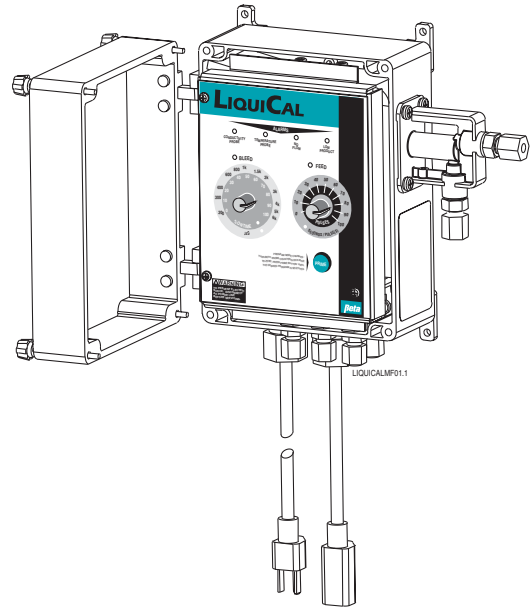


Figure 2. LiquiCal Unit with Pumps

Bleed functions are controlled by either:

1. Percentage ON-time (10-minute cycle)
2. Conductivity

Feed functions are controlled by either:

1. Water meter
2. Timer (counting 10-minute cycles)
3. Percentage of Bleed ON-time

Several modes allow the Feed functions to be independent of the Bleed functions.

The unit, illustrated in **Figures 1 & 2**, consists of a plastic enclosure (with or without integral pumps) containing a PCB and various input/output terminals and user controls. Additional equipment options depend on the mode of operation and include a conductivity probe and flow switch, water meter and low-product level float switch.

SPECIFICATIONS

DIMENSIONS

**Without Optional Mounting Plate and
Probe Assembly (without Internal Pumps)**

Height	Width	Depth
9.5	6	4.6 (in)
24.2	15.24	11.7 (cm)

With Optional Mounting Plate and Probe Assembly (with Internal Pumps)

Height	Width	Depth
17	11.5	4.6 (in)
43.2	29.21	11.7 (cm)

Weight without Integral Pump

5.3 lb (2.4 Kg) without Optional Mounting Plate and Probe Assembly

8.27 lb (3.75 Kg) with Optional Mounting Plate and Probe Assembly

Weight with Integral Pump

5.93 lb (2.6 Kg) without Optional Mounting Plate and Probe Assembly

8.68 lb (3.94 Kg) with Optional Mounting Plate and Probe Assembly

Materials

Plastic water resistant enclosure, NEMA 4X, IP65

Optional CPVC probe assembly

Optional stainless steel mounting plate

Mounting

Unit is mounted with four screw holes in the plastic enclosure, or assembled with the probe on a mounting plate.

Conductivity

Range = 200 to 6000 μ s (microSiemens)

Power

115 VAC, 50/60 Hz, 0.2 Amps maximum

208 VAC, 50/60 Hz, 0.1 Amps maximum

230 VAC, 50/60 Hz, 0.1 Amps maximum

Temperature

Ambient operating temperature: 34 to 120° F (2 to 50° C)

0 to 100% relative humidity (with unit door closed)

Water temperature (for optional flow assembly):

40 to 150° F (5 to 65° C)

Integral Pump

Maximum inlet vacuum = 10" Hg (25 mm Hg)

Maximum outlet pressure = 100 psi (6.9 bar)

Typical output rate = 0-26 gpd (0-91 liters per day)
(0-63 ml per minute)

Maximum lift distance = 10 feet (3 meters)

Inputs

Conductivity, temperature, water meter, flow switch

Conductivity Probe

Use recommended probe only (k factor = 2.2)

Maximum distance from LiquiCal = 100 feet (305 meters)

Place as close as possible to bleed valve

Temperature Sensor

Use recommended sensor only

Water Meter

Maximum wiring distance 500 feet (152 meters) using 16-18-gauge shielded cable

Outputs

Main Board

115 VAC, 1 Amp max

Bleed Output

115 VAC, 6 Amp max



If bleed valve voltage is different from that of the power source, see **Electrical Connections** section.

Pump Output

115 VAC, 3 Amps max



When connecting the flow manifold to the water system using flexible polyethylene tubing, a minimum size of 1/2" OD should be used to ensure the proper function of the flow switch.

INSTALLATION AND SETUP

OPTIONAL CONDUCTIVITY PROBE

A conductivity probe is required only if you set the unit to operate in mode 3, 4 or 5 (see **Table 1**). LiquiCal can be ordered with or without a combination probe/flow switch assembly. If you choose a remote conductivity probe, it must be no more than 100 feet from the unit and as close as practical to the bleed valve.

PROBE/FLOW SWITCH ASSEMBLY

The probe and tee assembly is suitable for system pressures up to 100 psi (6.9 bar). For pressures over 100 psi (6.9 bar), contact your technical support group. Flow through the sample line must be at least 1.5 gpm (5.7 liters per minute) to ensure accurate readings.

PROBE IN COOLING TOWER

The conductivity probe may be mounted to a float or attached to the side of a tower basin. It should be located in an area of the basin where there is good circulation and cleaning accessibility. If attached to the side of the basin, the probe should be located so that the electrode is submerged when the water level is low.

OPTIONAL WATER METER

The water meter is needed only if the unit will operate in modes 1 or 3 (see **Table 1**). The LiquiCal will accept inputs from contacting-head water meters. Water meters can be positioned up to 500 feet from controller, using 18/16-gauge shielded cable. Follow manufacturer's installation instructions.

OPTIONAL LOW PRODUCT LEVEL FLOAT SWITCH

Install the optional low product level float switch in the chemical container.

INSTALL EQUIPMENT

Figure 3 shows a typical installation in a cooling tower system, assuming operation mode 3. Survey the cooling tower system to determine the most appropriate location for installation of the unit. The chemical container should be within 5 feet of the unit for proper pump operation. The area should be dry, well lit and accessible. Mount the unit in a vertical position using the mounting plate. The power cord and other connections will be at the bottom. If there is an integral pump, provide adequate room to install chemical-feed tubing.

The chemical pump injection point fitting should be installed either in the makeup line to the system or the recirculation line.

If the injection line is fed directly to the cooling tower sump, locate it as far as possible from the bleed output. If the unit is not equipped with a side-flow assembly, then alternately plumb the output of the pump to an injector check valve located downstream of the bleed valve.

Connect the chemical feed pickup tubes to the piston pump and chemical container as described in the installation kit. The maximum uptake distance is 10 feet.

OPERATION MODE

The unit can run in one of six operation modes, as described in **Table 1**. The main components, equipment options and spares are listed in **Maintenance**.

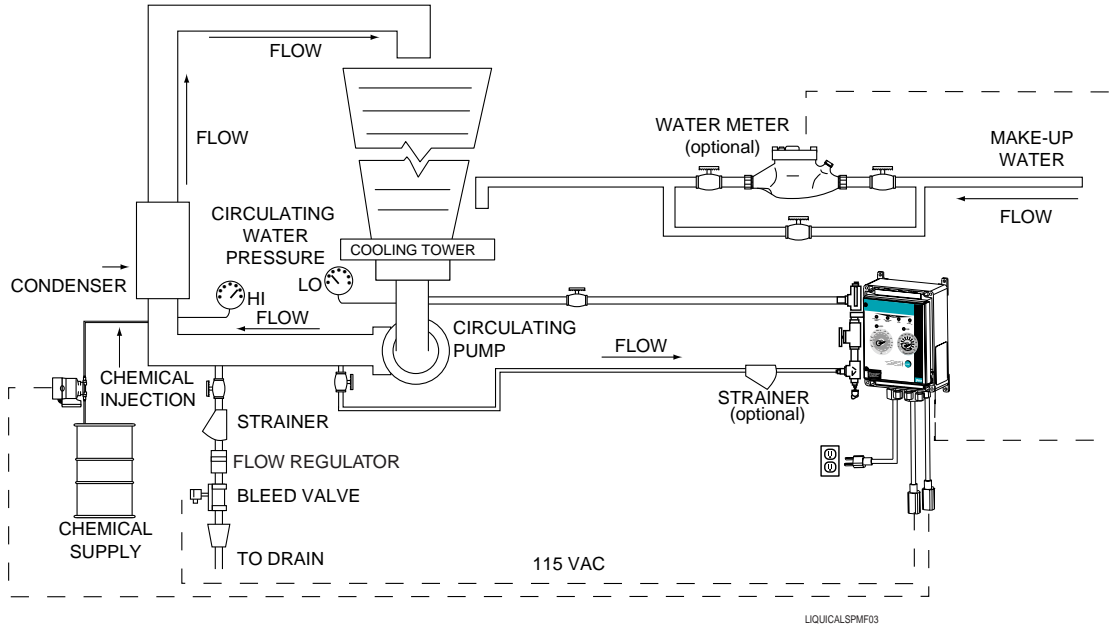


Figure 3. Cooling Tower Installation for Operation Mode 3

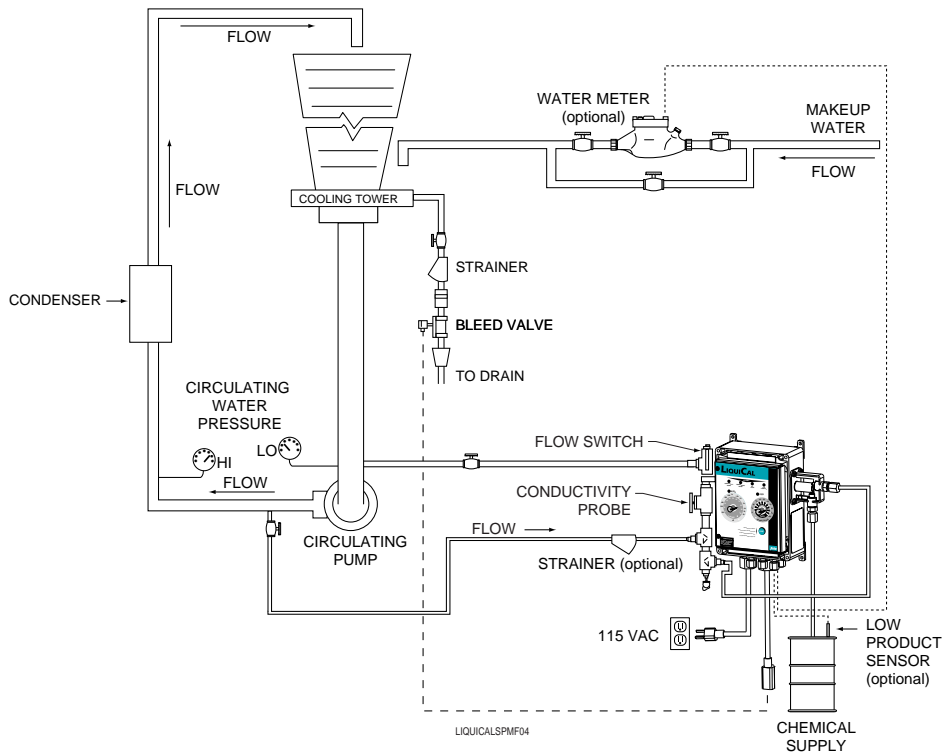


Figure 4. Cooling Tower Installation with Pumps

ELECTRICAL CONNECTIONS



Installation and service must only be done by qualified personnel and must comply with all applicable electrical codes. Dangerous voltages are wired into this unit and are present in the enclosure.

