VICI

Valco Instruments Co. Inc.

# 2 Position
# Electric Actuator
# Instruction Manual

MAN-2EA
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# 1. GENERAL DESCRIPTION

Valco 2 position valves are widely used in a variety of sample injection and switching applications. Rotating them to the desired position can be done manually, but is best done automatically with either the Valco 2 Position Air Actuator or the Valco 2 Position Electric Actuator described in this manual. For most laboratory uses, especially where a laboratory computer is available for control but compressed air is not, the Valco 2 Position Electric Actuator is the best choice.

Valco 2 Position Electric Actuators are available in 110VAC or 220VAC models for any 30°, 36°, 45°, 60°, or 90° Valco valve. The model numbers of the actuators are respectively E30, E36, E45, E60, and E90. (Or E30-220, etc.) An electric actuator can be retrofitted to existing air actuated or manual valves and is compatible with all Valco close coupling and standoff assembly hardware.

The 2 position electric actuator is a complete system, with all the necessary cables and power cord. It consists of (a) the actuator itself, (b) a control box with LED display, and (c) an interface cable for remote switching. The actuators are normally supplied with a motor/gear train that moves the valve from Position A to Position B in 0.56 seconds. All electric actuator models use separate line voltages (120V AC or 220V AC, 50/60 Hz) and require no power from the chromatograph with which they are used.

# 2. MANUAL USE OF THE 2 POSITION VALVE ACTUATOR

The electric actuator has a control box with a two-position, spring-loaded (normally off) toggle switch and two LED's which indicate the valve position. The valve can be moved from one position to the other by manually moving the toggle switch toward the light that is not illuminated.

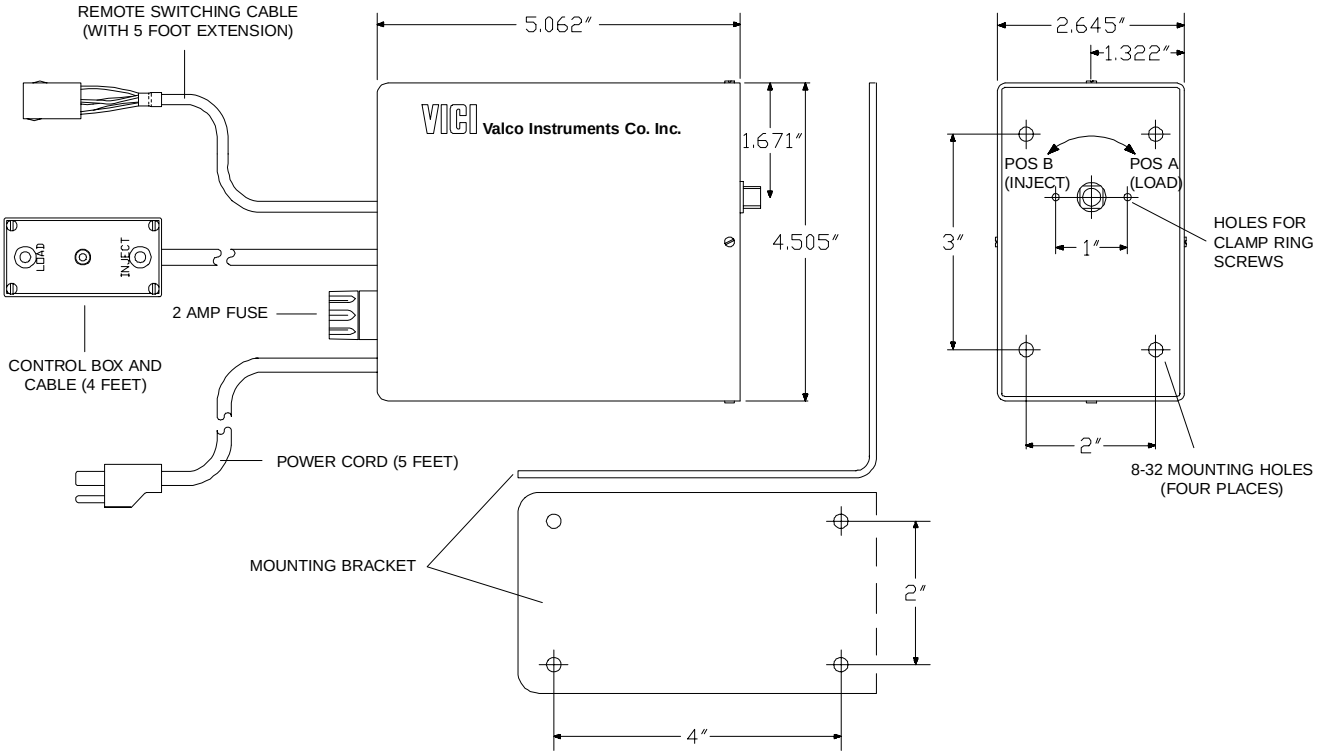



**Figure 1:** Actuator dimensions

# 3. CONTROLLING THE ACTUATOR WITH A COMPUTER

The remote switching cable is used to communicate a momentary or continuous contact closure or a negative true logic level signal from a data system, required for automated operation of the actuator. In addition, two of the cable's leads supply feedback from the actuator. Since the input signal must be of 10 to 20 milliseconds duration to switch the actuator, a sub-millisecond noise spike will not start the actuator.

## 3.1 Using a Relay Output

If the data system has two relays available, then one relay can be dedicated to each position of the actuator. This is ideal, since it allows the manual switch to function normally. Connect the black wire (INJECT) to the normally open (NO) terminal of the first relay and the the green wire (GROUND) to its common or logic ground terminal. Connect the red wire (LOAD) to the normally open (NO) terminal of the second relay, and connect a jumper wire from the common or logic ground of the first relay to that of the second. (**Figure 2**)

Program the data system to energize the first relay when the valve is to be switched to the INJECT position, leaving it energized for only two or three seconds. Likewise, at the time for LOAD, turn on the second relay for a few seconds. The INJECT relay must be turned off before the LOAD relay is turned on, and vice versa. If the valve will not move out of a position, it is most likely that the relay which switched it to that position has not been turned off. When neither relay is energized, the manual toggle switch can be used as described on the previous page.

If the data system has only a single double-pole relay with normally open (NO) and normally closed (NC) terminals (**Figure 3**), connect the green wire (GROUND) to the relay common or logic ground. Connect the black (INJECT) wire to the normally open (NO) relay terminal and the red (LOAD) wire to the normally closed (NC) terminal. The computer must be programmed to keep the Normally Open (NO) relay contact engaged (ON) as long as the actuator is to be in the INJECT position.

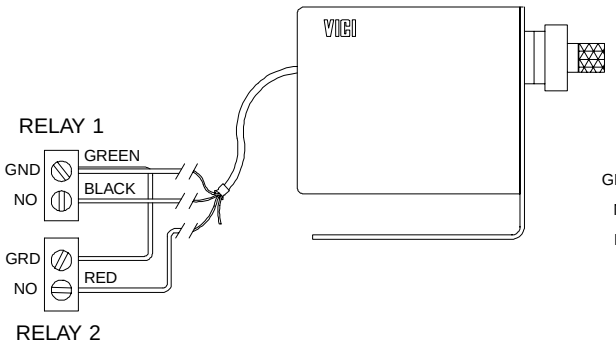



**Figure 2:** Dual relay connection

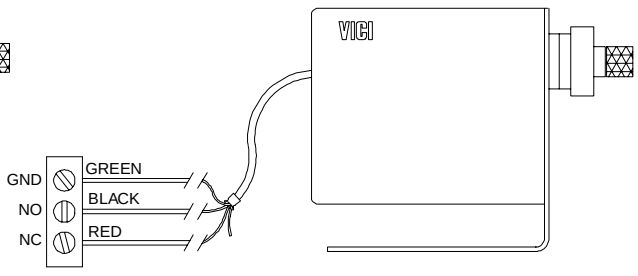



**Figure 3:** Single relay connection

## 3.2 Using a Logic Level Output

If the data system uses negative true logic level output, connect the green wire (GROUND) to the Logic Ground of the data system relay. Connect the red wire (LOAD) to one output of the relay and the black wire (INJECT) to the other output. Turning the relay off will switch the actuator to LOAD and turning it on will switch it to INJECT. If the operations are reversed, simply switch the connection of the red and black wires.

## 3.3 Using the Output from the Actuator

The white and clear wires can perform either of two functions, depending on the setting of the dipswitch on the circuit board. The factory setting is for the Inject Contact Closure mode.

### 3.31 Inject Contact Closure

In this mode, which is the factory default, the white and clear wires provide a contact closure when the actuator moves to the INJECT position. (The closure is approximately two seconds long.) It may also be used to "spike" a recorder or to start any device equipped with a remote contact closure input.

### 3.32 Positive Position Feedback

To change the setting on the dipswitch, follow Steps 1-4 in Section 6.21, **Actuator Conversion, Disassembly**. The dipswitch is on the board next to the connections for the manual switching cable. (See Drawing 21312, page 23.) In this mode, the clear wire carries a logic high when the actuator is in the Position A (LOAD): the white wire carries a high when the actuator in is Position B (INJECT).

# 4. INSTALLING A VALVE ON AN ACTUATOR

## 4.1 Preparing a Manual Valco Valve for Mounting on an Actuator

A manually switched 2 position valve has a handle or knob which must be removed before the valve can be installed on the actuator. Sections 4.11 - 4.14 describe the procedures for various Valco valves.

### 4.11 Disassembly of a Manual W or UW Type Valve

1. Rotate the knob counterclockwise so the valve is positioned properly for later installation on the electric actuator.
2. See **Figure 4**. Loosen the set-screw within the W valve knob and pull the knob off of the manual drive shaft.
3. Using a 9/64 hex driver, unscrew the two HWSC-SC8-16/socket head screws (8-32 x 1") until the valve comes loose from the rest of the assembly. Keep the driver with the valve.
4. The rest of the assembly will slide easily apart, but you may wish to keep it together for future use.
5. Proceed to Section 4.2 for closemount assembly, or Section 4.3 if the valve will go on a standoff before being installed on the actuator.

