peterson

MODEL RC-150™
SWELL SHADE OPERATOR
Installation Instructions

Revised 6/8/00
For Version 2.22 Software
Serial Numbers XXXX**W**8 or XXXX**W**16

11601 S. Mayfield Avenue, Alsip IL 60803-6007
Phone Toll Free: 1-800-341-3311
Outside of North America 1-708-388-3311
FAX: 1-708-388-3367 email@petersonemp.com
www.petersonemp.com

TABLE OF CONTENTS

INTRODUCTION:
PREPARATION FOR INSTALLATION

This “Preparation for Installation” section on pages 1-5 contains background information that will help you understand how to install and program your RC-150. Please read and understand this section before beginning your installation.

Precautions

These precautions must be read and understood before applying power!

Personal Safety Precautions

NEVER allow any part of your body to get close to the moving arm on the Motor Module or any part of the Shade Linkage Mechanism while power is applied to the RC-150.

Follow the instructions for securely mounting the Control Module and the Motor Module to prevent possible injury from either part coming loose from its mounting surface.

Do not turn the knurled shaft end on the Motor Module when any power is applied to the Swell Shade Operator; this may cause the arm to begin moving unexpectedly, creating a risk of personal injury.

When you are in any of the programming modes, such that neither the **"RC-150 IS OPERATIONAL"** screen nor the **"POWER DOWN ***WAITING***"** screen is displayed, the system will automatically return to the “Run” mode and display one of these two messages after approximately two minutes if no buttons are pressed. The Crank Arm will then begin moving and travel to the position determined by the Shoe Input if the Organ Rectifier is on, or to the position selected for Powerdown if the Organ Rectifier is not on. ***ALWAYS keep away from the Motor Crank Arm when AC Power is connected to the Swell Shade Operator to prevent possible injury***.

Pressing Function Key **F4** on the front panel of the Control Module will stop the motor from moving in most of the operational modes when it is not labelled for another function on the LCD Message Screen.

Important Precautions for Proper Operation

Be sure to set the voltage selector switch on the Control Module to 110 or 220 Volts, as appropriate.

Organ Positive and Organ Negative rectifier terminals and feed/ return wires must not be electrically connected to earth ground. However, the line cord must be plugged into a grounded AC outlet. ***This is extremely important. The RC-150 will not operate properly if this is disregarded.***

Be sure the organ rectifier voltage is always within the range of 10-27 volts DC under all conditions of loading from the rest of the organ, such as when operating pistons and/or playing large numbers of notes.

Use #24 AWG or larger red (for positive) and black (for negative) wire for the organ rectifier

connections to the two position plug-on terminal (Organ Rectifier Connector) of the Control Module. Double check the polarity of your Organ Positive and Organ Negative connections before applying power to the Swell Shade Operator.

Always press the two-position Organ Rectifier Connector and the six-position Motor Interconnect Cable Connector onto their mating sockets on the Control Module until the connector halves snap firmly in place.

The red Stall Indicator LED will illuminate and power to the motor will be interrupted any time the Control Module tries to move the motor but does not receive an electrical signal back from the Motor Module's Position Sensing Potentiometer via the Interconnect Cable indicating that the motor is indeed moving. The stall light will come on if the Interconnect Cable is not plugged in properly or if the Crank Arm or Shade Linkage Mechanism is jammed.

Support the Interconnect Cable with the supplied cable clamp near the Control Module end to prevent the weight of the cable from applying undue force on the wires or the connector.

Do not cut the Interconnect Cable to a shorter length. Use the full supplied length, and dress any excess cable neatly out of the way.

Double check the tightness of the small screws that hold the wires to the connector halves before applying power and again when the installation is complete.

Do not turn the knurled shaft end by hand except when moving the arm during the initial design and fitting of the Shade Linkage Mechanism, before power is connected to the Swell Shade Operator.

If fewer than eight shoe contacts are available, you may connect a shoe contact to more than one Shoe Input Pin on the Control Module. We recommend that you connect just one shoe contact per Shoe Input Pin starting with #1, and then connect the last contact that makes (when the shoe is advanced to open the shades) to all remaining Shoe Input Pins through pin #8.

Be sure that the Motor Crank Arm is able to rotate a full 360 degrees without hitting any obstructions, preferably even while connected to the Shade Linkage Mechanism.

Note for New Users of the RC-150

"Appendix A" has been provided later in this instruction manual, containing exact step-by-step instructions for installing and configuring your RC-150 for "typical" applications. If you are not yet familiar with how to use this product, we recommend that you follow the steps in this appendix, referring to the appropriate sections of the "main instructions" for more detailed information.