Input Power - 115 VAC

All units are delivered with a power cable for connection to a 115 VAC power source. We recommend an isolated 115 VAC outlet as the power source. This means that the outlet is energized only when the main circulating pump is on. This can be accomplished by using either auxiliary contacts on the main circulating pump motor starting relay or a relay connected across the pump motor windings. Select the relay coil to match the voltage rating of the pump motor. Such an isolated power source is desirable, but not critical. If the power cord is plugged into a 115 VAC receptacle, instruct operating personnel to unplug/plug in the unit as dictated by system usage. Failure to do this could result in wasteful, excessive use of both water and chemical.

Input Power - 208 or 230 VAC

1. If the power source to be used is 208 or 230 VAC, disconnect the 115 VAC power cable from the power terminal block and remove it from the unit.
2. Connect an appropriate power cable to the power terminal block as shown in **Figure 5**.

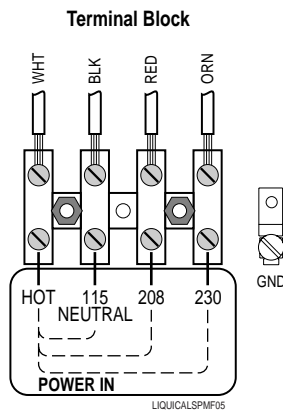


Figure 5. Power Terminal Block

The unit is factory set to supply 115 VAC to the customer-supplied bleed valve solenoid. If you change the input power to 208 or 230 volts, you must rewire the bleed valve and feed pump relays.

Bleed Valve/Feed Pump Voltage Same as Power Source

If the bleed-valve voltage is the same as the power source, move the black bleed-valve wire that is connected to the bleed-power contact (labeled COM) from its connection on the terminal block. Connect it to the 208 or 230 VAC location on the power terminal block. See **Figure 6**.

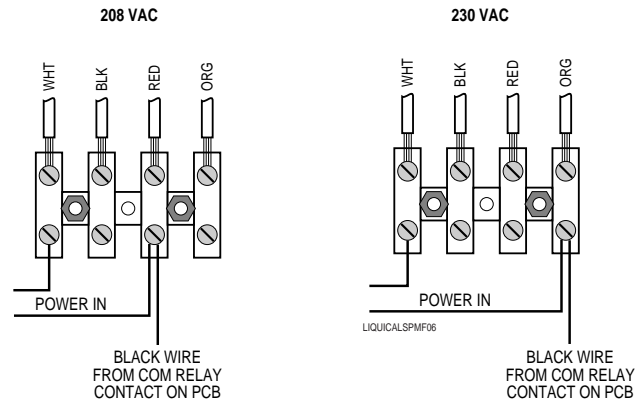


Figure 6. Reconnecting Power Source at Power Terminal Block

Bleed Valve Voltage Different From Power Source

If the bleed valve voltage is different from the power source voltage, make the following wiring changes:

1. Remove the black bleed-valve wire from both the power terminal block and the bleed-power contact (labeled COM) on the PCB.
2. Wire the bleed valve from an external power source of the desired voltage in the manner shown in **Figure 7**.

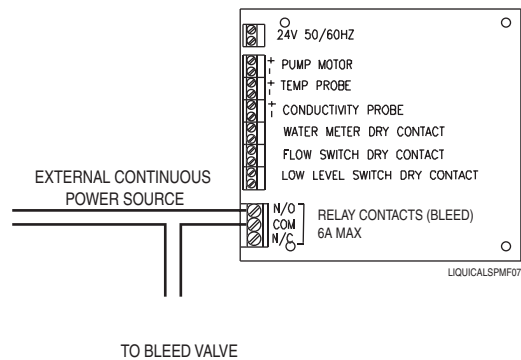


Figure 7. Wiring Bleed Valve from External Power Source



If you do not make the wiring changes when using different voltages for the power source and the bleed valve solenoid, the unit's transformer will overload and fail.

Conductivity Probe

If installed, make the connection at the contact on the PCB labeled CONDUCTIVITY PROBE. Refer to **Figure 7a** for connection color codes. Avoid long runs of sensor cable. Run the wiring into the unit at the bottom.

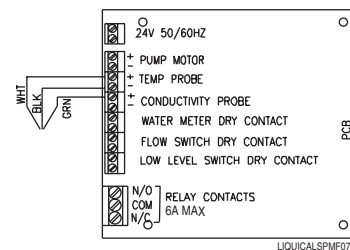


Figure 7a. Conductivity Probe Wiring



The remote conductivity probe must be no more than 100 feet from the unit.

Water Meter

If installed, make the connection at the contact on the PCB labeled WATER METER DRY CONTACT. Run the wiring into the unit at the bottom.

Low Product Level Float Switch

If installed, make the connection at the contact on the PCB labeled LOW LEVEL SWITCH DRY CONTACT. Run the wiring into the unit at the bottom.

SET OPERATION MODE

Using the controls on the unit front panel, as shown in **Figure 8**, set the operation mode and adjust the corresponding scales on the Bleed and Feed dials.

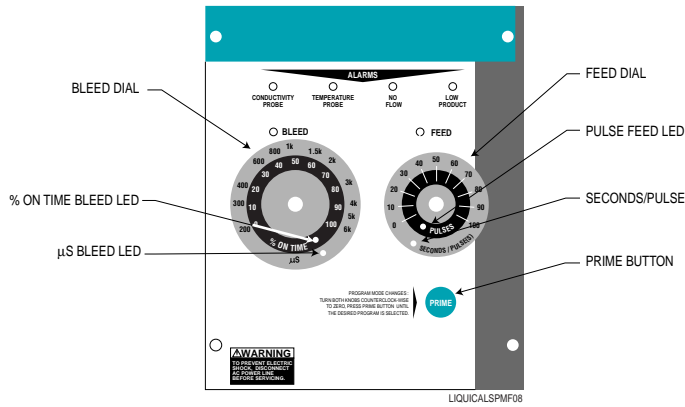


Figure 8. Front Panel Controls

1. Turn on power to the unit.



When you do step 2, do not force the door.

2. Hand-loosen the four knobs that hold down the clear plastic door of the unit. To open the door, first pull the hinged side away from the enclosure, then open the door like a book.
3. Turn the Bleed and Feed dials full left (counterclockwise) and then press and release the Prime button.
4. Repeatedly press the Prime button to cycle through the six available operating modes. When the lit LED on the two dials indicates the mode you wish to set, follow the steps to program as shown in **Table 1**.



The bleed and feed dials have concentric scales around the dial. Each scale has an associated LED which is lit when that scale is selected.

	Control Method Selection		External Equipment Requirements	Control Setpoint Programming
Mode Description (See notes 1-4 below)	Turn Feed and Bleed dials full counter-clockwise. Press Prime button to change mode.			
	Bleed Dial LED Status	Feed Dial LED Status		
Mode 1 Feed (0-100 seconds) based on water meter pulse accumulation. Bleed based on percentage (0-100%) of recycling 10-minute time period.	% ON time LED ON	Pulses LED ON Seconds/Pulse ON	Water Meter	Step 1: Set Feed dial to number of pulses to accumulate before activating feed (1-100 pulses). Step 2: Set Bleed dial to percentage (0-100%) that bleed output activates during the recycling 10-minute period. Step 3: Set Feed dial to desired duration (0-100 seconds) for the pump to operate after the desired number of accumulated pulses is reached.
Mode 2 Feed (0-100 seconds) based on 10-minute cycle accumulation. Bleed based on percentage (0-100%) of a recycling 10-minute time period.	% on time LED ON	Pulses LED ON Fast Flash Seconds/Pulse ON Fast Flash	None	Step 1: Set Feed dial to number of 10-minute cycles to accumulate before activating feed (1-100 cycles). Step 2: Set Bleed dial to percentage (0-100%) that bleed output activates during the recycling 10 minute period. Step 3: Set Feed dial to desired duration (0-100 seconds) for the pump to operate after the desired number of accumulated cycles is reached.
Mode 3 Feed (0-100 seconds) based on water meter pulse accumulation. Bleed occurs when conductivity exceeds microSiemen setpoint.	MicroSiemen LED ON	Pulses LED ON Seconds/Pulse ON	Water Meter and Conductivity Probe	Step 1: Set Feed dial to number of pulses to accumulate before activating feed (1-100 pulses). Step 2: Set Bleed dial to microSiemen value (200-6000) above which bleed output activates. Step 3: Set Feed dial to desired duration (0-100 seconds) for the pump to operate after the desired number of accumulated pulses is reached.
Mode 4 Feed (0-100 seconds) based on a 10-minute cycle accumulation. Bleed occurs when conductivity exceeds microSiemen setpoint.	MicroSiemen LED ON	Pulses LED ON Fast Flash Seconds/Pulse ON Fast Flash	Conductivity Probe	Step 1: Set Feed dial to number of 10-minute cycles to accumulate before activating feed (1-100 pulses). Step 2: Set Bleed dial to microSiemen value (200-6000) above which bleed output energizes. Step 3: Set Feed dial to desired duration (0-100 seconds) for the pump to operate after desired number of accumulated cycles is reached.
Mode 5 Feed runs at same time as bleed (0-100 minutes) then locks out. Bleed occurs when conductivity exceeds microSiemen setpoint	MicroSiemen LED ON	Pulses LED OFF Seconds/Pulse OFF	Conductivity Probe	Step 1: Set Feed dial activation period (0-100 minutes) after which the feed output is locked-out. The feed lockout will be reset when the bleed cycle finishes. Step 2: Set Bleed dial to microSiemen value (200-6000) above which bleed output energizes.
Mode 6 Feed runs as a percentage (0-100%) of Bleed ON time based on a 10-second recycling time period. Bleed based on percentage (0-100%) of a recycling 10-minute time period.	% ON time LED ON	Pulses LED OFF Seconds/Pulse OFF	None	Step 1: Set Feed dial to percentage (0-100%) that feed will activate during the 10 second recycling time period. Step 2: Set Bleed dial to percentage (0-100%) that bleed will activate during the recycling 10 minute period.
1. When Mode 1, 2, 3, or 4 is selected, both feed scale LEDs are lit (steady or flashing). In this mode, the user can set the number of accumulated pulses by following these steps: The feed light above the dial turns on when at the previously-entered setpoint 1) Turn the feed dial to desired setpoint value (0-100 seconds) 2) Turn the bleed dial off zero to exit the programming mode. This setup stores the pulse accumulator setpoint into non-volatile memory.				
2. Bleed Setpoint (% time LED ON) Bleed dial sets % of a 10-minute recycle period that the bleed output is energized. Example: Setting of 25% energizes the bleed output 2.5 minutes every 10 minutes.				
3. Bleed Setpoint (MicroSiemens LED ON) Rotate bleed dial to desired setting. Bleed output is energized when actual microSiemens exceed the setpoint.				
4. Pump Runtime (Modes 1,2,3,4) Turn the Feed dial to desired duration (0-100 seconds) for the pump to operate after accumulated pulses (1-100) or cycles (1-100) is reached.				