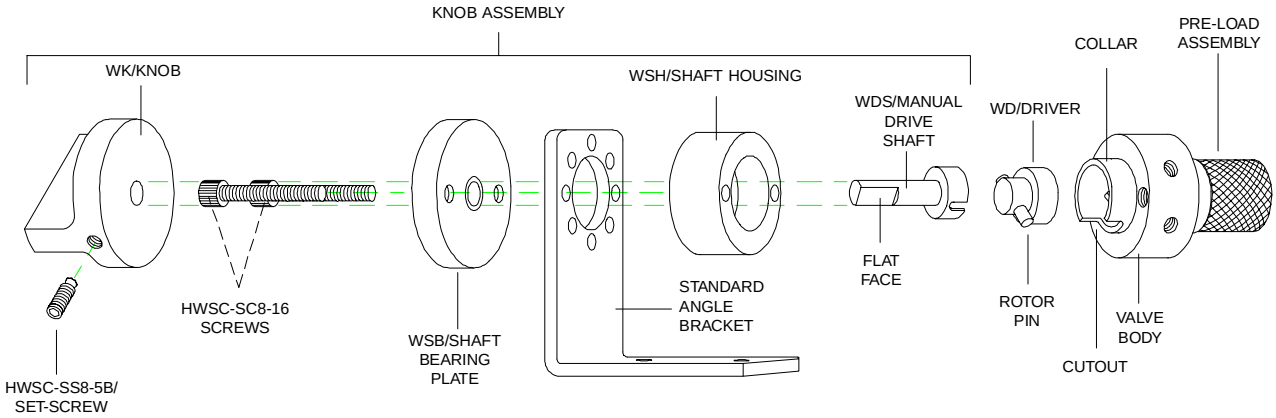



**Figure 4:** W or UW type valve with knob assembly

### 4.12 Removing the Handle or Knob from a Valve on a Standoff

1. Rotate the knob counterclockwise so the valve is positioned properly for later installation on the electric actuator.
2. See **Figure 5**. Simply pull the handle or knob, with the manual handle adapter and retainer, off of the standoff tube.
3. Proceed to Section 4.3.

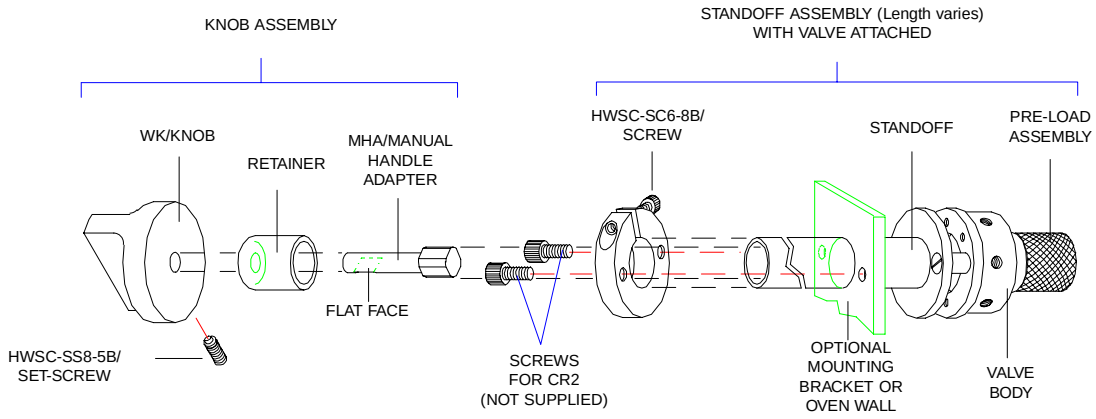



**Figure 5:** Manual valve on a standoff

### 4.13 Removing the Handle from a P Type Valve

These types of valves have a 1-1/8" metal rotor shaft that connects to the handle.

1. Rotate the knob counterclockwise so the valve is positioned properly for later installation on the electric actuator.
2. See **Figure 6**. Remove the black handle by sliding its shaft out of the coupling.
3. Place the coupling in a bench vise with the side with only one hole facing up. Use a hammer and punch to remove the roll pin which connects the coupling to the valve rotor shaft. Pull the coupling off of the shaft.

**CAUTION: Do not hold the valve body in the vise when removing the coupling. Valve damage will result.**

4. Proceed to Section 4.2 for closemount assembly, or Section 4.3 if the valve will go on a standoff before being installed on the actuator.

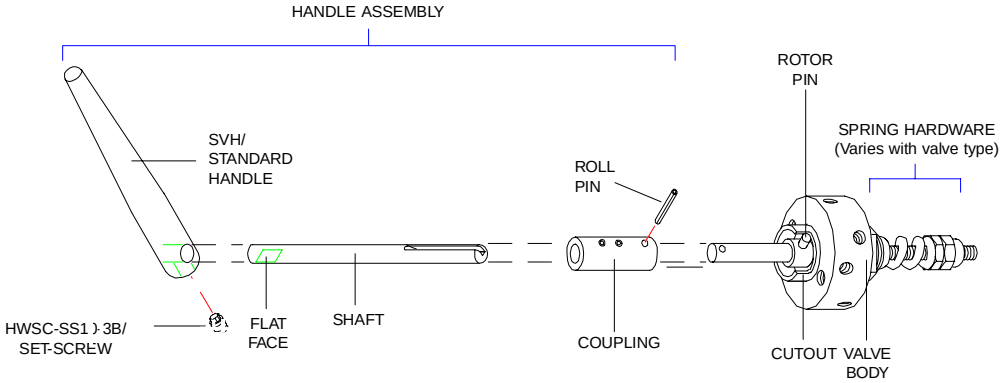



**Figure 6:** P Type valve with an SVH handle

### 4.14 Removing the Handle from a U Type Valve

In addition to removing the handle, it is necessary to cut the 3" shaft of the manual U Type valve to approximately 1".

1. Rotate the knob counterclockwise so the valve is positioned properly for later installation on the electric actuator.
2. See **Figure 7**. Remove the handle by using a 1/8 hex driver to unscrew the *two* set screws within the handle.
3. Take all the fittings out of the valve. Cover all the ports with masking tape so that no debris can enter the ports.
4. Clamp the end of the shaft, *not the valve body*, in a bench vise. Carefully cut the valve shaft to a length of 1" or less with a hack saw. Be sure not to let the valve fall and become damaged.

**CAUTION: Do not hold the valve body in the vise when cutting the shaft. Valve damage will result.**

5. Proceed to Section 4.3.

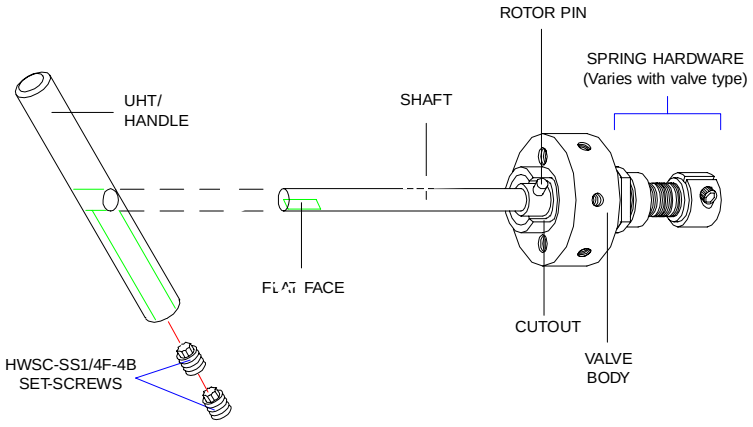



**Figure 7:** U Type valve with UTH handle

## 4.2 Installation of a Valve With Closemount Hardware

If the electric actuator has been specified for use with closemount hardware, it will be received from the factory with the CR4/clamp ring already affixed to the actuator. The clamp ring is attached to the actuator with a two HWSC-SC8-6TDH/modified socket head screws (8-32 x 3/8").

**CAUTION: Do not use screws longer than 1/2" to attach clamp rings to electric actuators. They will interfere with internal moving parts and damage the actuator.**

1. Plug in the electric actuator and put it into the LOAD position (indicated by a red light in the LOAD position) on the control box. The valve will have been rotated to the counterclockwise position before the knob or the handle was removed, so they should now be in the same relative rotational position.

**CAUTION: The valve and the actuator must be in corresponding rotational positions before assembly. If they are not, the valve or actuator may be damaged when operated.**

2. Place the slotted coupling over the driver (**Figure 8**) or the valve shaft (**Figure 6 and 7**) and engage the rotor pin.
3. The actuator is shipped with the CR41/closemount standoff mounted in the CR4/clamp ring. Remove the CR41 from the CR4 and attach it to the valve body with the two HWSC-SC6-10NT/modified socket head screws (6-32 x 5/8"). (Only one is used for a P-Type 10 port valve.) The CR41 must be oriented so that the valve cutout is visible through the long slot on its side.
4. Press the flange of the CR41/closemount standoff into the CR4/clamp ring on the actuator, making sure that the square driver of the actuator engages the squared hole of the slotted coupling. (It may be easier to put the slotted

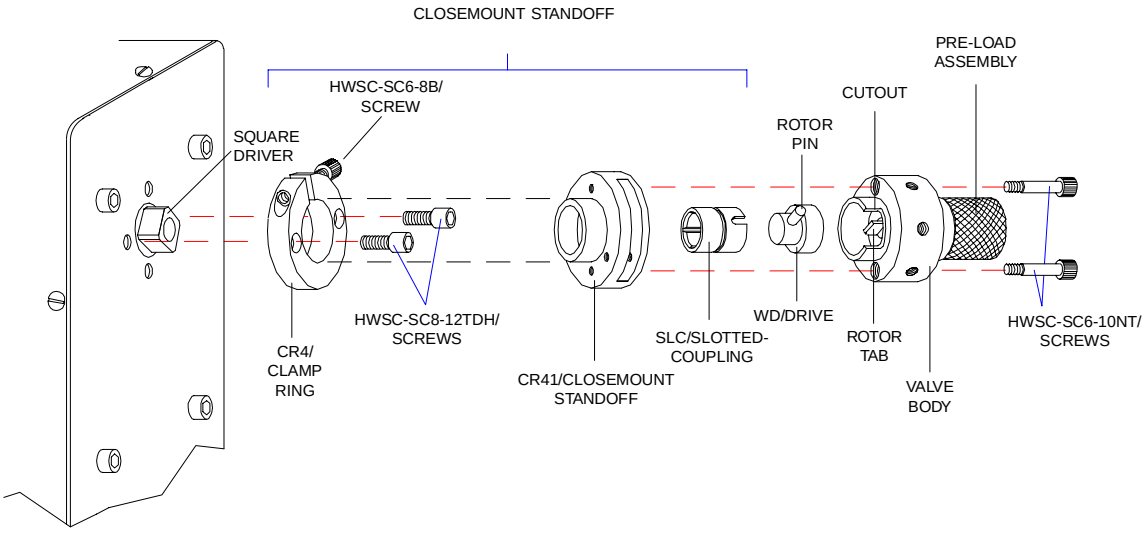



**Figure 8:** Valve on actuator with closemount hardware

coupling on the square driver of the actuator first. However, make sure that the driver doesn't get cocked.) The CR41/closemount standoff should end up flush against the CR4/clamp ring.