Voltage and Grounding Requirements

IMPORTANT: The **Model RC-150™** is designed to be used on either 105-125 or 210-250 Volt, 50/60 Hertz AC power sources. *IT IS VERY IMPORTANT THAT THE VOLTAGE SELECTOR SWITCH IS SET FOR THE PROPER VOLTAGE BEFORE PLUGGING IN THE LINE CORD.....***FAILURE TO DO SO MAY RESULT IN SEVERE DAMAGE TO THE SWELL SHADE OPERATOR!**

The Voltage Selector Switch is located near the connector for the AC line cord on the front panel of the Control Module. Check the setting of the voltage selector switch. If it must be changed, use a

small blade screwdriver and rotate it so the white dot above "110" or "220" lines up with the pointer for the voltage you require. For installations where power is supplied through other than the USA standard 110-120 Volt receptacle, an appropriate modular line cord compatible with the Control Module's line cord disconnect jack should be available locally. Alternately, you may be able to use a stepping transformer to convert the available voltage source to 110-120 Volts on a USA standard receptacle.

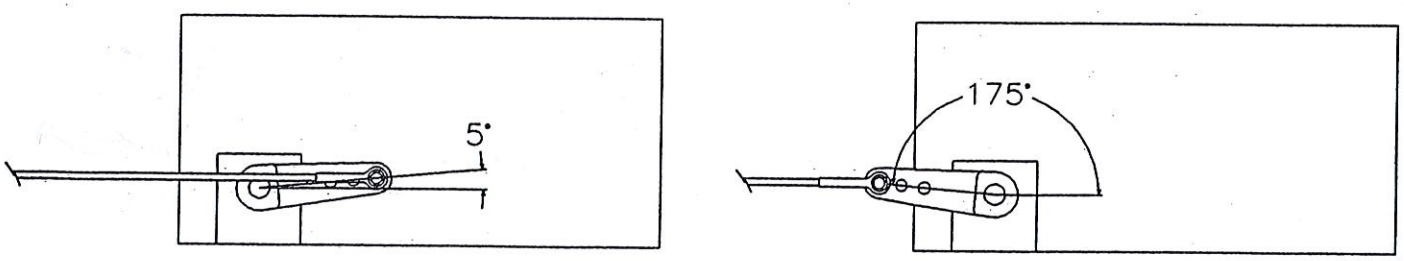
The Model RC-150™ is designed to operate on well regulated organ rectifier voltages in the range of 10 to 27 Volts DC. The voltage from the organ rectifier serves only to signal the switching on and off of the organ power, and to supply the sensing current through the swell shoe contacts and thus indicate the expression shoe's position. The maximum DC current draw from the Control Module is 250 mA. The motive power for moving the swell shades on the Model RC-150 is derived from a built-in A.C. power transformer. This built-in power transformer must be connected to an A.C. power source which is never switched off. If an older rectifier is used, be certain that the voltage does not fall below 10 Volts, even for a brief moment, under conditions of heavy load from the rest of the organ, such as while playing heavy chords and/or operating pistons. A green light is provided which will illuminate whenever the rectifier voltage is present on this Control Module connector.

The RC-150 will not operate properly if there is an electrical connection between the organ's Rectifier Positive voltage and Earth Ground. Such a connection will apply Positive Voltage to all shoe input circuits, and the control module display will indicate that the highest shoe contact is activated. For proper protection against damage to any Peterson solid state equipment due to nearby lightening strikes, neither the Rectifier Negative nor Positive should be connected to Earth Ground. However, the chassis must be connected to earth ground by plugging the line cord into a grounded AC outlet.

Recommended Linkage/ Crank Arm Orientation

For smooth operation of the shades with the Model RC-150 it is ***extremely important*** that the Motor Module be mounted in an orientation which allows the Motor Crank Arm to rotate over nearly the full 170° arc of rotation. This full rotation of the Motor Crank Arm permits the longest possible linear travel of your Expression Shade Trace, along with the strongest possible driving torque from the Motor Module. ***This is likely the single most important criterion for a successful installation.***

To achieve this full rotation, move the carriage bolt in the Motor Crank Arm to the hole that is as close as practical to the gearmotor's output shaft so that you use as short a radius as possible, and design the mounting of the Motor Module so the Connecting Link moves in a direction which is parallel to the Motor Crank Arm. Start the Connecting Link movement from the fully closed position of the expression shades so that the Motor Crank Arm begins its motion in either the range of 0° to 10°, or in the range of 170° to 180°. This is shown in the two figures below:



CRANK ARM ORIENTATION

Minimizing Noise

Before connecting the Motor Module to the Shade Linkage Mechanism, the necessary steps should be taken to minimize noise within the shade system. Possible sources of noise include free play between the Shade Arms and the Expression Shade Trace, and free play within the upper and lower expression shade pivots (bearings). Free play in these parts should be minimized. Also, play can be present at the connection between the RC-150 Motor Crank Arm and the Connecting Link, and between the Connecting Link and the Expression Shade Trace. Rod end swivel joints similar to the type supplied on the Motor Crank Arm are recommended. Consult the factory for additional rod ends if needed.

In some cases you may not be able to position the RC-150 Motor Module in line with the Expression Shade Trace as needed for rigid connection. In these instances, an additional connecting system of some sort must be used. When this additional connecting system is a pulley and cable linkage, a return spring or hanging weight will be required. This has the advantage of minimizing free play and the noise that often results from free play. When using a pulley, the pulley should be as large as possible to reduce losses. Aircraft cable works well for a cable connection to the Expression Shade Trace.

The effect of free play within the Shade Linkage Mechanism can be reduced, if not completely eliminated, by pulling the Expression Shade Trace toward the fully closed position with a spring or weight return. The extra tension of the spring or weight will increase the loading and electrical current draw of the motor. The microprocessor control in the RC-150 compensates for the extra load and retains very satisfactory performance from the Swell Shade Operator under these conditions. Be sure not to exceed the maximum driving torque of the Motor Module (this is 20 pounds at the longest driving point of 2⅞ inches on the factory supplied Motor Crank Arm).

EXCESS FORCE BEYOND OUR SPECIFICATIONS MAY STRIP THE MOTOR GEARS PREMATURELY. STRIPPED MOTOR GEARS ARE NOT COVERED BY OUR NORMAL USE WARRANTY.

We have found on rare occasions that a "squeak" noise develops in the gearmotors after much use. This type of noise is usually caused by glazing of the surfaces of the motor's two brushes. This can usually be corrected by switching the brushes into each other's holding compartment. The brushes are located on opposite sides of the motor under plastic slotted caps.

A soft “singing” sound may be heard from the Control Module when the gearmotor is moving. This sound is caused by inductors that are essential to the operation of the Swell Shade Operator. Much effort has gone into minimizing this noise. If even less noise is required, the Control Module may be enclosed in a simple wooden enclosure with sound absorbing material on the inside.

Linkage Connections

If your expression shade system contains free play, a spring or a weight return can help to minimize noise. When using such a tensioned return system, choose pulleys that are large in diameter (3" or 4"). Plastic or wood pulleys are usually the quietest. The spring should be preloaded and be as long as practical, so that the difference in tension between the open and closed positions is minimal. Do not use excessive spring tension. Use only the tension needed to positively return the shades to the closed position. When using a weight system, the loading is constant throughout the range of travel. Use only enough weight to return the shades effectively. Always have the spring or weight pulling the shades to the closed position and have the swell shade operator pull against the return spring or weight to open.

The Motor Crank Arm is furnished with a rod end swivel joint and a length of (¼-28) fine pitch threaded rod. It is recommended that you make as direct a connection as possible from this threaded rod to the Expression Shade Trace. It will often be necessary to use a length of threaded oak or metal rod which we refer to throughout this manual as a Connecting Link. The other end of the Connecting Link can then be attached to the Expression Shade Trace with a pivot pin of your own fabrication, or you can use an additional rod end assembly identical to the one supplied on the Motor Crank Arm, available from Peterson as Part Number 400777.

If you are using a cable/pulley system instead of a rigid Connecting Link, you may have trouble matching the (¼-28) fine thread of the rod end assembly. Hardware store turnbuckles usually have a coarse (¼-20) thread. We have a ¼-28 fine thread turnbuckle assembly available that will attach to the end of the rod end assembly. The Part Number for this is 400778. If you require these additional parts please send your request to PETERSON ELECTRO-MUSICAL PRODUCTS, INC., 11601 South Mayfield Avenue, Alsip, IL 60482-2476, call toll free 1.800.341.3311, or FAX us at 1.708.388.3367.

(New users return to step 2, page 29).