Table 1. Set Operation Mode

OPERATION

Once the operation mode is set, the unit functions continuously as long as power is on. If power should be interrupted, the unit returns to the operation mode last selected as soon as power is restored. No operator action is necessary unless you wish to change the mode of operation, replace worn components or deal with an alarm condition. **Table 2** lists the LEDs that light during normal operation. Alarm LEDs are described under **Troubleshooting**.

Normal Operation LEDs (Green)	
Bleed	On when any mode bleed is occurring normally
Feed	On when any mode feed is occurring normally

LIIQUICAL/SPMT04

Table 2. Normal LEDs

MAINTENANCE & TROUBLESHOOTING

MAINTENANCE



Installation and service must only be done by qualified personnel and must comply with all applicable electrical codes. Dangerous voltages are wired into this unit and are present in the enclosure.

Replace PCB

1. Remove power to the unit.



In step 2, do not force the door.

2. Open unit enclosure as you would for programming.
3. Remove the two black knobs and save them for future use.
4. Remove the four screws holding the front cover assembly. Gently lower the front cover until the wire harness supports it.
5. Remove all wires from the PCB terminals.
6. Remove the four screws holding the PCB cover.
7. Remove the PCB cover and PCB.
8. Compare the new PCB with the old one to ensure that the new PCB has an extension shaft on the prime switch.
9. Align new PCB and PCB cover over standoffs.
10. Install the four screws removed in step 6 through PCB cover and new PCB.
11. Reconnect all wires to PCB terminals. Be sure the connections are the same as the initial installation. Refer to the wiring diagram in the **Appendix**.
12. Lift front cover assembly up into place and install the four screws removed in step 4, and the two black knobs removed in step 3.
13. Perform calibration procedure (see **Calibration Procedure**).

14. Close unit enclosure.

Replace Motor/Gearbox Assembly

1. Using the Prime button, ensure that the piston is at the end of its stroke (rightmost position) inside the pump housing.
2. Remove power to the unit.
3. Disconnect chemical suction and discharge lines from pump housing.



In step 4, do not force the door.

4. Open unit enclosure. To do so, hand-loosen the four knobs that hold down the clear plastic door. To open the door, first pull the hinged side away from the enclosure, then open the door like a book.
5. Remove the four screws holding the front cover assembly. Gently lower the front cover until the wire harness supports it.
6. Disconnect red and black motor wires from PCB.
7. Remove the two screws securing the bottom of the pump housing. This will also allow you to remove the piston support bracket from inside the enclosure.
8. Remove the two screws securing the top of the pump housing. Remove pump housing and neoprene washer. Inspect, and if necessary, clean piston pump housing as described under **Inspect/Clean Piston Pump**.
9. You can now remove the piston by slipping the link arm off of the crank arm, or removing the wrist pin separating the link arm and piston. Refer to **Figure 9**.
10. Remove crank from motor shaft.
11. Lift out the bracket and motor/gearbox assembly.
12. Remove the four screws securing the gearbox to the bracket.
13. Remove plastic motor cover and O-ring from motor.
14. Reinstall new motor/gearbox in reverse order. Refer to the wiring diagram in the **Appendix**.

Inspect/Clean Piston Pump

The unit's piston pump should be visually inspected periodically during operation for evidence of malfunction. If any malfunction exists, refer to **Troubleshooting**. If the pump is to be out of operation for a period of time, as in seasonal duty, the pump should be cleaned to remove all chemicals. This will extend the life of the check valves and the seals. Clean the pump and parts with detergent; do not use solvents.

Replace Pump O-Ring

1. Using the Prime button, ensure that the piston is at the end of its stroke (rightmost position) inside the pump housing.
2. Remove power to the unit.
3. Disconnect chemical suction and discharge lines from pump housing.



In step 4, do not force the door.

4. Open unit enclosure. To do so, hand-loosen the four knobs that hold down the clear plastic door. To open the door, first pull the hinged side away from the enclosure, then open the door like a book.
5. Remove the four screws holding the front cover assembly. Gently lower the front cover until the wire harness supports it.
6. Remove the two screws securing the bottom of the pump housing. This will also allow you to remove the piston support bracket from inside the enclosure.
7. Remove the two screws securing the top of the pump housing. Remove pump housing and neoprene washer. Inspect and clean piston pump housing as described under **Inspect/Clean Piston Pump**.
8. You can now remove the piston by slipping the link arm off of the crank arm, or removing the wrist pin separating the link arm and piston. Refer to **Figure 9**.
9. Remove the O-rings from piston.



If using a tool to remove O-rings, be careful not to scratch, gouge or damage any of the piston surfaces. If they are damaged, the pump will not prime.

10. Apply Dow Corning 111 silicon grease to new O-rings.
11. Install new O-rings on piston.
12. Reinstall piston in reverse order from step 8.

Clean or Replace Duck Bill Valves

To clean or replace the duck bill valves in the piston pump assembly, refer to **Figure 7** and use the following procedure.

1. Remove power to the unit.
2. Remove chemical suction and discharge line from pump housing.
3. Remove **discharge** fitting.
4. Remove small white insert and save for future use.
5. Remove duck bill valve for cleaning and inspection.



Slit in duck bill valve should be free of dirt or any object that would prevent it from closing. If slit is still open after cleaning, discard and install new duck bill valve.

6. Reassemble discharge-side duck bill valve, insert and fitting and install in pump housing. Tighten by hand.
7. Repeat steps 3-6 for the suction-side duck bill valve.



*Orientation of the duck bill valve and insert on the suction and discharge sides is different. Be sure to reassemble as illustrated in **Figure 9**.*

8. Connect chemical suction and discharge lines to the pump housing.

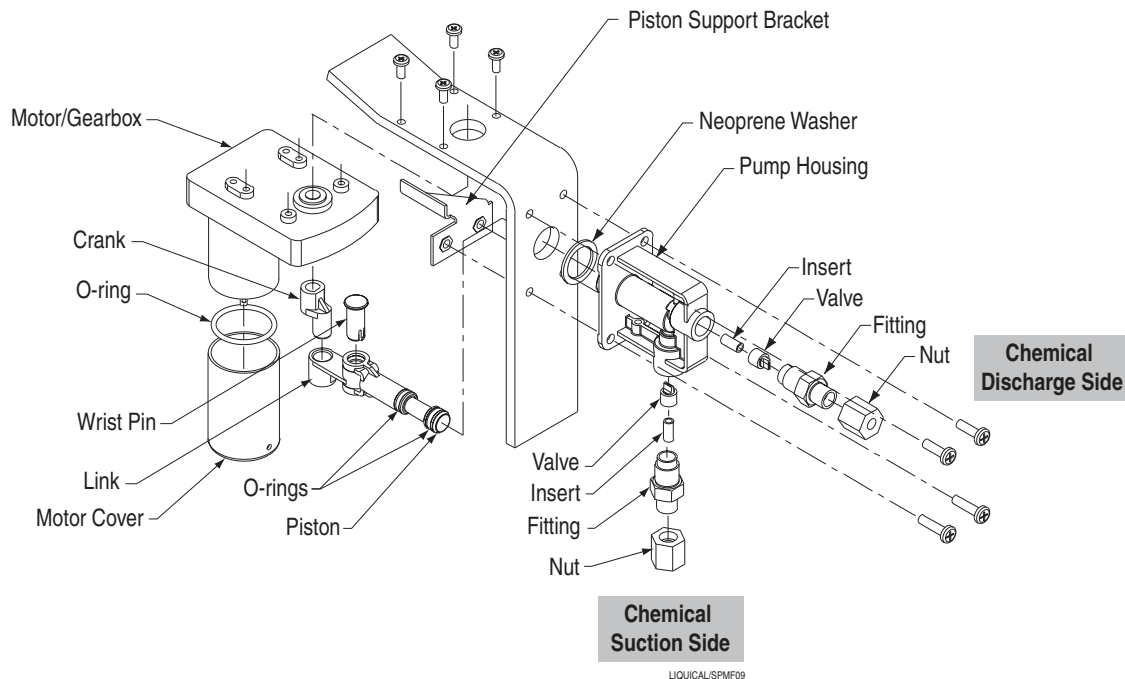


Figure 9. Piston Pump Assembly

Clean Unit Cover

When cleaning the outer plastic cover, do not use solvents or harsh detergents. This may cause clouding. Use a small amount of gentle detergent on a damp cloth, then dry with a clean cloth.

Calibration Procedure



The unit is calibrated at the factory. New units need not be calibrated in the field. However, if you replace the PCB in the future, the unit should be recalibrated.

This procedure calibrates the bleed and feed dials with the scales.

1. Remove power to the unit.
2. Place a jumper at the position labeled TEMP PROBE and the position labeled CONDUCTIVITY INPUT on the unit's PCB.

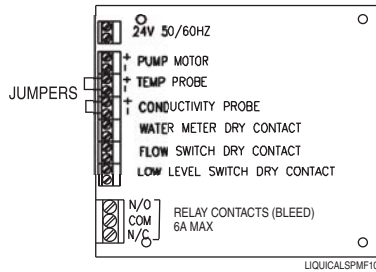


Figure 10. Jumpers

3. Restore power to the unit.
4. Turn the Bleed dial full left (counterclockwise). The scale LEDs **on that dial** will go off.
5. Remove knob from the bleed shaft and turn shaft to the right (clockwise) until the dial's LEDs are on.
6. Slowly turn shaft left (counterclockwise) until the dial's LEDs turn off.
7. Being careful not to move the shaft, push the knob back onto the shaft with the pointer pointing to the

zero (0) in the % **on time** scale. This calibrates the dial to zero.