5. Tighten the HWSC-SC6-8B/screw (6-32 x 5/8") in the clamp ring with a 7/64 hex driver.

6. Align the valve and actuator according to the **Alignment Procedure** found in Section 5.4.

**CAUTION: If the valve and actuator are not properly aligned, the slots on the valve rotor and the ports in the valve body will not align properly. The flow of sample may be blocked, and other problems may result.**

## 4.3 Installation of a Valve With a Standoff

If the electric actuator has been specified for use with a standoff, it will arrive from the factory with the CR3/clamp ring already on the actuator. The clamp ring is attached to the actuator with two HWSC-SC8-8B/socket head screws (8-32 x 1/2").

**CAUTION: Do not use screws longer than 1/2" to attach clamp rings to electric actuators. They will interfere with internal moving parts and damage the actuator.**

1. Plug in the electric actuator and put it into the LOAD position (indicated by a red light in the LOAD position) on the control box. The valve will have been rotated to the counterclockwise position before the knob or the handle was removed, so they should now be in the same relative rotational position.

**CAUTION: The valve and the actuator must be in corresponding rotational positions before assembly. If they are not, the valve or electric actuator may be damaged when operated.**

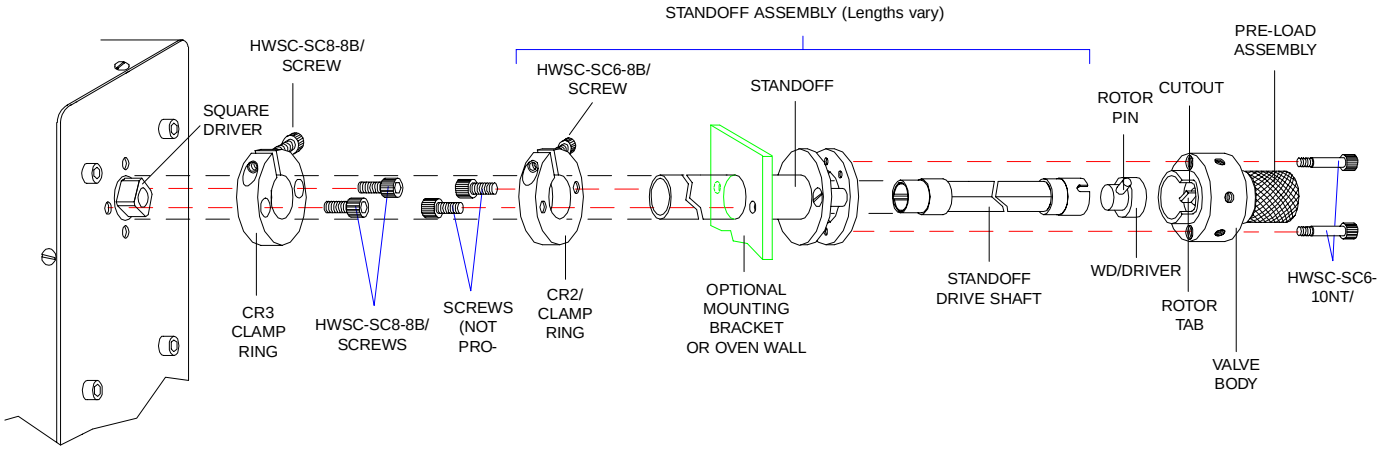



**Figure 9:** Valve on actuator with a standoff

2. Remove the CR2/clamp ring from the standoff and mount it on the oven wall. (Screws are not provided for this purpose.) Slide the standoff through the CR2/clamp ring on the oven wall or bracket. (The standoff requires an 11/16" clearance hole.)

3. Firmly press the end of the standoff into the CR3/clamp ring mounted on the actuator, making sure that the square driver of the actuator engages the squared hole of the standoff drive shaft. Position the entire assembly so that the entire valve body cutout is visible.

4. Tighten the screw in the CR3/clamp ring.

5. Align the valve and actuator according to the **Alignment Procedure** found in Section 5.4.

**CAUTION: If the valve and actuator are not properly aligned, the slots on the valve rotor and the ports in the valve body will not align properly. The flow of sample may be blocked, and other problems may result.**

7. Position the standoff in the CR2/clamp ring and tighten the clamp ring screw to secure the standoff in place.

# 5. VALVE ALIGNMENT

When the valve arrives from the factory installed on the actuator, it is accurately aligned and ready to use. However, every time the clamp ring on the actuator is loosened to readjust or remove the valve from the actuator, the valve and actuator alignment **must** be checked to be sure that the internal ports and slots on the rotor align properly.

## 5.1 Visually Checking the Alignment

It is important to note that the actuator actually drives only the rotor within the valve body, and that the valve or valve/standoff assembly remain stationary with respect to the actuator. To check the alignment, cycle the actuator from one position to the other and observe the location of the rotor pin. The rotor pin should come to rest against both sides of the cutout in the valve body. **Figures 10-12** show the rotor pin in both positions (LOAD and INJECT). In **Figure 10**, the rotor pin contacts one side of the cutout but does not touch the other side, indicating that the valve needs to be aligned. (See Section 5.4, **Alignment Procedure**.) In **Figure 11**, the pin does not touch the cutout on either side, indicating that the actuator stroke must be adjusted. (See Section 6.1, **Adjusting the Actuator Stroke**.) **Figure 12** shows the pin properly contacting both sides of the cutout.

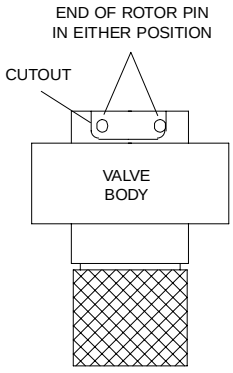



**Figure 10**
Adjust alignment

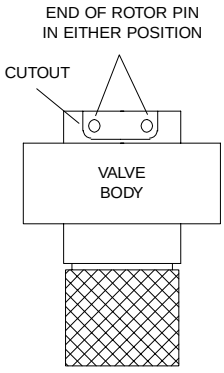



**Figure 11**
Adjust stroke

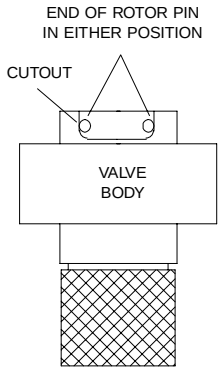



**Figure 12**
Proper alignment

## 5.2 Chromatographic Symptoms of Misalignment

### 5.21 Loss of Flow or Blocked Flow

When the rotor does not rotate completely or accurately, the ports of the valve may not intersect the engravings on the valve rotor. This can cause a loss of flow at outlets or a blockage of flow at inlets.

### 5.22 Multiple Peaks or Doublets

In some configurations, the engraving may not be aligned properly even though flow is not eliminated. Some engravings are very small or very large, and inaccurate alignment can cause what appear to be multiple injections due to the sweeping action of the rotor.

## 5.3 Causes of Misalignment

### 5.31 Removal of the Valve from the Actuator for Mounting

To mount valves through a bracket or oven wall, the valve and standoff assembly must be separated from the actuator. Any time the clamp ring screw has been loosened, the alignment of the valve after replacement on the actuator **must** be checked, and realigned as necessary.

**NOTE: To reduce the possibility of having to realign after installation, before removing the valve from the actuator:**
**Closemount:** Make temporary registration marks on the face of the valve where it lines up with the slot in the stainless clamp ring on the actuator.
**Standoff:** Make temporary registration marks on the standoff tube where it lines up with the slot in the black anodized clamp ring on the actuator. Do not remove the valve from the standoff assembly.
When this mark is lined up with the slot on reassembly, the factory alignment will be approximately reproduced as long as the valve and the actuator remain in their original positions.

Whenever the valve and standoff assembly is removed from the actuator and replaced, be certain that the assembly is inserted into the actuator as far as possible (approximately 3/8 inch) to achieve complete driver coupling.

### 5.32 Shock from Heavy or Continuous Use

Occasionally, when valves are used in applications requiring a high-duty cycle, wear or shock may cause the valve mounting screws or the clamp ring screw to loosen. This allows the valve to overthrow and may result in misalignment. The most obvious symptom is movement observed in the valve or valve/standoff assembly, which normally would not move when the valve is actuated.

## 5.4 Alignment Procedure

1. After determining that alignment is necessary, actuate the valve to the position in which the rotor pin is against the stop.
2. Loosen the clamp ring screw slightly. This will allow the actuator to complete its travel if it was being stopped by the end of the valve rotor travel. The valve body will rotate slightly.
3. Tighten the clamp ring screw and cycle the actuator to the other position. The pin should come to rest against the stop. If it does not, repeat the procedure. If after several attempts the pin still does not contact the stop in both positions, see Section 6.1, **Adjusting the Actuator Stroke.**

# 6. ACTUATOR MODIFICATIONS

## 6.1 Adjusting the Actuator Stroke

If for any reason the actuator will not rotate the valve rotor completely, or if you have reason to believe that the actuator is stroking too far, refer to the directions below to adjust the actuator for slightly more or less rotation than is supplied by the factory.