INSTALLATION STEPS

Mounting the Control Module

The Control Module should be securely mounted at a location within fifteen feet of the Motor Module, and within 6 feet of an A.C. power outlet that is always live (not switched with the chamber lights, organ power, etc.). All of the connection points and adjustments of interest to the installer are located on the front panel of the Control Module.

With the rectifier power off and the line cord unplugged, connect Organ Positive and Organ Negative to the two position connector on the Control Module. Use wire conductors which are #24 AWG or larger for the connection between the organ rectifier and the Control Module. Remember that this organ rectifier voltage must remain within the range of 10-27 Volts DC under all conditions.

Installing the Motor Module

The base plate of the Motor Module has four rubber grommets with holes in them. These grommets provide vibration dampening. When bolting the module to its mounting surface, use the supplied #12 screws and large flat washers if mounting into studs. Screws are provided in 1-¼" length for use when mounting into exposed studs, and 2" long screws are provided for use when they must be run through drywall before entering the studs. Be sure that the screws “bite” securely into the mounting surface for a strong, permanent mount. If no studs are available, comparably sized toggle bolts or other specialty mounting hardware must be used.

Once the Motor Module is securely mounted, temporarily plug the Motor Interconnect Cable connector into its Control Module socket. Support the weight of the cable near the Control Module with the supplied cable clamp to avoid excessive force on the connector which could cause it to come unplugged. Neatly dress the cable to the wall of the expression box, chamber or organ structure. The Model RC-150 uses a shielded Interconnect Cable between the Control Module and the Motor Module. ***Do not*** cut the cable to length as is recommended for the Model ***RC-100!*** Wrap any excess cable neatly and position it in an out-of-the-way location. Now carefully unplug the Interconnect Cable from the Control Module. The Shade Linkage Mechanism should not be connected to the Motor Module at this time.

Wiring the Expression Shoe to the Control Module

There is one 9 pin in-line connector located on the Control Module front panel. An additional 8 pin connector is used on 16 stage models and covered with a plastic extrusion on 8 stage models. The terminal marked "+" is fed internally with Organ Positive voltage, and may be used as a source for the feed to the expression shoe contacts. It is not necessary to use this pin to feed the expression shoe. Any source of Organ Positive may be used. **CAUTION: Do not connect Organ Negative to the pin labelled "+" on the nine pin connector. Damage to the Swell Shade Operator would result. Consult the factory for polarity inverters if Organ Negative must be used for the shoe contacts.**

The remaining terminals 1 through 8 are to be connected in sequence to the terminals on the shoe. EXAMPLE: The pin labeled #1 on this connector is wired to the first contact that is made when the shoe is advanced toward the open direction. Pin #2 is to be wired to the second contact made when the shoe is further advanced toward the open direction. When using a 16 contact expression shoe system, wire contacts #1 through #8 to the left-most connector (the one nearest to the 2-position connector used for the organ rectifier voltage input). Then wire the shoe contacts #9 through #16 in sequence to the corresponding contacts on the second connector.

If the expression shoe contacts are electrically configured to sequentially make as the organist's heel moves downward to close the shades, wire the contacts to the connector pins so that the first shoe contact which makes is connected to the highest numbered pin (#8 or #16), the second shoe contact which makes is wired to the next highest pin, etc. A prompt on the Control Module LCD Message Screen will allow you to reconfigure the RC-150 for this expression shoe contact arrangement. Please see the later section about PROGRAMMING THE RC-150 for further information.

After the expression shoe contacts are wired to the Control Module, unplug the shoe contact cable in preparation for the initial setup steps below.

(New users return to step 16 on page 32).

INITIAL SETUP

The procedures in this section will configure the Swell Shade Operator's most basic parameters for your installation. Before continuing, be sure the Motor Crank Arm is clear of any obstructions. Plug the Interconnect Cable into the Control Module, and plug the line cord into the AC outlet. The Organ

Rectifier should remain off, and the Shade Linkage Mechanism should not be connected to the Motor Module.

Setting the Motor Direction to Open the Shades

The RC-150 is shipped from the factory set so that the Motor Crank Arm rotates in a clockwise direction to open the expression shades, as defined by the small diagram on the Control Module's front panel. If counterclockwise motion of the Motor Crank Arm is required to open the shades, press the MODE/ ENTER key to reprogram the direction from the Main Menu. Next, press Function Key F1 **(**labelled "**PROG**"**)**, and choose **CCW** for counterclockwise Motor Crank Arm direction to open the shades. The display will confirm your choice of counterclockwise (or clockwise) direction for a few seconds. When you see the prompt for setting the Motor Crank Arm to a new closed position, press Function Key F3 (labelled "**RUN**").