8. Do steps 2-5 for the Feed dial.
9. After both dials are calibrated to zero, turn them right (clockwise) until they point to their maximum scale settings. All scale LEDs will be on.
10. Press the Prime button to save the calibration values.
11. Remove power to the unit.
12. Remove the jumpers you installed in step 1.

TROUBLESHOOTING

Alarm LED is On

If one of the alarm LEDs is lit (red), the pump output is disabled. Bleed is also disabled during conductivity probe, temperature probe and no-flow alarms. After you clear the alarm, as described in **Table 3**, the pump automatically restarts.

If no LED is lit and the unit is not functioning normally, check and correct the following:

- Is 115/208/230 VAC input power present across the correct terminals?
- Is 24 VAC present across the secondary of the transformer?
- Are all electrical connectors firmly connected to the correct terminals
- If the above are OK, and the LEDs are not lit, replace the printed circuit board.

Alarm LEDs (Red)		To Clear the Alarm
Feed	On if continuous bleed occurs for a period of four hours or longer. For modes when feed occurs continuously during bleed (modes 3, 4, or 5), this alarm helps prevent overfeeding of chemical.	Generally, no action is necessary. When the bleed finishes, the alarm is cleared and the pump output re-energizes. To manually clear the alarm, turn the Bleed dial to a higher setting momentarily to stop the bleed. Then turn the Bleed dial back to the original setpoint.
Conductivity Probe Alarm	In mS bleed mode, on if the conductivity probe is disconnected, or is not properly submerged, or is out of accuracy range.	Be sure the conductivity probe is properly connected and is submerged.
Temperature Probe Alarm	In mS bleed mode, on if temperature is higher than 150° F or if temperature probe is not connected.	Check the conditions of the cooling system to evaluate why the water temperature is so high. Also, be sure the temperature probe is properly connected.
No Flow Alarm	On when an external flow problem occurs in any operation mode. No-flow detection feature is optional and is part of the probe assembly.	Make sure the cooling system-recirculating pump is on. This should reestablish flow. Ensure flow rate through flow assembly is minimum of 1.5 GPM
Low Product Alarm	On if low-product level is sensed in any operation mode.	Change the chemical container.

Table 3. Alarm LED

Pump Problems

Table 4 lists possible pump problem symptoms, their possible causes, and the recommended remedies.

Symptom	Possible Cause	Remedy
Pump does not prime	Suction line blocked	1. Open suction line 2. Check foot valve
	Discharge line blocked	1. Open discharge line 2. Inspect check valve
	Suction-check duck bill valve open	Clean or replace duck bill valve
	Discharge-check duck bill valve open	Clean or replace duck bill valve
	No chemical supply	Add chemical
Chemical leaking from drain port in pump housing	Pump O-ring failure on piston	Replace pump O-rings

LIQUICAL/SPMT03

Table 4. Pump Troubleshooting

ORDERING INFORMATION

The following list provides a quick reference source for ordering. Please use the item number when you order.

Major Components

Item N°	Description
097711	LiquiCal 120/240 VAC with Flow Assembly
097710	LiquiCal 120/240 VAC without Flow Assembly
098572	LiquiCal SP, 120/240 VAC without Flow Assembly or Pigtailed
098573	LiquiCal SP, 120/240 VAC without Flow Assembly, with Pigtailed
098570	LiquiCal SP, 120/240 VAC with Flow Assembly, without Pigtailed
098571	LiquiCal SP, 120/240 VAC with Flow Assembly and Pigtailed

Spare Parts

099508	PCB, LiquiCal
098031	Relay PCB, LiquiCal
092236	1 Amp Fuse
092240	6 Amp Fuse
092238	3 Amp Fuse
013322	Replacement Probe, pin-type
016167	Replacement Flow Switch
094685	Pump O-Ring, .299 by 0.103 AFL
094270	Motor/Gearbox Assembly
027090	Duck Bill Valve
094888	Duck Bill Valve Fitting
025715	¼ inch Piston Pump Tube Fitting Nut

Accessories

014829	Low Product Level Float Switch
099368	Flow Assembly, CPVC 80
099373	Assy Kit, CPVC Flow Assembly with Stainless Steel Mounting Plate
030283	Bleed Valve, 3/4"
035195	Drop-in Probe
058285	Flow Regulator 10 GPM*
097271	Water Meter, 3/4 in, 20 gpm, 1 pulse every 10 gallons*
097272	Water Meter, 1 in, 50 gpm, 1 pulse every 10 gallons*

*Contact factory for additional water meter and flow regulator sizes and ratings.

TECHNICAL ASSISTANCE

If you require technical assistance or additional product technical information, contact Technical Support at (800) 468-4893.

RETURNS

No equipment may be returned without a Return Authorization, which can be obtained by contacting Beta Customer Service. Equipment returned under warranty will be received freight-prepaid by customer and returned freight prepaid by Beta. Freight charges for out-of-warranty repairs will be the responsibility of the customer both to and from Beta. Returns for credit must be authorized within 30 days after invoice date and shall be subject to a 20% restocking charge plus prepaid freight.

WARRANTY

Beta Technology, Inc. (Beta) warrants each new item of unit equipment manufactured by Beta to be free from defects in materials and workmanship under normal use and operation in accordance with Beta's instructions and use directions for a

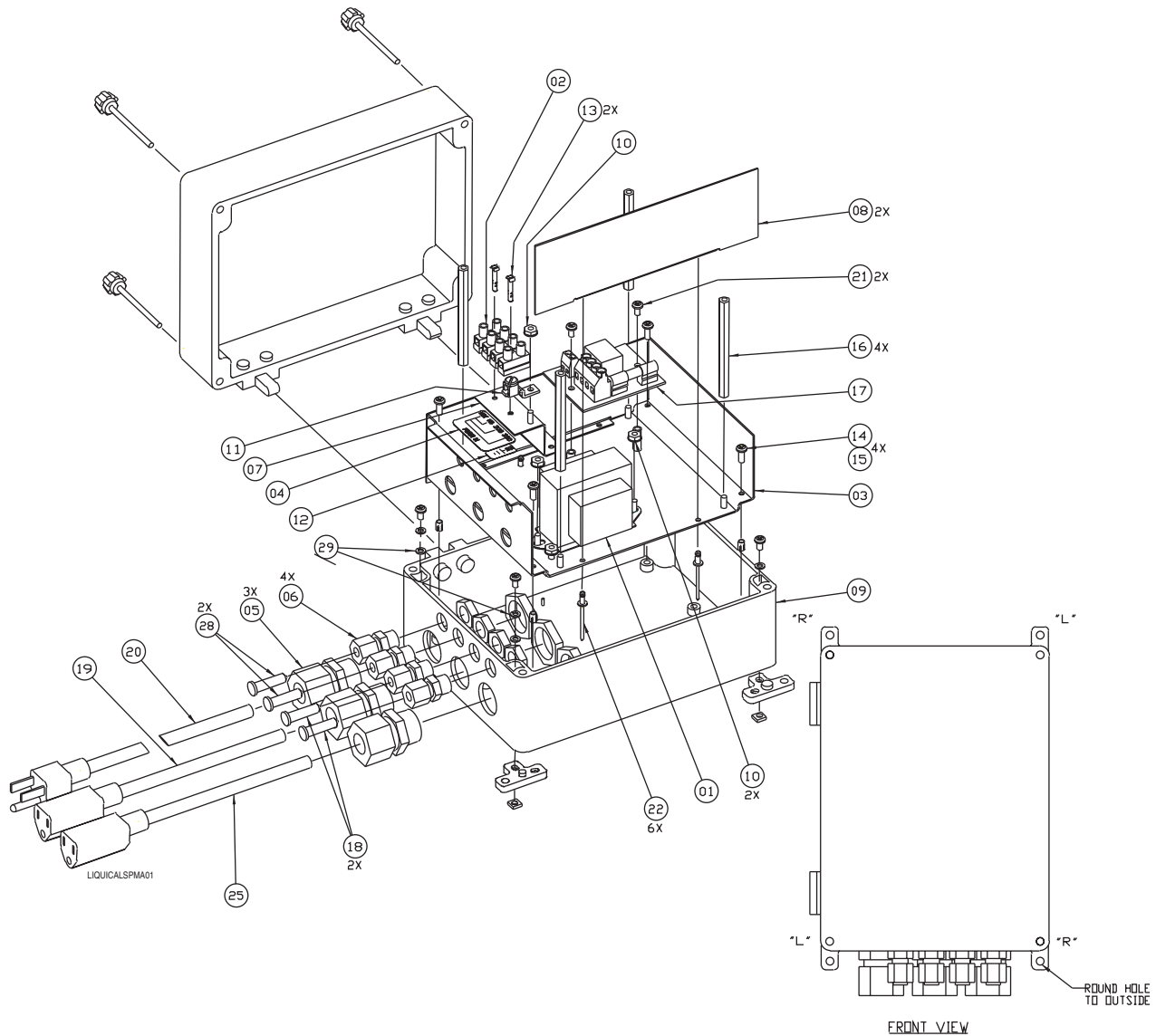
period of twenty-four (24) months from the date of delivery to the original purchaser. Exception: pH probes are only guaranteed to be operational at the time of delivery. All probe claims must be submitted in writing within 30 days from the date of shipment from Beta.

Beta's obligation under this warranty is limited to the repair or replacement of any such item of equipment (or part thereof) shown to be defective or, at Beta's option, to refunding the purchase price of any such defective item of equipment less a reasonable allowance for prior use. Replacement parts furnished by Beta shall be warranted as stated above for the unexpired portion of the original equipment's twenty-four (24) month warranty. This does not extend to any item or part subjected to misuse, accident, improper installation, maintenance or application, improper packing by purchaser in return shipment to Beta, or any item or part repaired or altered outside of Beta's factory without expressed prior authorization of Beta.

"Goods Sold as Purchased" item warranty will be passed on as furnished by the vendor.

The foregoing warranty is in lieu of any other warranty, expressed or implied, in fact or in law, including without limitation the warranty of merchantability or the warranty of fitness for a particular purpose. It is expressly understood that purchaser's sole and exclusive remedy is limited to enforcement of Beta's obligation as set forth above. Beta shall not be liable to purchaser or others for loss of use of the equipment or for other direct, special, indirect, incidental or consequential damages.