Because of differing amounts of play designed into the components, the actuator stroke *must* be checked any time that the actuator is refitted to operate with different mounting hardware than it originally received at the factory: i.e., a standoff assembly used with an actuator that originally had closemount hardware, or closemount hardware used with an actuator originally supplied with a standoff assembly.

Valve alignment should always be checked before adjusting the actuator stroke to confirm that the rotor pin is not contacting either side of the cutout. Since it is difficult to see whether the stroke is too great, adjust the stroke by very small increments so that you can stop as soon as the rotor pin just contacts both sides of the cutout.

NOTE: This adjustment cannot make a 36° actuator into a 60° actuator. To do that, see Section 6.2, **Actuator Conversion**.

1. Step the actuator to the LOAD position. Remove the valve and its mounting hardware from the actuator.

   **For a closemount valve,** (**Figure 8**, page 9) use the 7/64 hex driver to loosen the HWSC-SC6-8B/socket head screw (6-32 x 5/8") in the stainless CR4/clamp ring. Pull off the valve and its attached black-anodized CR41/closemount standoff. With a 9/64 hex driver remove the two HWSC-SC8-6TDH/modified socket head screws (8-32 x 3/8") which hold the clamp ring to the actuator.

   **For a valve on a standoff,** (**Figure 9**, page 10) use the 9/64 hex driver to loosen the HWSC-SC8-8B/socket-head screw (8-32 x 5/8") in the black anodized CR3/clamp ring on the actuator. Pull off the standoff with the valve attached. The same hex driver will remove the two HWSC-SC8-6/socket-head screws (8-32 x 3/8") which hold the clamp ring to the actuator.

2. **Unplug the actuator**. Use a 9/64 hex driver to remove the four HWSC-SC8-6/screws (8-32 x 3/8") which hold the black right angle mounting bracket to the actuator body. (See **Figure 13**)

3. Remove the four HWSC-PL4-4/screws (4-40 x 1/4") holding the outer cover and pull the cover back 1 to 2 inches. It may be necessary to remove the two strain reliefs labeled REMOTE SWITCHING and MANUAL SWITCHING. **Do not remove** the bottom strain relief labeled 120V AC 50/60 HZ.

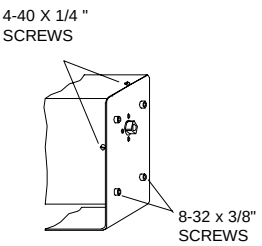



**Figure 13:** Bracket and cover screws

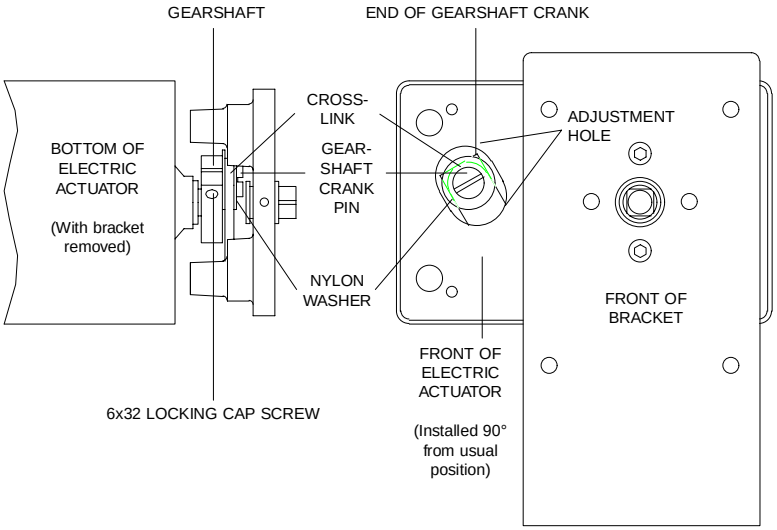



**Figure 14:** Actuator stroke adjustment

4. Temporarily install the mounting bracket at 90° from normal (see **Figure 12**) so that the adjustment hole is accessible.
5. Put the clamp ring back on and attach the valve or valve/standoff assembly. Plug in the actuator power cord and align the valve as nearly as possible, as described in Section 5.4, **Alignment Procedure**.
6. **Unplug the power cord.**
7. Use a 7/64 hex driver to loosen the 6-32 cap screw on the gearshaft crank. (**Figure 14**)
8. Use a screwdriver to *slightly* move the gearshaft crank pin. (**Figure 15**) To *increase* the stroke, rotate it slightly (1/16 turn) in the direction which has the **most** resistance. To *decrease* the stroke, rotate it in the direction which has the **least** resistance.

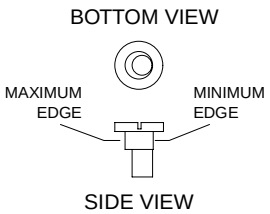


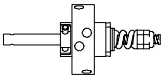

**Figure 15:**
Gearshaft crank pin

9. Lock the 6-32 cap screw on the gearshaft.
10. Plug in the power cord. Cycle the valve several times and check the alignment. If the valve rotation is still incorrect, loosen the gear shaft crank screw and readjust the gear shaft crank pin to set rotation correctly.
11. When the rotation is correct, unplug the power cord and reassemble the electric actuator and valve with all the parts in proper orientation.
12. Realign the valve as described in Section 5.4, **Alignment Procedure**.

## 6.2 Actuator Conversion

In situations where a serviceable Valco two position actuator has been relegated to the shelf because it rotates the wrong number of degrees, it makes economic sense to restore it to useful service by converting it to the desired rotation. This can be accomplished by following the procedure in this section.

You will need one of the following:



For P Type valves
with coil spring hardware:

| No. of ports | Description | Product No. |
|---|---|---|
| 3 port | 90 degree crank assembly | I-21826-90 |
| 4 port | 90 degree crank assembly | I-21826-90 |
| 6 port | 90 degree crank assembly | I-21826-90 |
| 8 port | 90 degree crank assembly | I-21826-90 |
| 10 port | 60 degree crank assembly | I-21826-60 |
| 12 port | 60 degree crank assembly | I-21826-60 |

For new W and UW Type valves
with preload assembly:

| No. of ports | Description | Product No. |
|---|---|---|
| 3 port | 90 degree crank assembly | I-21826-90 |
| 4 port | 90 degree crank assembly | I-21826-90 |
| 6 port | 60 degree crank assembly | I-21826-60 |
| 8 port | 45 degree crank assembly | I-21826-45 |
| 10 port | 36 degree crank assembly | I-21826-36 |
| 12 port | 30 degree crank assembly | I-21826-30 |

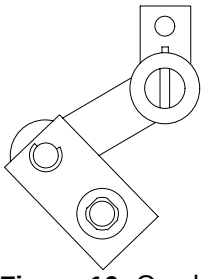


**Figure 16:** Crank assembly

**CAUTION: Before performing any operations on the actuator,** *make sure the actuator power cord is unplugged.*

### 6.21 Disassembly

1. Step the actuator to the LOAD position. Remove the valve and its mounting hardware from the actuator.

   **For a closemount valve,** (**Figure 8**, page 8) use the 7/64 hex driver to loosen the HWSC-SC6-8B/socket-head screw (6-32 x 5/8") in the stainless CR4/clamp ring. Pull off the valve and its attached black-anodized CR41/closemount standoff. With a 9/64 hex driver remove the two HWSC-SC8-6TDH/modified socket head screws which hold the clamp ring to the actuator.

   **For a valve on a standoff,** (**Figure 9**, page 9) use the 9/64 hex driver to loosen the HWSC-SC8-8B/socket-head screw (8-32 x 5/8") in the black anodized CR3/clamp ring on the actuator. Pull off the standoff with the valve attached. The same hex driver will remove the two HWSC-SC8-6/socket-head screws (8-32 x 3/8") which hold the clamp ring to the actuator.

2. **Unplug the actuator**. Use a 9/64 hex driver to remove the four HWSC-SC8-6/screws (8-32 x 3/8") which hold the black right-angle mounting bracket to the actuator. (**Figure 13**)

3. Use a pair of pliers to compress and remove the top two cable strain relief devices from the actuator cover. They are at the points marked REMOTE SWITCHING and MANUAL SWITCHING. Once they are out, pull them apart and remove them from the cables to allow the cables to travel freely through the holes in the cover.

4. Remove the four 4-40 x 1/4" slotted-head screws which secure the actuator cover to the front casting. Slide the cover back far enough to allow the wiring connectors to be pulled from the circuit board. Make careful note of their location for reattachment later. Now remove the cover completely.

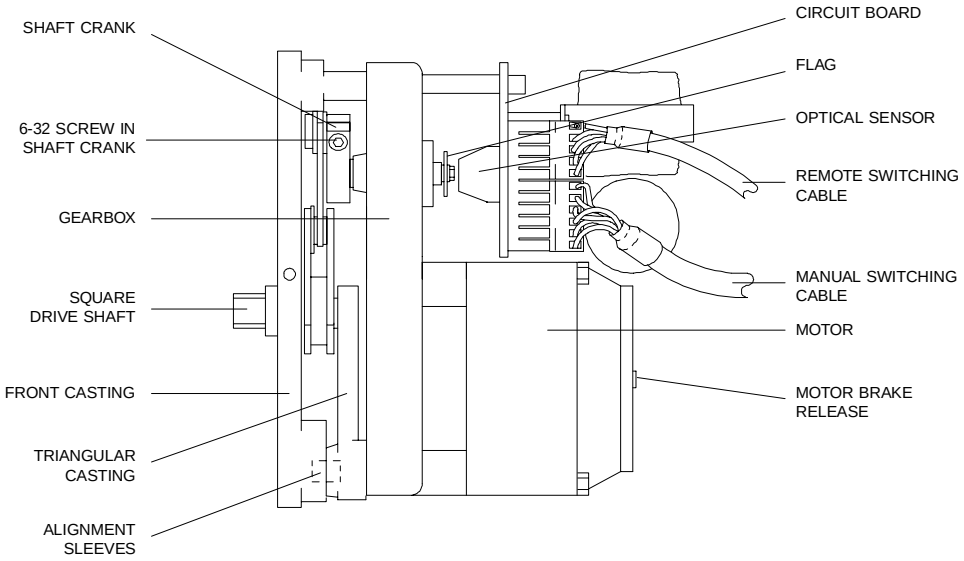



**Figure 17:** Identification of actuator parts

5. Place the actuator in front of you so that the square black motor is down and away, and the front casting with the square valve drive shaft extending through it is facing you. Use the 9/64 hex driver to remove the four 8-32 x 1" socket-head screws at the corners of the casting, observing that two of these screws must pass through small sleeves which align this front casting and the triangular casting. As the front casting is removed, the sleeves may come with it or they may stay with the triangular casting. Locate and retain both alignment sleeves.