Adjusting the Initial Position of Motor Crank Arm

After setting the RC-150 Swell Shade Operator for clockwise or counterclockwise rotation of the Motor Crank Arm as described above, the Motor Crank Arm should be positioned so it is in line with the Connecting Link. This is explained on page 3 in the section titled "Recommended Linkage and Motor Crank Arm Orientation". In most cases it will be easiest to position the Motor Crank Arm by using a set-up procedure described below and illustrated in Figure 2. This method allows the Motor Crank Arm to be set to virtually any starting position, without removing the Motor Module cover. The Motor Module contains a position sensing potentiometer. The adjustment is made by rotating the shaft of this position sensing potentiometer relative to the sprocket gear which provides the position information.

WARNING: Never turn the knurled shaft end by hand at any time when AC power is connected to the Swell Shade Operator, or when the Shade Linkage Mechanism is connected to the Motor Module, or after the initial position of the Motor Crank Arm is adjusted. Doing so could cause the Motor Crank Arm to begin moving unexpectedly possibly causing personal injury, damage to the Shade Linkage Mechanism, or disruption of the initial position adjustment.

(New users return to step 12 on page 30).

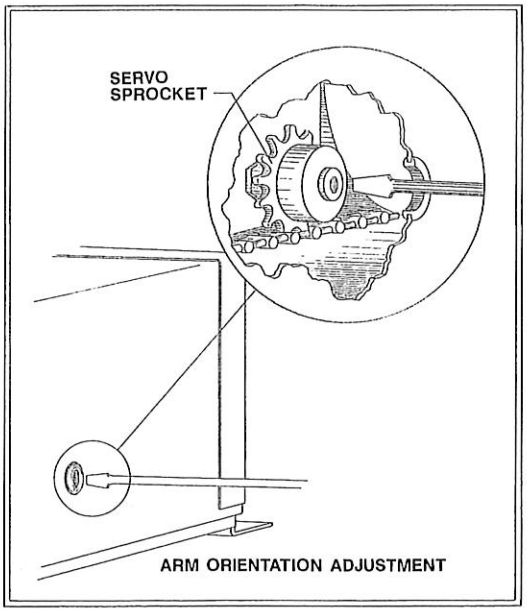


FIGURE 2

1. Before making any adjustments, be sure the Shade Linkage Mechanism will not bind or jam at any position around the Motor Crank Arm's 360° rotation. If in doubt, disconnect the Connecting Link. Certain procedures below could cause the Motor Crank Arm to rotate fully 360°.

2. If the expression shoe contacts were connected to the Control Module, unplug the Shoe Input Connector from the Control Module before proceeding.

3. With the AC line cord plugged in and the organ rectifier off, the LCD Message Screen will display

the "**RC-150 IS OPERATIONAL**" screen. Press the MODE / ENTER key to access the Main Menu. Next, press Function Key F1 (labelled "**PROG**"). Choose Function Key F4 (labelled "**N/C**" for No Change) for the direction of Motor Crank Arm motion since you have already chosen the direction of motion in the section entitled "Setting the Motor Direction To Open The Shades". The display will confirm the chosen direction of motion for a few seconds.

You will now be presented with the question: "**DO YOU WISH TO SET THE ARM TO A NEW CLOSED POSITION?**". Select Function Key F1 (labelled "**YES**").

4. To reorient the Motor Crank Arm to the required "shades closed" position, insert a narrow tipped (1/8" or narrower) straight blade screwdriver through the hole in the Motor Module's cover until it contacts the slot in the center of the servo pot sprocket. See Figure 2. Rotate the servo pot shaft by small increments, IN THE PROPER DIRECTION ONLY as follows:

   --If the Control Module is configured for "CLOCKWISE TO OPEN", rotate the servo pot shaft *Counterclockwise*.

   --If the Control Module is configured for "COUNTERCLOCKWISE TO OPEN", rotate the servo pot shaft *Clockwise*.

   Rotating the shaft in the "wrong" direction may cause the arm to rotate abruptly 180° or more.

5. Using small increments of pot shaft rotation will cause the gear motor to move slowly. This will allow good precision while adjusting the Motor Crank Arm. If the desired position is missed, bring the arm through a full rotation and try again. Do not try to "back up" by rotating the servo pot shaft in the opposite direction.