APPENDIX

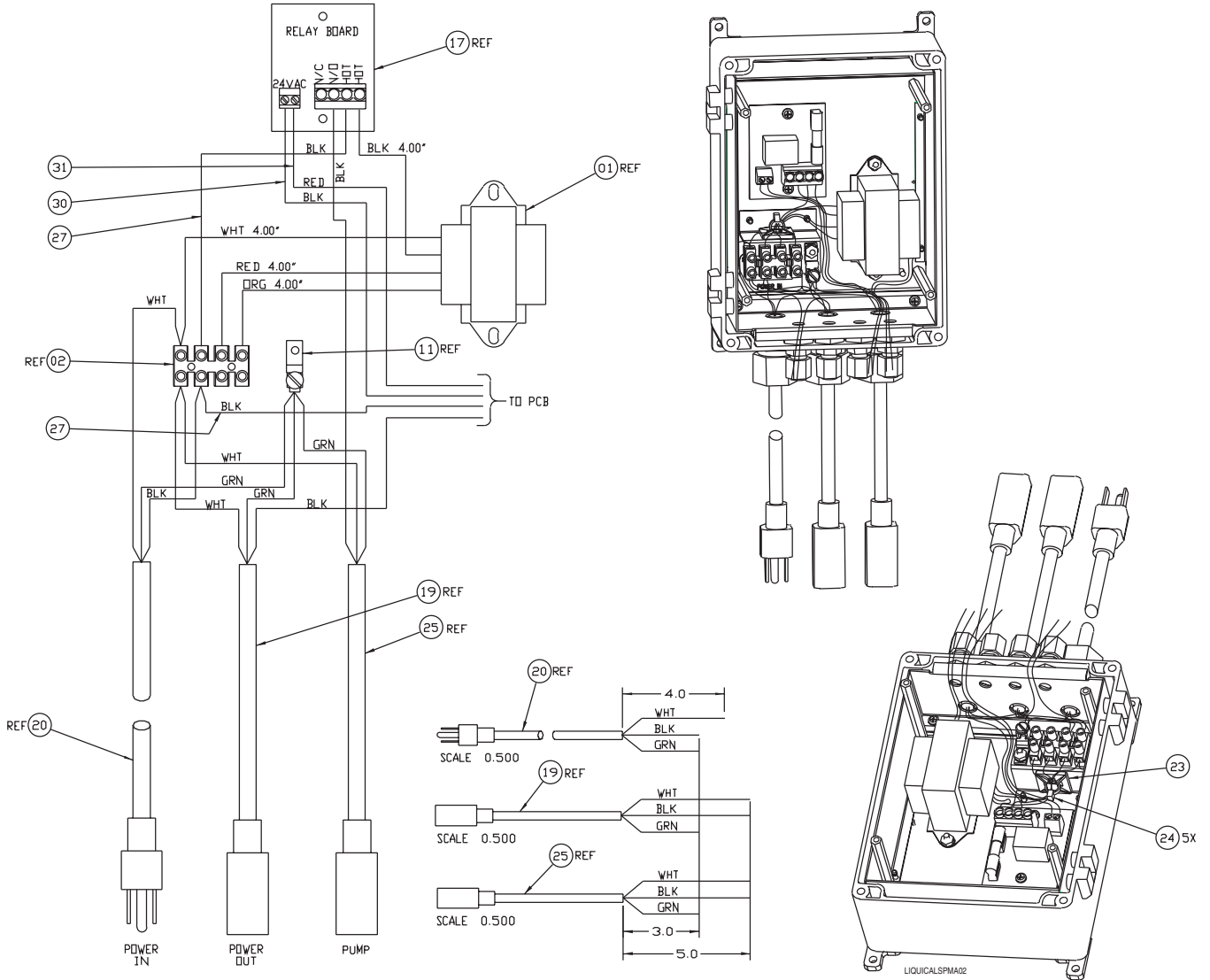


Seq#	Item#	Description
01	094786	XFMR, PWR, 120/208/240V, 24V
02	051124	TERM, BLK, 10MM, SCR, 4X2
03	098366	BRKT, BASE, SST, LIQCAL, W/O PMP
04	055708	LBL, TB, 4 P, 115-230V, HOT/NEUT
05	090369	STRN RLF, SLNG, 0.230-0.546, NYL
06	032121	STRN RLF, SLNG, 0.114-0.250, NYL
07	094334	BRKT, TERM BLK, LIQCL
08	098367	BRKT, SIDE FRAME,SST, LIQCL, W/O PMP
09	098369	ENCL, MOD, 8X6X4, LIQCL, W/O PMP
10	041088	NUT, KEP, 6-32
11	041711	TERM BLK, 1X1, PNL, GND LUG, #8
12	039409	LBL, GROUND SCREW
13	051369	PIN, FIX, TERM BAR, PLSTC
14	094780	SCR, PH PNH, M3X6MM, ZP STL
15	042028	ADH, THREADLOCKER, LOCTITE 242

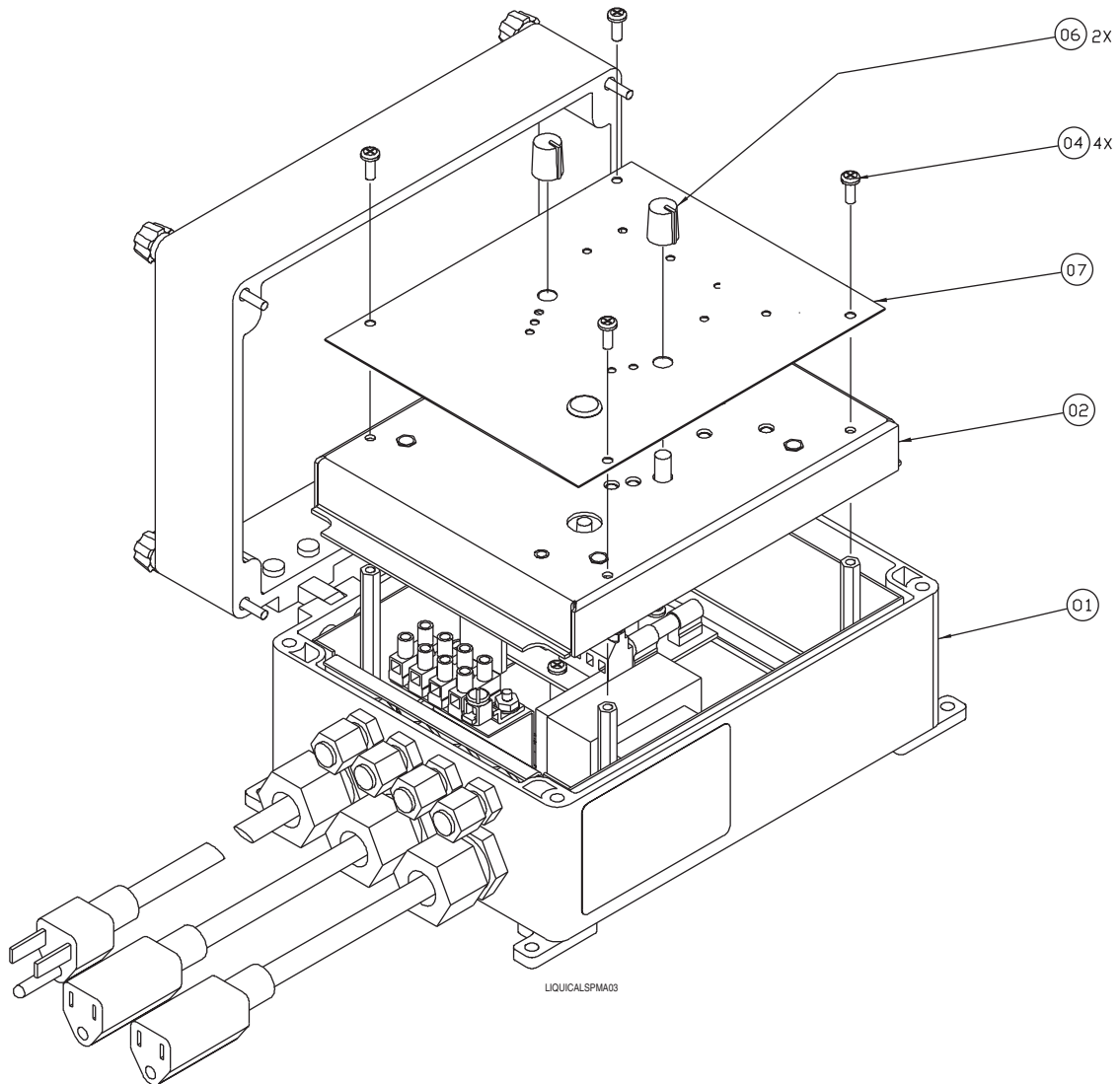
Seq#	Item#	Description
16	097719	STDF, F-F, 1/4HEX, 6-32X3, ALU
17	098031	PCB ASSY, 24V, RELAY
18	096808	PLUG, FTG, INJR, NYL12
19	090203	PWR CD, BLK, 16GA, 12", NEMA 5-15R
20	014045	CORD ASSY 3CND, 16 GA, 84L, SJOW
21	025329	SCR, PH PNH, 6-32X1/4, SST
22	025373	RVT, POP, 1/8 X 1/8, DOME, ALUM
23	041323	TIWRP, AHR, ADH, RB, 3/4", NYL, NAT
24	017467	TIWRP, 0.10X4L, NYL, NAT
25	090203	PWR CD, BLK, 16GA, 12", NEMA 5-15R
27	041404	WIRE, 1, 18GA, 5, BLK
29	041123	WSHR, LK, SPT, #8
30	027231	WIRE, BLK, 18GA, TR-64, PRBND
31	041343	WIRE, RED, 18GA, TR-64, PRBND

APPENDIX

ELECTRICAL DIAGRAM (SEE PREVIOUS PAGE TO REFERENCE SEQUENCE NUMBERS)