6. Swing the entire crank assembly to one side, away from the body of the actuator, and slide the triangular casting off of the crank assembly. (**Figure 18**)

7. The shaft crank is threaded on to the output shaft extending from the gear-box. (See **Figure 19**) Since simply trying to unscrew the shaft crank will only turn the output shaft instead, it is necessary to first break it loose by placing the 1/2" open end or the adjustable crescent wrench on the shaft crank and applying a sharp counterclockwise snap to break it loose. Once it has been freed, it is an easy matter to unscrew it the rest of the way by hand.

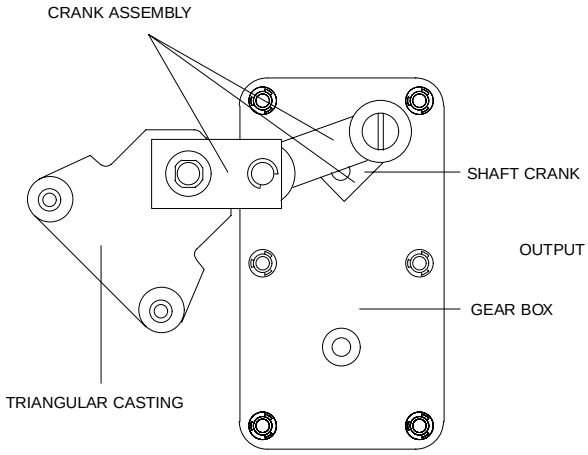



**Figure 18:** Removal of triangular casting

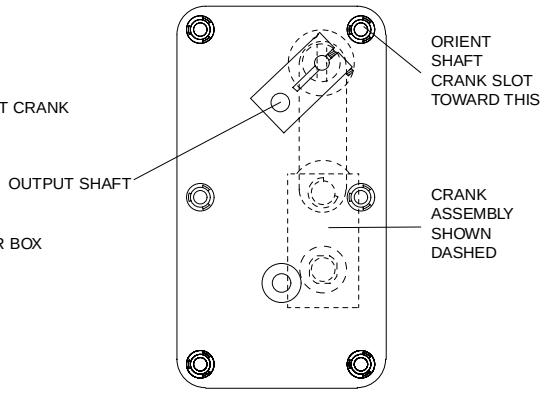



**Figure 19:** Shaft crank at one o'clock

### 6.22 Installation of the New Crank Assembly

1. Screw the shaft crank of the new crank assembly onto the output shaft. Once the threads have bottomed out, use the open end or adjustable wrench to apply a sharp clockwise snap to lock it in position.
2. Turn the actuator around so that the motor is toward you and locate the small button in the center of the round motor casting. While pushing this button to release the brake, use the wrench on the shaft crank to rotate the output shaft until the slotted end of the shaft crank is oriented toward the screw hole at one o'clock. (**Figure 19**)
3. With its countersunk recesses for the alignment sleeves facing you, slide the triangular casting onto the crank assembly from the back side.
4. Position the triangular casting over its mounting holes, making sure that the crank assembly is pivoted to the left. (**Figure 20**) Put the alignment sleeves in their recesses in the triangular casting.
5. Reinstall the front casting. It is helpful to get all four screws started before tightening any of them.

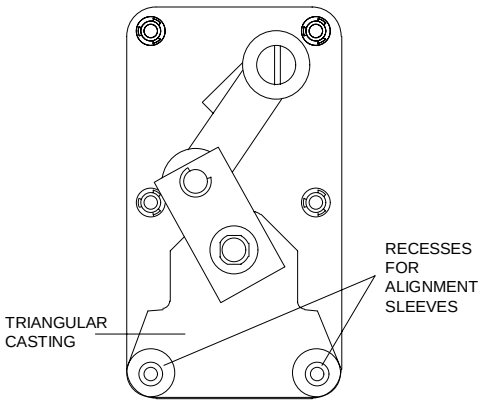



**Figure 20:** Triangular casting in place with crank assembly pivoted to left

### 6.23 Flag Adjustment

As noted above, the shaft crank screws onto the threaded output shaft extending from the gearbox. On the opposite end of this shaft is a thin metal "flag" which operates in conjunction with two optical sensors to signal the motor to start and stop. (**Figure 17**) For the actuator to function properly, this flag must be positioned in correct relationship to the newly installed crank assembly.

1. With the 1/4" open-end wrench, reach between the circuit board and the gearbox and loosen the hex head screw that holds the flag in position in front of the sensors.
2. From the same viewpoint previously described (motor down and away, casting in front), position the flag at three o'clock. Partially tighten the screw so that the flag stays in place but can still be moved.
3. Turn the actuator cover so that the writing is upside down and slide it on the actuator far enough to allow the connectors to be plugged back onto the board. The manual switching cable has six wires, while the remote switching cable has only five. They connect to the same row of eleven pins, with the six wire connector closest to the motor. (See **Figure 17**.) The three wire lead which supplies power goes on with the green wire to the outside. Plug in the actuator.

**Caution: The following steps describe adjustments which require the use of metal tools in close proximity with electrical circuits. Checking the result of the adjustments requires that the actuator be plugged in, but remember to unplug the actuator before further adjustments are made.**

4. Step the actuator from position to position two or three times. Look through the adjustment hole (**Figure 14**) in the front casting to see if the arms of the crank assembly are parallel. They should look like **Figure 23**, with the shaft crank virtually hidden behind the other arm. If they do, **unplug the actuator,** tighten the screw which secures the flag, and proceed to Step 5 in Section 6.1, **Adjusting the Actuator Stroke**. If they do not, proceed to the next step.
5. **Unplug the actuator.** If the arms are off in the direction of **Figure 21**, move the flag *slightly* toward 6 o'clock. If they are off as in **Figure 22**, move it *slightly* toward 12 o'clock.
6. Plug the actuator in and repeat Steps 4 and 5 until proper adjustment is achieved.
7. Proceed to Step 5 in Section 6.1, **Adjusting the Actuator Stroke**.

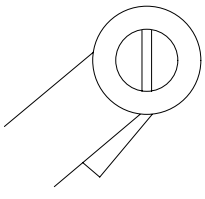


**Figure 21:** Move flag to 6 o'clock

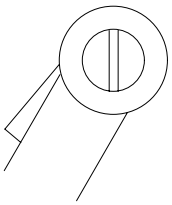


**Figure 22:** Move flag to 12 o'clock

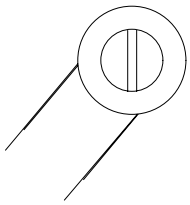
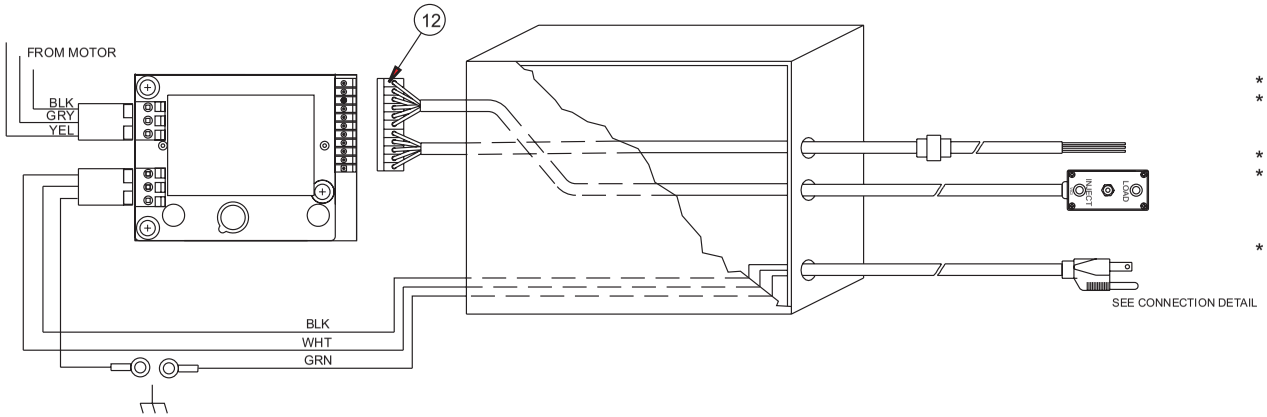


**Figure 23:** Proper adjustment

# 7. TECHNICAL DRAWINGS

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| E | ECN #2000 ADD CSA SPEC AND TAG | 20JUL94 | JDURR |
| F | ECN #3268 CORRECT WIRE COLOR/FUNCTION | 07/01/96 | JDURR |
| G | ECN #4470 ADD CHANGES FOR GSS ITEMS | 11/03/98 | JDURR |
| H | ECN #9472 UPDATE TO REV U PCB | 10/05/07 | JDURR |
| J | ECN #10466 UPDATE GND LOC. (ADD ITEM 17) | 09/10/08 | R.S.S. |

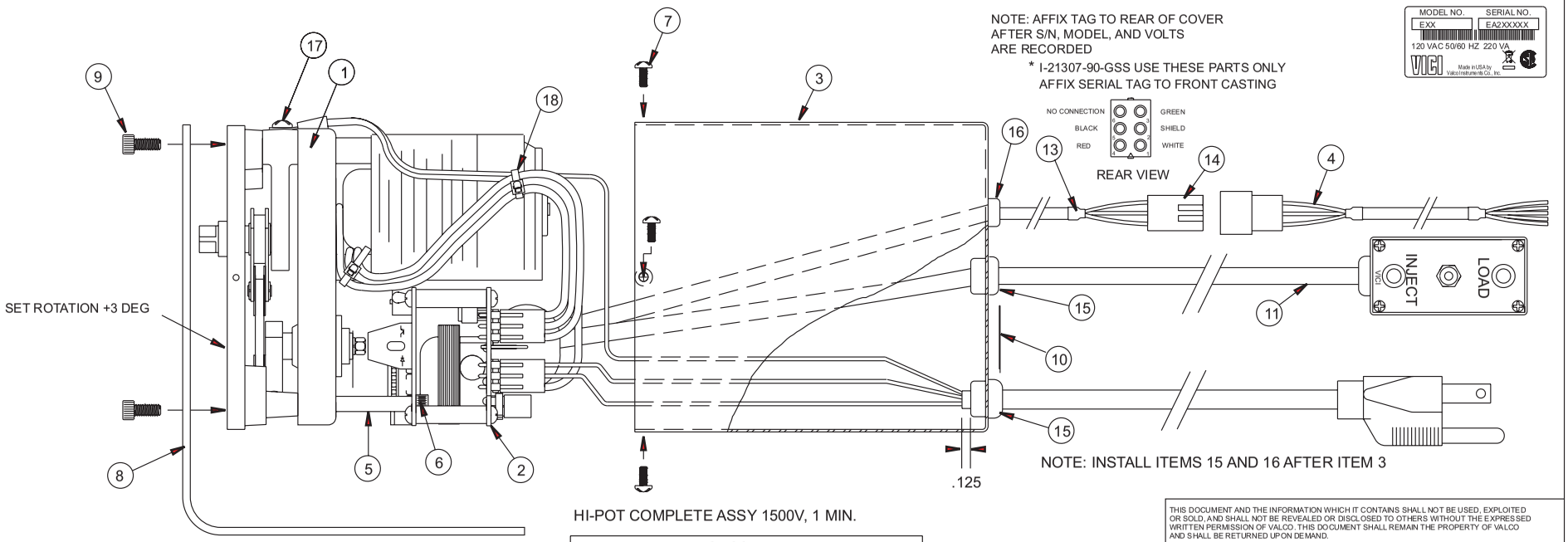



| PARTS LIST | | | |
|---|---|---|---|
| ITEM | DESCRIPTION | VALCO # | QTY |
| * 1 | BASE & MOTOR ASSY: 2PEA | SEE DASH SCHEDULE | 1 |
| * 2 | PCB ASSY: 2PEA, 110V | I-21312-01 | 1 |
| 3 | ENC. ASSY: 2PEA, 110V | I-21710-01 | 1 |
| 4 | CABLE ASSY: REMOTE INTERFACE (2-P) | I-21361 | 1 |
| * 5 | SPACER: #8 X 1" ALUM. | HWSP-8527 | 2 |
| * 6 | SCREW, SHCS: 8-32 X 1-1/4 LG | HWSC-SC8-20B | 2 |
| 7 | SCREW, PLMS: 4-40 X 1/4 LG | HWSC-PL4-4 | 4 |
| 8 | BRACKET: 2PEA | I-21308 | 1 |
| 9 | SCREW, SHCS: 8-32 X 3/8 LG | HWSC-SC8-6B | 4 |
| * 10 | TAG: 1 X 2" METALIZED (3000/PKG) | I-TAG73T1-795 | 1 |
| 11 | CONTROLLER ASSY: 2PEA | I-21360 | 1 |
| 12 | SOCKET: 6 POSITION, 24 GAUGE- PANDUIT | I-T100F24-6 | 1 |
| 13 | CABLE ASSY: REMOTE, 2PEA, 1 FT | I-21791-01 | 1 |
| 14 | CONN: 6 PIN MALE MOLEX | I-T03061062 | 1 |
| 15 | STRAIN RELIEF: SRR-10 | HWSRR-10 | 1 |
| 16 | STRAIN RELIEF: .375 SR 2M-4 HEYCO | HWSR2M-4 | 1 |
| 17 | SCREW,PLMS: 6-32 X 1/4 LG,PL,SS | HWSC-PL6-4 | 1 |
| 18 | TY-WRAP: TYTON 1/8 X 4" T18R | HWTYWRAP-2 | 1 |
| | | | |
| | | | |
| REF | SCHEMATIC B-21313 | --- | -- |
| REF | VIEW WITH DIMENSIONS C-21364 | --- | -- |
| REF | VALVE INSTALLATION (CL MOUNT) B-21446 | --- | -- |

NOTE: AFFIX TAG TO REAR OF COVER
AFTER S/N, MODEL, AND VOLTS
ARE RECORDED

* I-21307-90-GSS USE THESE PARTS ONLY
AFFIX SERIAL TAG TO FRONT CASTING

MODEL NO. EXX
SERIAL NO. EA2XXXXX
120 VAC 50/60 HZ 220 VA
VICI Made in USA by Valco Instruments Co., Inc.




NOTE: INSTALL ITEMS 15 AND 16 AFTER ITEM 3

HI-POT COMPLETE ASSY 1500V, 1 MIN.

REMOTE INTERFACE CONNECTIONS

| | | |
|---|---|---|
| 1 | WHITE - | CONTACT |
| 2 | SHIELD - | CLOSURE |
| 3 | GREEN | - COMMON |
| 4 | RED | - GO TO LOAD |
| 5 | BLACK | - GO TO INJECT |

| DASH SCHEDULE | | |
|---|---|---|
| DASH | ITEM 1 | ANGLE |
| I-21307-30 | I-21358-30-110 | 30 ° |
| I-21307-36 | I-21358-36-110 | 36 ° |
| I-21307-45 | I-21358-45-110 | 45 ° |
| I-21307-60 | I-21358-60-110 | 60 ° |
| * I-21307-90 | I-21358-90-110 | 90 ° |

220V VERSION-SEE DWG: 21612



TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS 1/64" DEC. .X .1 .XX .01 .XXX .005 ANGLES 1
63

VICI Valco Instruments Co., Inc.

ACTUATOR: ELECTRIC

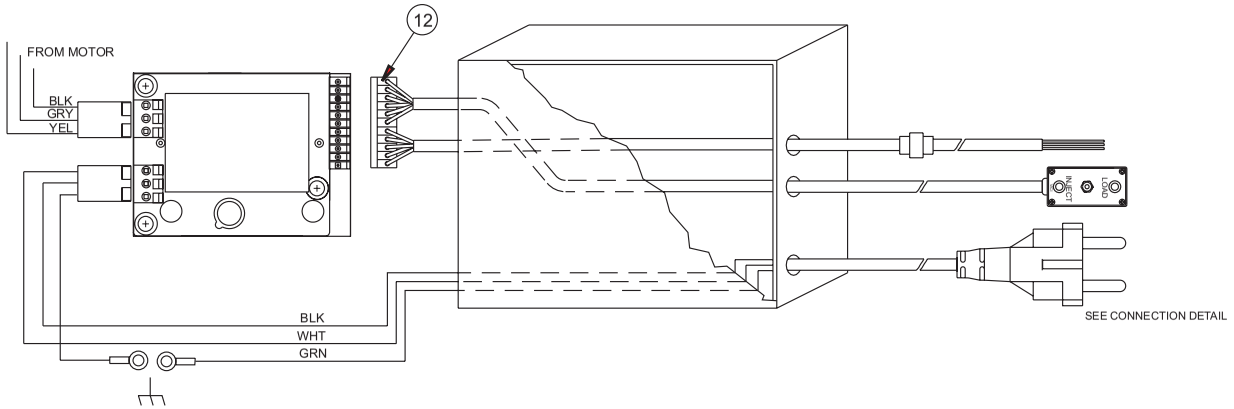
2 POS 110V I-21307

| | | | |
|---|---|---|---|
| APPROVED | DATE | | |
| DRAWN DJM | 6/24/88 | SCALE --- | SIZE C |
| DESIGNED | | | DRAWING NO. 21307 |
| CHECKED | | | |
| FILE NAME 21307 | SUB-DIR \EA\ | USA PROJECTION | SHEET OF |

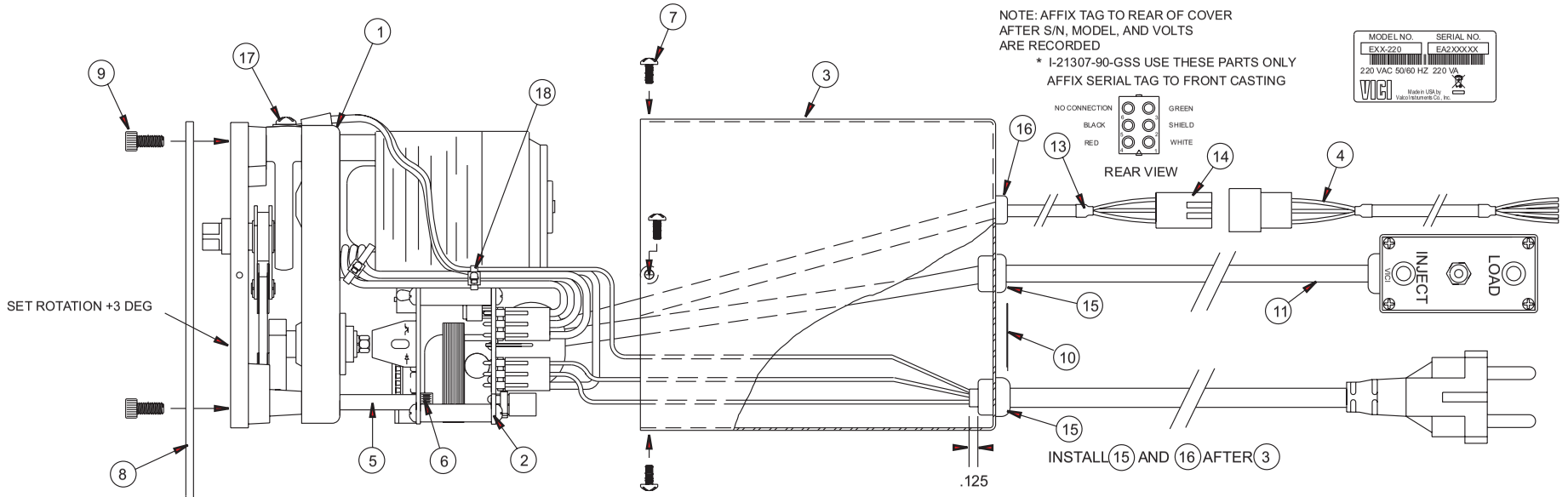
21

21307

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | INITIATED |
| A | ECN #109 DELETE CR3 AND HWSC-SC8-8B | 12/11/89 | |
| B | REVISE DRAWING TO SHOW VALCO P/N | 4-2-92 | DJM |
| C | ECN #2000 UPDATE PER NEW P.C.B. | 7/20/94 | J DURR |
| D | ADD PROPER GROUNDING ECN# 2524 | 10/27/95 | J DURR |
| E | CORRECT WIRE COLOR/FUNCTION ECN# 3268 | 07/01/96 | J DURR |
| F | ECN #9472 UPDATE TO REV U PCB | 10/05/07 | JDURR |
| G | ECN #10466 UPDATE GROUND WIRING | 5/20/08 | RSS |