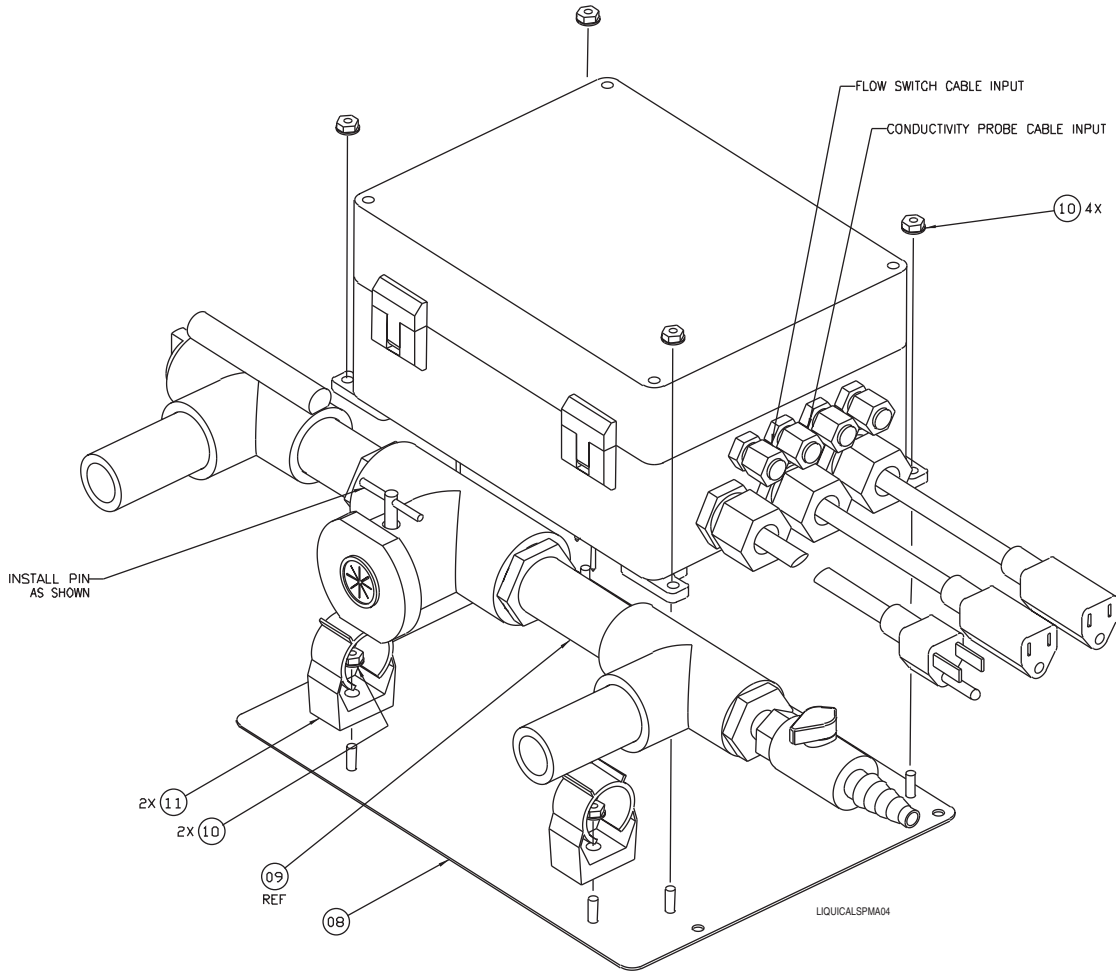


APPENDIX



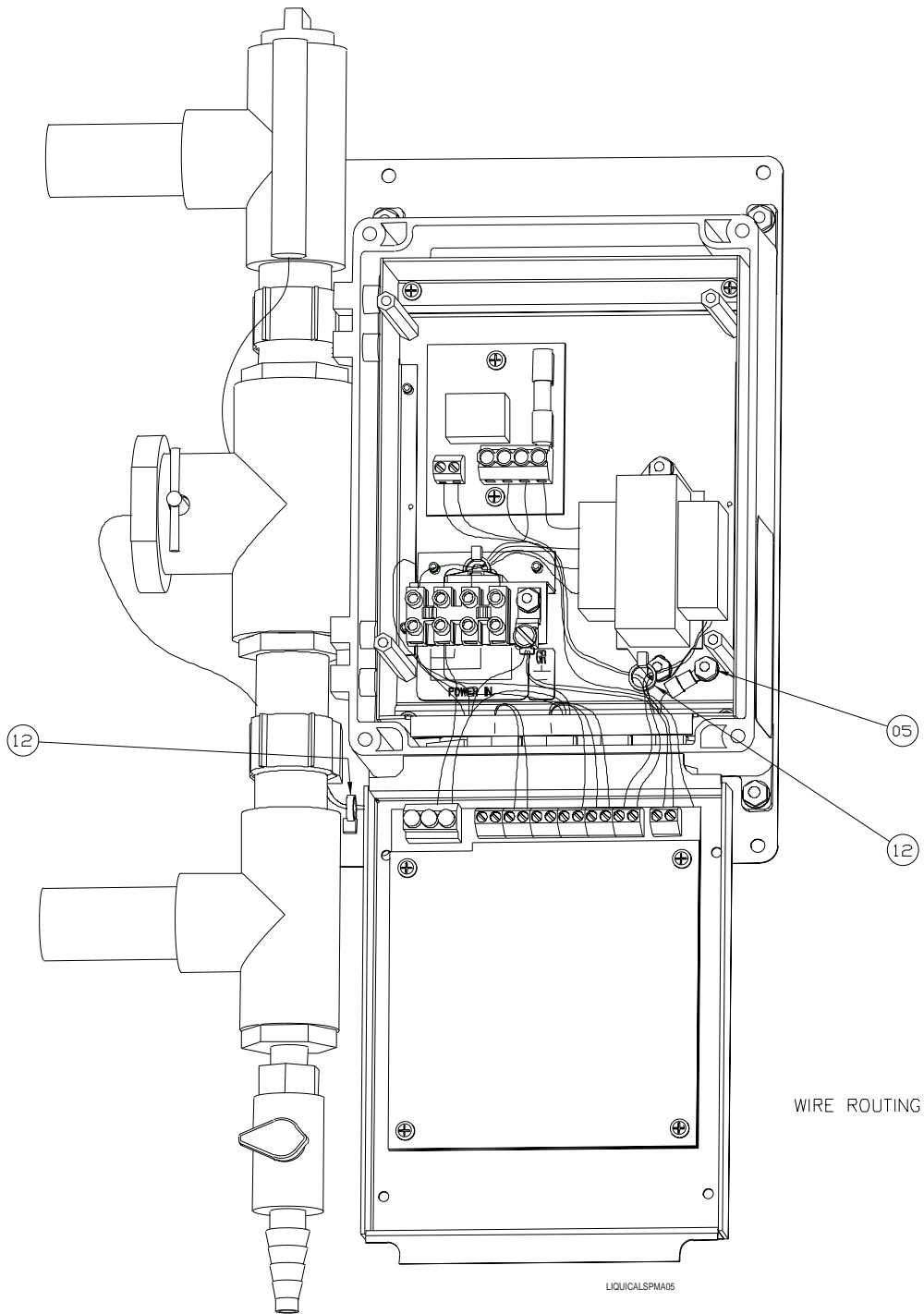
Seq#	Item#	Description
01	098575	MBA, BASE, LIQCL SP, 120/240VAC
02	099556	MBA, CVR, LIQCL SP
04	025329	SCR, PH, PNH, 6-32X1/4, SST
06	094238	KNOB, POINTER, 11MM, RUB, PUSH-ON
07	098907	LBL, SS, LIQUICAL SP, BETA

APPENDIX

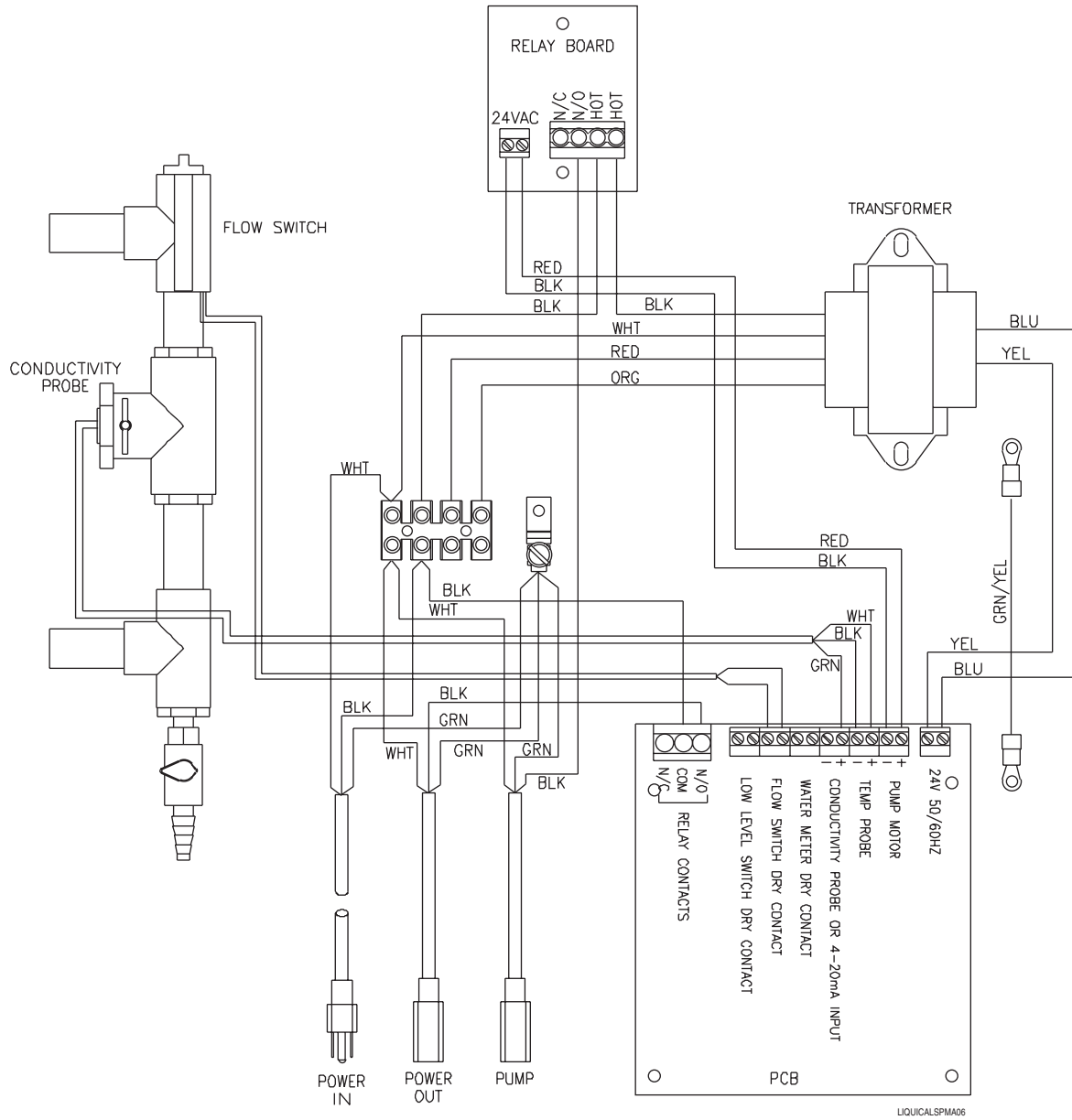


Seq#	Item#	Description
08	094471	BRKT, MTG, FLO ASSY, LIQCL
09	099368	FLO S/A, COND-PET-FLO
10	041089	NUT, KEP, 8-32
11	028480	CLP, CNDT, CLIC TYPE, 3/4, NYL