| PARTS LIST | | | |
|---|---|---|---|
| ITEM | DESCRIPTION | VALCO # | QTY |
| 1 | BASE & MOTOR ASSY: 2PEA | SEE DASH SCHEDULE | 1 |
| 2 | PCB ASSY: 2PEA, 220V | I-21312-02 | 1 |
| 3 | ENC. ASSY: 2PEA, 220V | I-21710-220 | 1 |
| 4 | CABLE ASSY: REMOTE INTERFACE (2-P) | I-21361 | 1 |
| 5 | SPACER: #8 X 1" ALUM. | HWSP-8527 | 2 |
| 6 | SCREW, SHCS: 8-32 X 1-1/4 LG | HWSC-SC8-20B | 2 |
| 7 | SCREW, PLMS: 4-40 X 1/4 LG | HWSC-PL4-4 | 5 |
| 8 | BRACKET: 2PEA | I-21308 | 1 |
| 9 | SCREW, SHCS: 8-32 X 3/8 LG | HWSC-SC8-6B | 4 |
| 10 | TAG: 1 X 2" METALIZED (3000/PKG) | I-TAG73T1-795 | 1 |
| 11 | CONTROLLER ASSY: 2PEA | I-21360 | 1 |
| 12 | SOCKET: 6 POSITION, 24 GAUGE- PANDUIT | I-T100F24-6 | 1 |
| 13 | CABLE ASSY: REMOTE, 2PEA, 1 FT | I-21791-01 | 1 |
| 14 | CONN: 6 PIN MALE MOLEX | I-T03061062 | 1 |
| 15 | STRAIN RELIEF: SRR-10 | HWSRR-10 | 1 |
| 16 | STRAIN RELIEF: .375 SR 2M-4 HEYCO | HWSR2M-4 | 1 |
| 17 | SCREW, HHMS: 632_1/4 LG, PL, HD,SS | HWSC-PL6-4 | 1 |
| 18 | TY-WRAP: TYTON 1/8 X 4" T18R | HWTYWRAP-2 | 1 |
| | | | |
| REF | SCHEMATIC B-21313 | ---- | -- |
| REF | VIEW WITH DIMENSIONS C-21364 | ---- | -- |
| REF | VALVE INSTALLATION (CL MOUNT) B-21446 | ---- | -- |




| REMOTE INTERFACE CONNECTIONS | | |
|---|---|---|
| 1 | WHITE - | CONTACT |
| 2 | SHIELD - | CLOSURE |
| 3 | GREEN - | COMMON |
| 4 | RED - | GO TO LOAD |
| 5 | BLACK - | GO TO INJECT |

HI-POT COMPLETE ASSY 1500V, 1 MIN.

| DASH SCHEDULE | | |
|---|---|---|
| DASH | ITEM 1 | ANGLE |
| I-21612-30 | I-21358-30-220 | 30° |
| I-21612-36 | I-21358-36-220 | 36° |
| I-21612-45 | I-21358-45-220 | 45° |
| I-21612-60 | I-21358-60-220 | 60° |
| I-21612-90 | I-21358-90-220 | 90° |



TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS 1/64" DEC. X .1 XX .01 XXX .005 ANGLES 1
63

Valco Instruments Co., Inc.

ACTUATOR: ELECTRIC

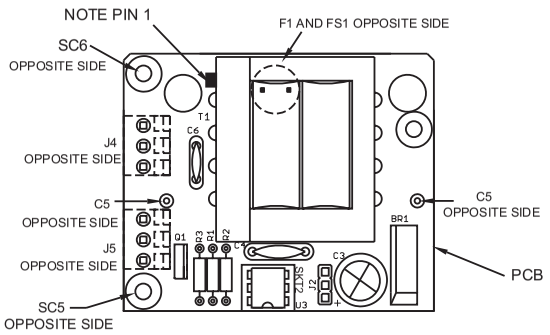
2 POS 220V I-21612

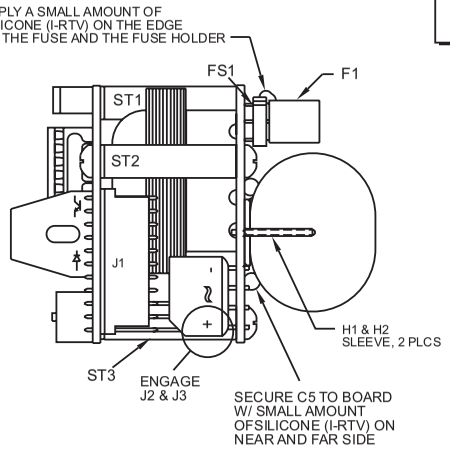
| APPROVED | DATE |
|---|---|
| DRAWN JDURR | 4MAY07 |
| DESIGNED | |
| CHECKED | |
| FILE NAME 21612 | SUB-DIR \EA\ |

SCALE ---
SIZE C
DRAWING NO. 21612
USA PROJECTION
SHEET OF

110V VERSION-SEE DWG: 21307

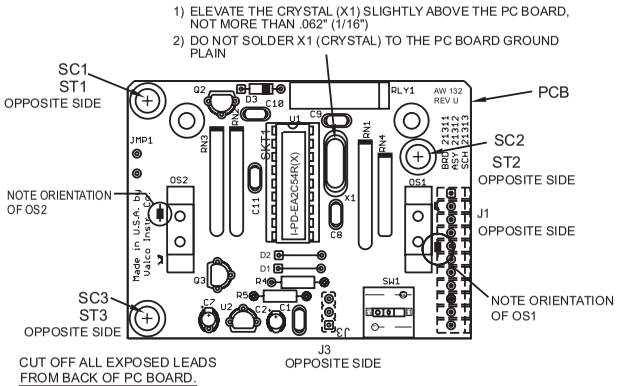
21612

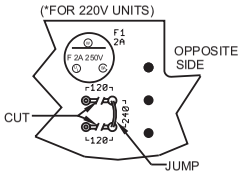



MFG TO
RoHS
SPECS

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| AC | ECN #10916 ADD ASSEMBLY NOTE FOR CRYSTAL (X1) and ADD NOTE CONCERNING APPLICATION OF ITEM FT TO ASSEMBLY | 03/31/09 | BILL S |
| AD | ECN #11066 ADD NOTE TO INDICATE HEAT SENSITIVE PARTS. & REMOVE LW1, 2, 3 | 07/21/09 | C. PRATCHER |
| AE | ECN #15146 REMOVE D1, D2, REPLACE W/WIRE JUMPERS | 10/05/10 | RSS |




PARTS LIST CONTINUED

| PARTS LIST | | | | |
|---|---|---|---|---|
| | DES | DESCRIPTION | VALCO # | QTY |
| | PCB | PCB: ELECT. ACT. 2 POS., (CSA) | I-PCB21311 | 1 |
| ** | U1 | PROGRAMMED DEVICE: 2P EA I-ICPIC16F54 | I-PD-EA2F54R(X)** | 1 |
| | U2 | IC: VOLTAGE REGULATOR, 5V, T092 | I-IC78L05 | 1 |
| | U3 | IC: OPTO-TRIAC ZERO CROSSING | I-IC3082 | 1 |
| *** | OS1,2 | SENSOR: OPTICAL REFLECTIVE (OPB742) | I-ICTIL139 | 2 |
| | BR1 | RECTIFIER BRIDGE: 2A, 50V, 4 PIN DIP | I-D3N253 | 1 |
| | Q1 | TRIAC: 4AMP-600V, ISO, T0-220, txt | I-Q6004L4 | 1 |
| | Q2,Q3 | TRANSISTER: SIGNAL, NPN, TO92 | I-Q2N4401 | 2 |
| **** | D1, D2 | WIRE: BUSS, UNINSULATED,.025 DIA,22 AWG | I-W-BUSS-1 | 2 |
| | D3 | DIODE: SILICON SIGNAL | I-D1N914 | 1 |
| | X1 | CRYSTAL: 16 MHZ, LOW PROFILE | I-XTAL-6 | 1 |
| | T1 | TRANSFORMER: 110/220V, 12V SEC, PC MOUNT | I-X-DSW-212 | 1 |
| | SKT1 | SOCKET: DIP, 18 PIN LOW PROFILE | I-TDS-18-LP | 1 |
| | SKT2 | SOCKET: DIP, 6 PIN, LOW PROFILE | I-TDS-6-LP | 1 |
| | FS1 | FUSE HOLDER: TR5, PC MOUNT | HWFUSEHOLD-5 | 1 |
| | F1 | FUSE: 2AMP, TR5, PC MOUNT | HWFUSE-2A-TR5 | 1 |
| | C1,C11 | CAP: MONO CERAMIC, .01uF 50V, .1" LEADS | I-CC103-50-1 | 2 |
| | C2 | CAP: TANTAL, 4.7MF, 35V | I-CT475-35 | 1 |
| | C3 | CAP: ELECT, 220uF, 35V, RADIAL LEAD | I-CE227-35RL | 1 |
| | C4 | CAP: CERAMIC, .01uF 1000V | I-CC103-1K | 1 |
| * | C5 | CAP: MYLAR, 20uf 250V | SEE DASH SCHED | 1 |
| | C6 | CAP: CERAMIC, .005uF 1KV | I-CC502-1K | 1 |
| | C7 | CAP: TANTAL, .47MF, 35V | I-CT474-35 | 1 |
| | C8,C9 | CAP: CERAMIC, 12PF 50V | I-CC120-50 | 2 |
| | C10 | CAP: MONO CERAMIC, .22 uF 50V, .2"LEADS | I-CC224-50 | 1 |