APPENDIX

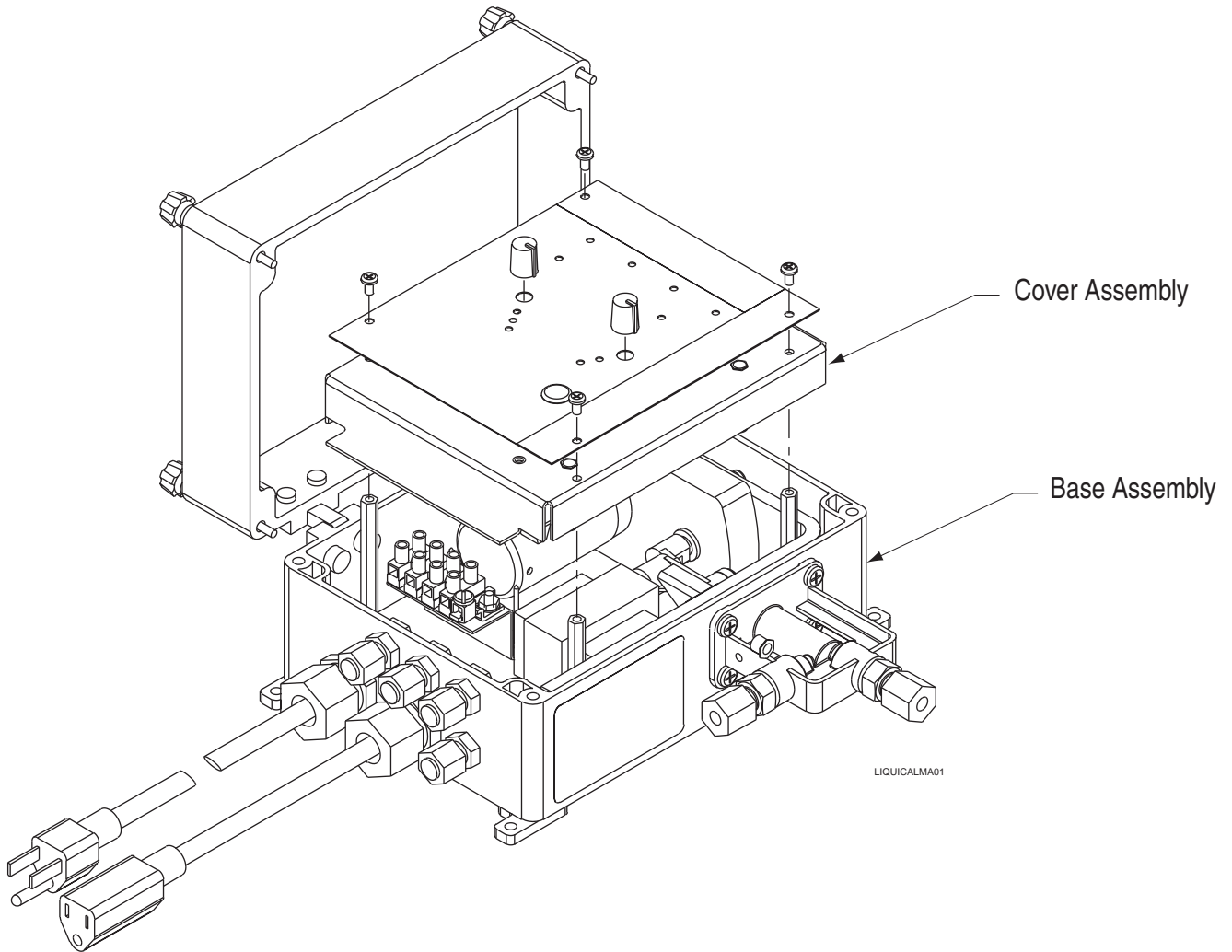


APPENDIX

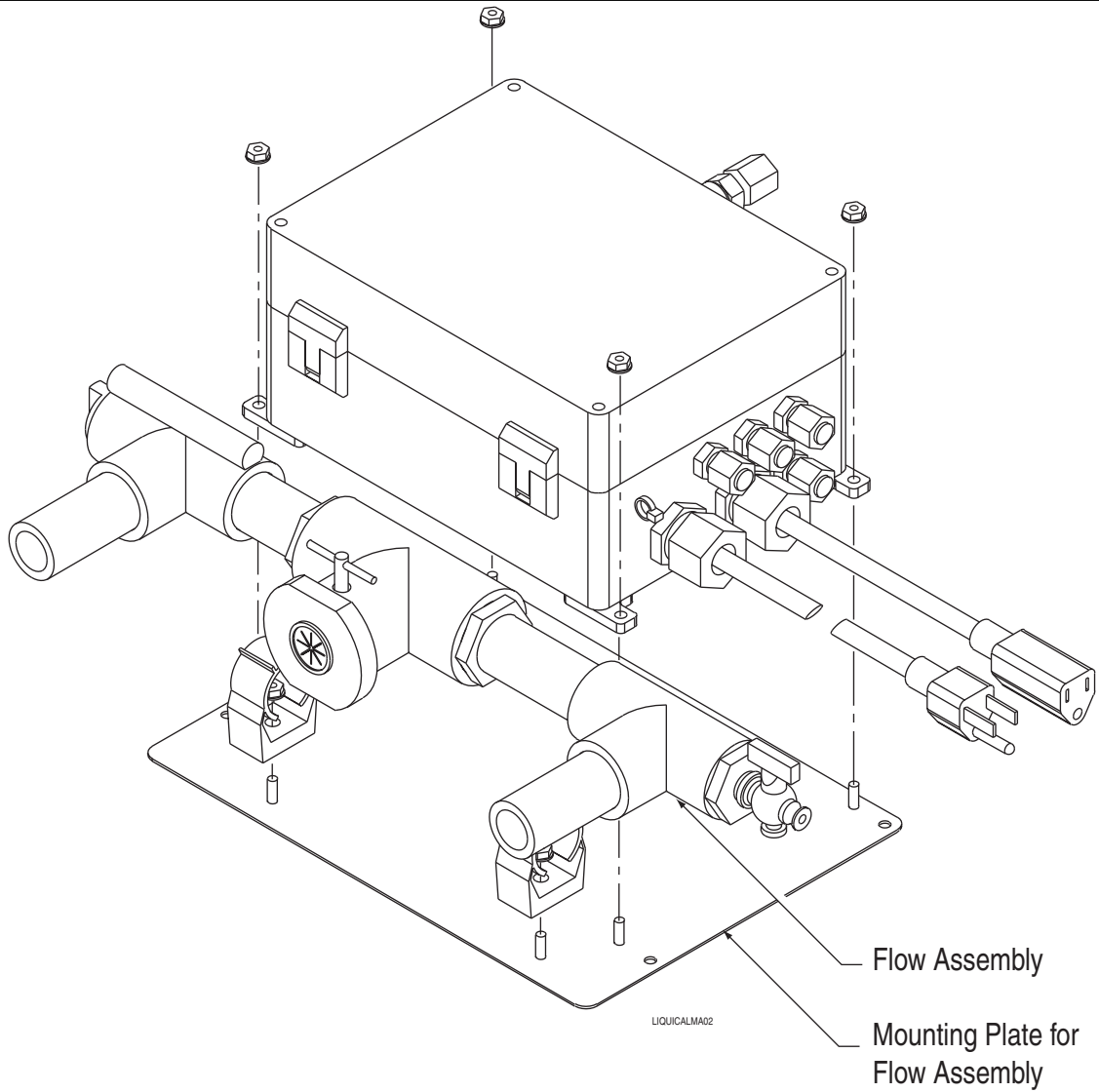


WIRING DIAGRAM

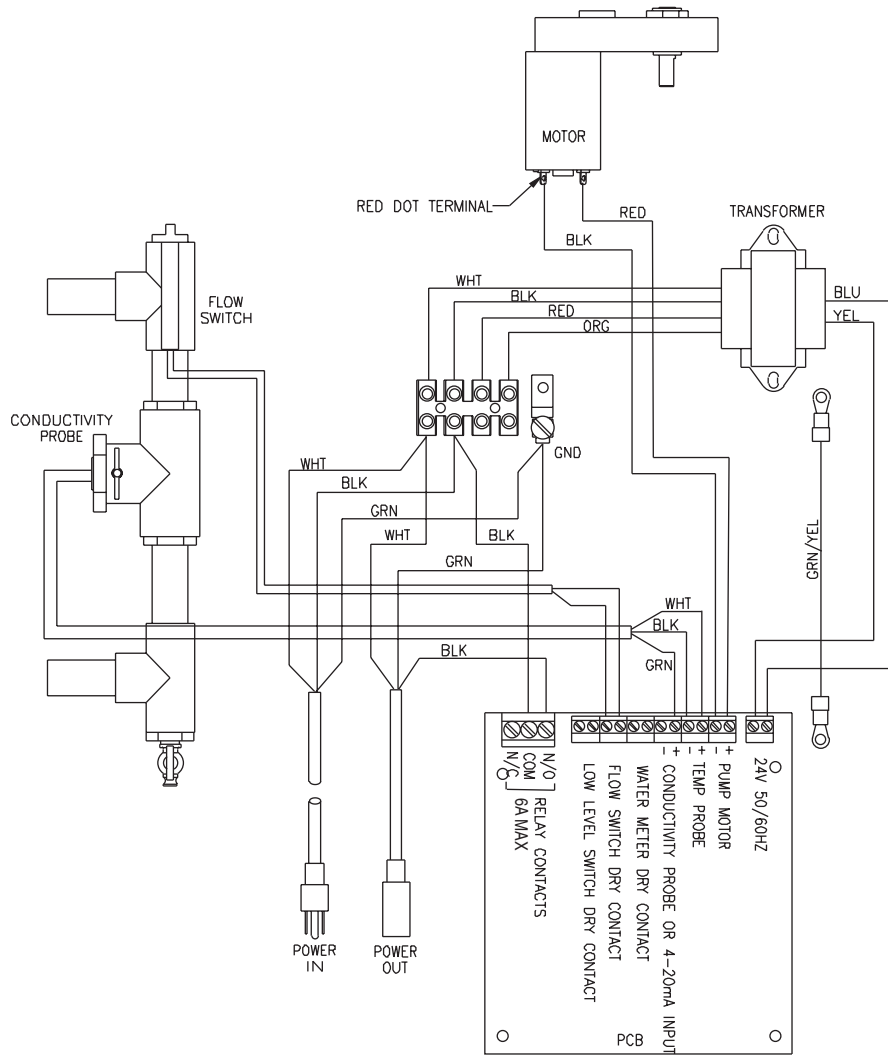
APPENDIX



APPENDIX



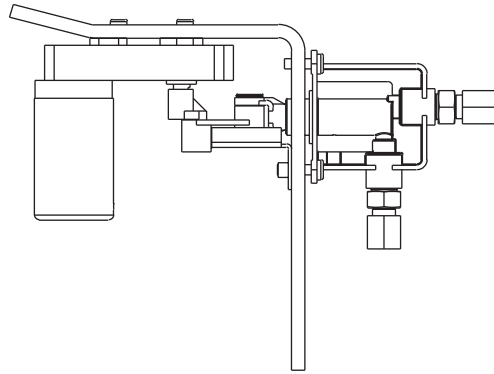
APPENDIX



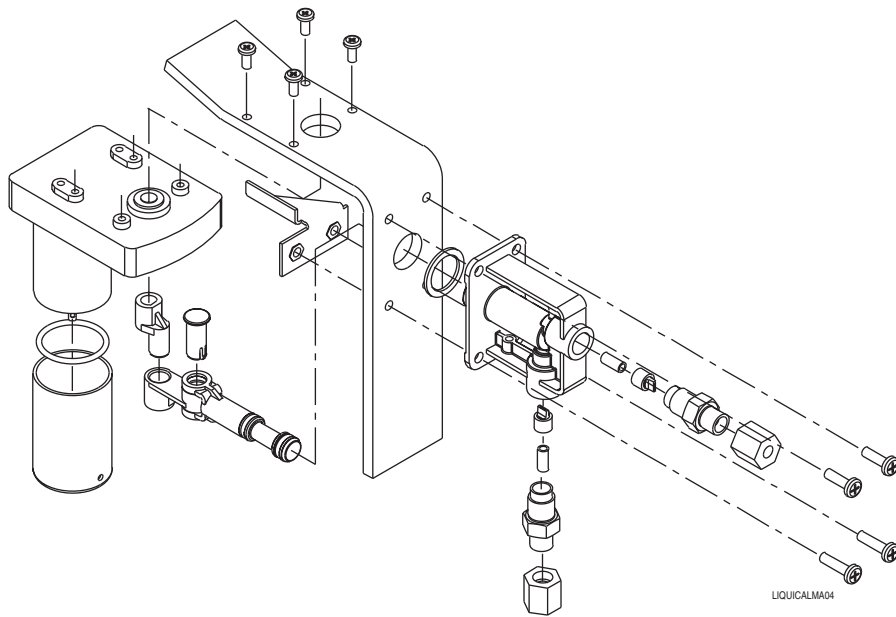
Wiring Diagram (115 VAC)

LIQUICALM03

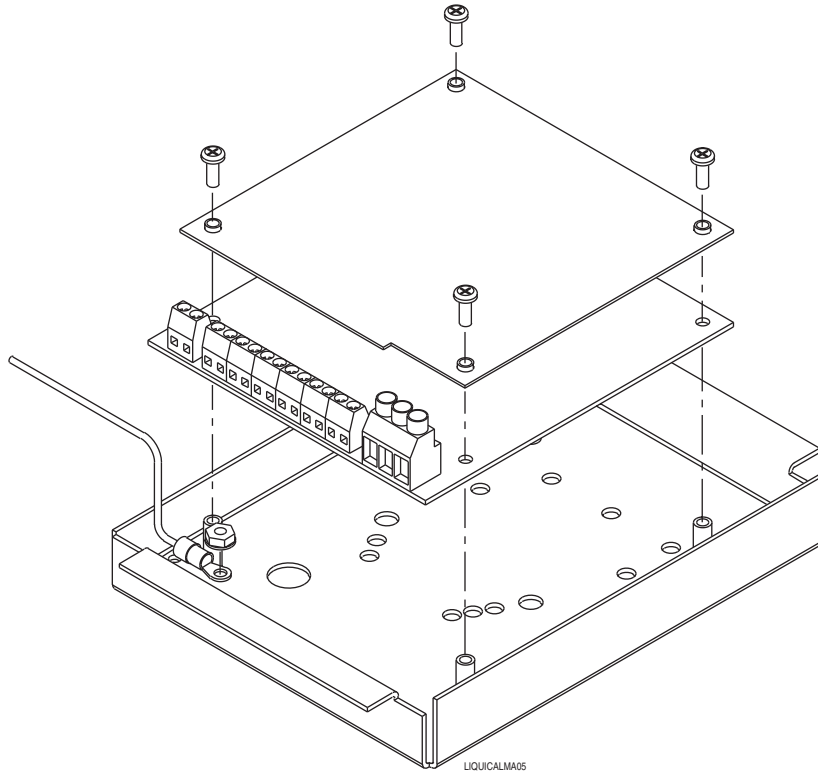
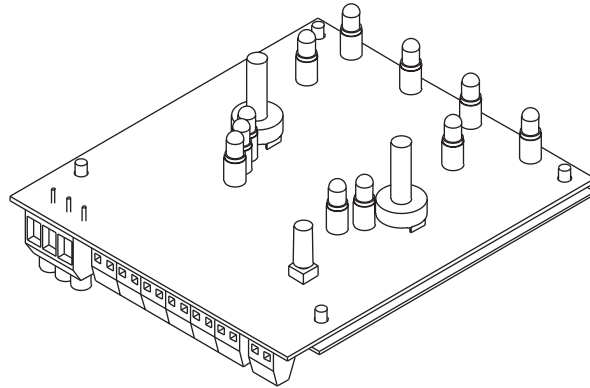
APPENDIX



Piston Pump Assembly

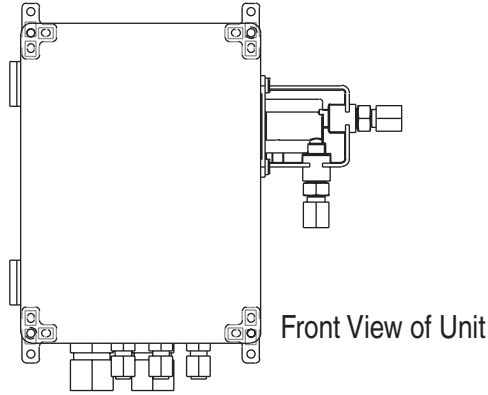


APPENDIX

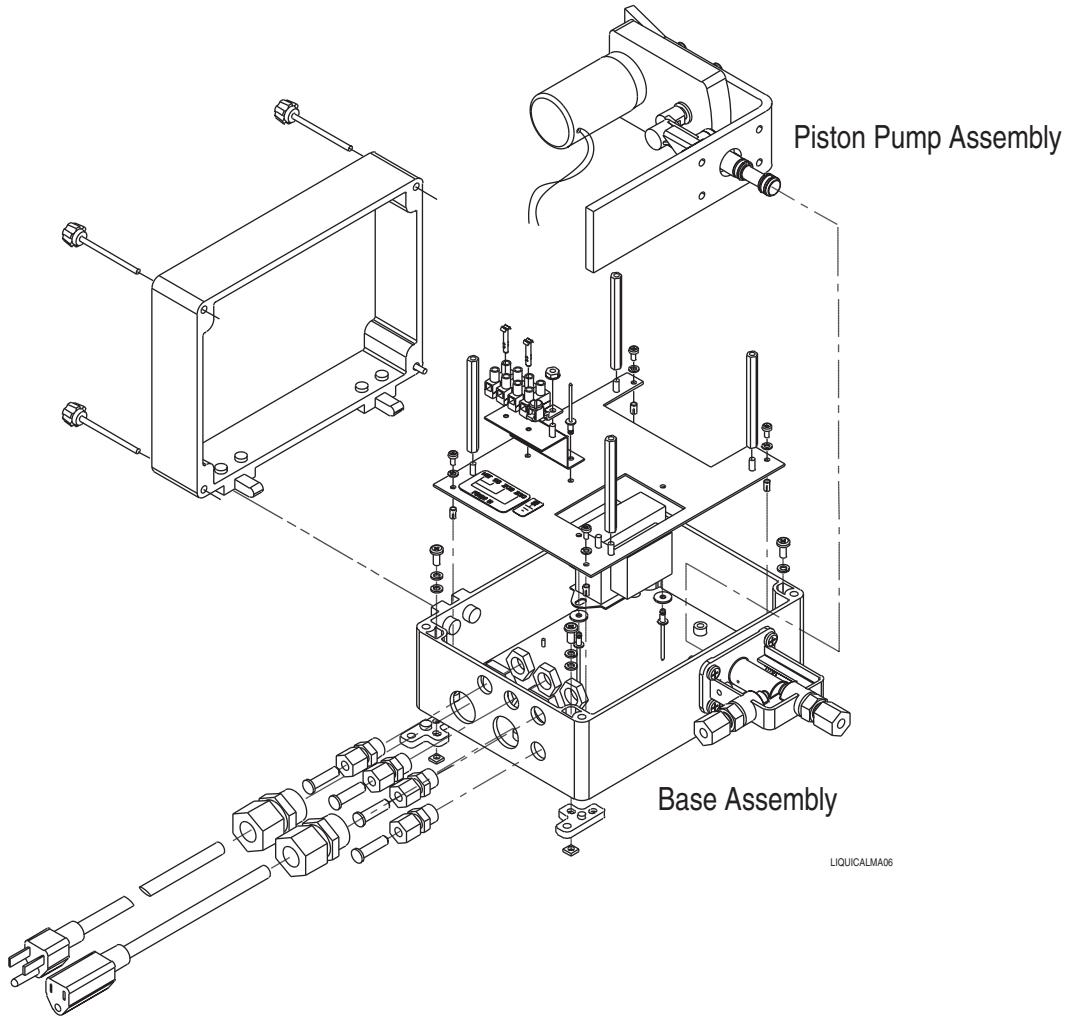


Cover Assembly

APPENDIX



Front View of Unit



Piston Pump Assembly

Base Assembly

LIQUICALMA06



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