NOT INSTALLED UNTIL NEXT ASSY

**** D1, D2 REPLACE W/WIRE JUMPERS.

*** OS1, OS2 ARE HEAT SENSITIVE AND NEED TO BE HAND SOLDERED TO THE BOARD.

** USE CURRENT REV.

PN: I-21312 - ASSEMBLED PCB (EXCLUDING - C5 CAP)

* PN: FOR 110V. UNITS - I-21312-01
PN: FOR 220V. UNITS - I-21312-02 (SEE NOTE 4)

PN: FOR -TM. UNITS - I-21312-01-TM, -02-TM

NOTES:
1. APPLY LOCTITE 242 ON THE TIP OF ALL SCREWS BEFORE ASSEMBLY.
2. SCREWS SC4, 5, 6, TO BE INSTALLED AFTER BOARDS ARE REMOVED FROM CARRIER.
3. FOR -TM MODELS- CHANGE U3 TO I-IC3011
* 4. MATERIALS AND PROCESSES MUST BE RoHS COMPLIANT
5. FOR 220 VOLT AC UNITS: CUT & JUMP AS INDICATED, INSTALL APPROPRIATE C5 CAP.
6. CAPACITOR C5 LEADS TO BE SOLDERED INTO THE LOCATIONS MARKED "C5"

| DASH SCHEDULE | | |
|---|---|---|
| PN: | MODEL: | CAP (C5) |
| I-21312-01 | 110V | I-CM206-250 |
| I-21312-02 | 220V | I-CM687-400 |

| DES | DESCRIPTION | VALCO # | QTY |
|---|---|---|---|
| R1, R2 | RES: 330, 5%, 1/4W | I-R513300 | 2 |
| R3 | RES: 39, 5%, 1/4W (REEL) | I-R5139R0 | 1 |
| R4 | RES: 10K, 5%, 1/4W | I-R511002 | 1 |
| R5 | RES: 1K, 5%, 1/4W | I-R511001 | 1 |
| RN1 | RES NET: 22, 8 PIN SIP, DISCRETE | I-RN750-83-22R0 | 1 |
| RN2 | RES NET: 1K, 8 PIN SIP, DISCRETE | I-RN750-83-102 | 1 |
| RN3 | RES NET: 47K, 8 PIN SIP, DISCRETE | I-RN750-83-473 | 1 |
| RN4 | RES NET: 330, 6 PIN SIP, COMMON | I-RN750-61-331 | 1 |
| J1 | HEADER: 11 POSITION, PANDUIT | I-T100-11 | 1 |
| J2 | HEADER: 3 PIN, UNSHROUDED, .9L, SAMTEC | I-TTSW-103-19-S-S | 1 |
| J3 | CONN: SOCKET STRIP, 3 PIN, SIP, GOLD | I-TSSW-103-01-S-S | 1 |
| J4,J5 | CONN: 3 PIN W/RAMP, MOLEX | I-T26510032 | 2 |
| RLYI | RELAY: HAMLIN #HE3621A0500 | I-RY-HAMLIN | 1 |
| SW1 | SWITCH: DIP DPDT GRAYHILL #76DS01 | I-SW-76SD01 | 1 |
| SC1-6 | SCREW,PLMS: 4-40*1/4 lg,PANHD,PH,SS | HWSC-PL4-4 | 6 |
| ST1,2,3 | STANDOFF: 4-40 1.00, F/F,HEX | HWSO-2334 | 3 |
| FT | TAPE: DOUBLE-SIDE/FOAM,3M,216 IN/EA CUT LENGTH WISE IN HALF | I-TAPE-D/S FOAM | 2" |
| HS 1,2 | TUBING: HEAT SHRINK #19 AWG, TFE | I-STUBE #19 | 1" |



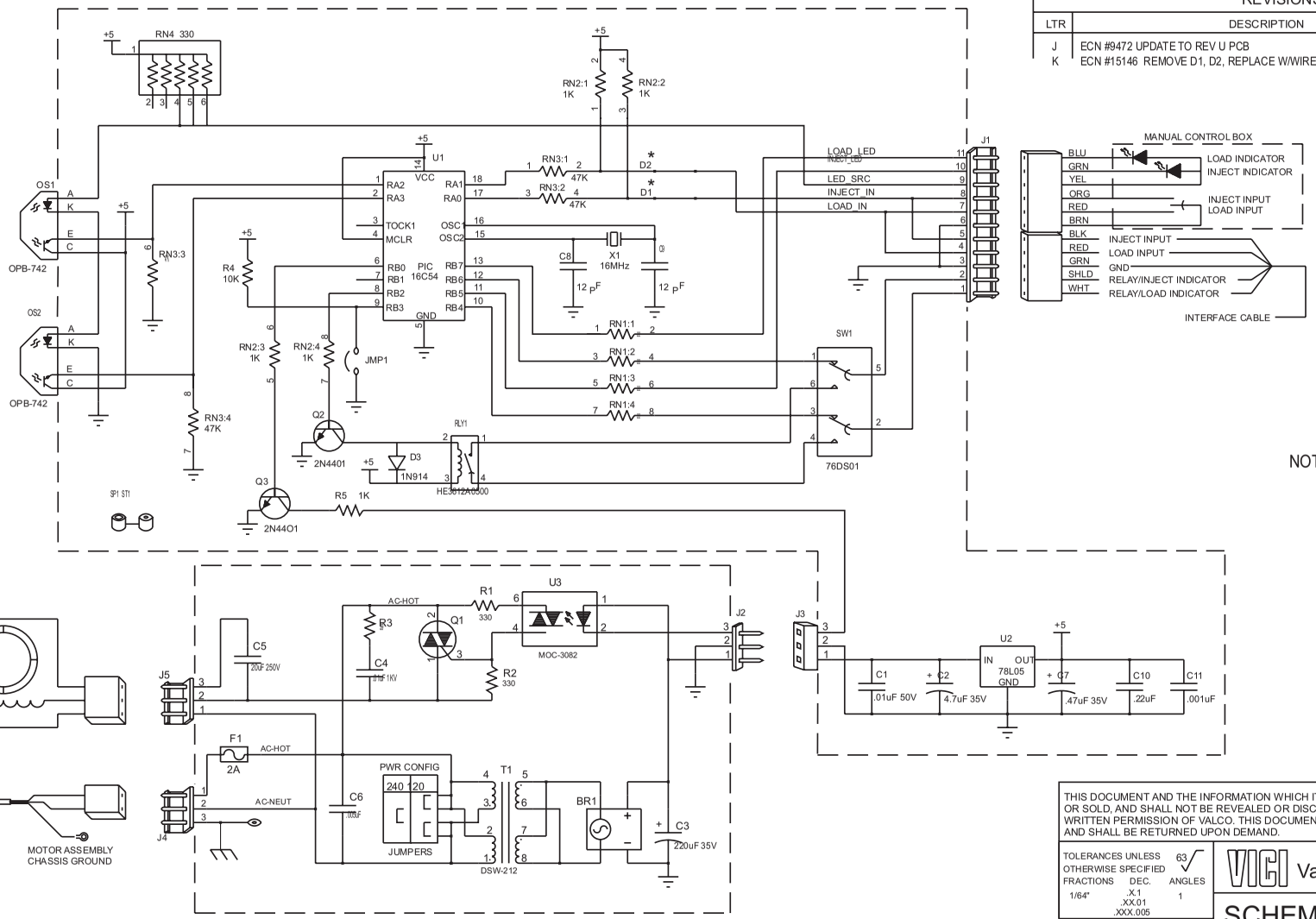
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1
63

Valco Instruments Co., Inc.

PCB ASSY: 2PEA

| APPROVED | DATE |
|---|---|
| DRAWN JDURR | 2APR07 |
| DESIGNED RSIMPSON | |
| CHECKED | |
| FILE NAME 21312 | SUB-DIR EA |

SCALE ---
SIZE B
DRAWING NO. 21312
USA PROJECTION
SHEET OF




| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPROVED |
| J | ECN #9472 UPDATE TO REV U PCB | 10/05/07 | RSS |
| K | ECN #15146 REMOVE D1, D2, REPLACE W/WIRE JUMPERS | 10/05/10 | RSS |



TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS 1/64" DEC. .X.1 .XX.01 .XXX.005 ANGLES 1 63

Valco Instruments Co., Inc.

# SCHEMATIC: 2 POS ACTU.

21312 REV U

| | | | |
|---|---|---|---|
| APPROVED | DATE | | |
| DRAWN JDURR/BOB S | 4APR07 | | |
| DESIGNED BOB S | | SCALE --- | SIZE B |
| CHECKED | | | DRAWING NO. 21313 |
| FILE NAME 21313 | SUB-DIR EA | USA PROJECTION | SHEET OF |

# 8. WARRANTY

This Limited Warranty gives the Buyer specific legal rights, and a Buyer may also have other rights that vary from state to state.

For a period of 365 calendar days from the date of shipment, Valco Instruments Company, Inc. (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. Repaired parts are warranted for 90 days. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at Seller's option, the repayment of the price.

SELLER EXCLUDES AND DISCLAIMS ANY LIABILITY FOR LOST PROFITS, PERSONAL INJURY, INTERRUPTION OF SERVICE, OR FOR CONSEQUENTIAL INCIDENTAL OR SPECIAL DAMAGES ARISING OUT OF, RESULTING FROM, OR RELATING IN ANY MANNER TO THESE GOODS.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is VOID when repairs are performed by a nonauthorized service center or representative. For information about authorized service centers or representatives, call or write Customer Repairs, Valco Instruments Company, Inc, P.O. Box 55603, Houston, Texas 77255. ph(713) 688-9345 At Seller's option, repairs or replacements will be made on site or at the factory. If repairs or replacements are to be made at the factory, Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed in accordance with the laws of the State of Texas.

THE WARRANTIES CONTAINED IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.