6. Press the **MODE / ENTER** key when the Motor Crank Arm is at the correct starting position for fully closed expression shades. See the section entitled "PROGRAMMING THE RC-150" for further information concerning the screen prompts which follow this procedure.

As an alternate to the above software procedure, the Motor Crank Arm may be removed from the motor shaft and then repositioned at 90° increments. Simply loosen the set screw on the Motor Crank Arm and reposition the arm to the next 90° increment on the motor shaft. Retighten the set screws firmly. Note that when repositioning or replacing a Motor Crank Arm, make sure a set screw bears down squarely on the flat of the motor shaft to prevent the Motor Crank Arm from coming loose. At this time, disconnect all power to the RC-150 and then connect the Shade Linkage Mechanism to the Motor Crank Arm.

We recommend that at this time you adjust the Shade Linkage Mechanism so the shades are fully closed, and then rotate the knurled shaft end approximately 170 degrees to see if this results in the shades being fully open. If not, choose a different hole in the Motor Crank Arm or make other adjustments in the Shade Linkage Mechanism so that about 170 degrees of rotation results in the desired full range of travel of the expression shades. ***This is an important but often neglected part of achieving smooth, quiet movement of the shades under a variety of playing conditions.***

PROGRAMMING GUIDE

Following is a step-by-step guide through the prompts (messages on the LCD Message Screen) that allow you to program the Peterson Model RC-150 Swell Shade Operator. The Shoe Contact Cable,

Interconnect Cable, and line cord must all be plugged in before continuing. It is not necessary to have the Organ Rectifier turned on or even connected during programming. The first few screens are informational. The system will automatically step through these first messages when the Control Module is first plugged in or when the organ rectifier is first turned on. It will then go into the Run (normal operation) mode until you press the **MODE/ENTER** button. In Run mode the message "**POWERDOWN OPEN ***WAITING***"** will be displayed if the Organ Rectifier voltage is not present. Otherwise, the message "**THE RC-150 IS OPERATIONAL**" will be displayed and the current shoe position and shade location will be shown.

Initial Messages

WELCOME TO THE
PETERSON
RC-150 SWELL SHADE
OPERATOR

MOTOR DIRECTION IS
SET AT CLOCKWISE
TO OPEN SHADES

RC-150 IS OK AND
RUNNING. PRESS AND
HOLD THE MODE SWITCH
TO PROGRAM

THE RC-150
IS OPERATIONAL
SHOE POSITION- XX
SHADE LOCATION- XXX

The Power On Operational Screen (above) **OR** the Power Off Operational Screen (below) will appear, depending on whether or not the organ rectifier is connected and under power.

POWERDOWN
OPEN
*****WAITING*****

Press the Mode/Enter Button ***after*** the word “Waiting” appears as shown.

MAIN MENU PLEASE SELECT MODE Software Rev. X.XX PROG ADV RUN DIAG

After 45 seconds the system automatically returns to RUN mode if no buttons are pushed.

Basic Programming

- **MOTOR DIRECTION**
- **INITIAL ARM POSITIONS**
- **FACTORY STANDARD SETTINGS**
- **SHADE LOCATIONS**
- **SPEEDS**

From the Main Menu press the "**PROG**" button to begin programming

Setting the Motor Direction to Open Shades

(This may have been set in the "INITIAL SETUP" section above. If so, press "**N/C**" to skip)

MOTOR DIRECTION SET AT (CW)(CCW) TO OPEN. CHANGE DIRECTION? CCW CW N/C

Either "**CW**" (Clockwise) or "**CCW**" (Counter Clockwise) will be displayed to show the current setting. Press the button that represents the desired new setting or **N/C** for No Change. After one of the function keys is pressed, a confirming message will be displayed for a few seconds:

MOTOR DIRECTION IS SET AT CLOCKWISE TO OPEN SHADES

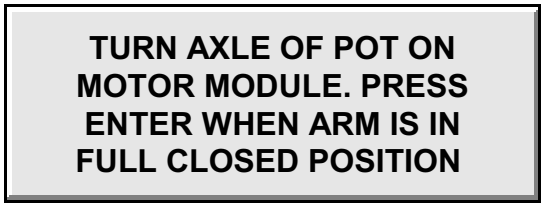
Adjusting the Initial Position of the Motor Crank Arm

(This may have been set in the "INITIAL SETUP" section above. If so, press "**NO**" to skip.)

1. Before making any adjustments, disconnect the Connecting Link from the Motor Crank Arm unless you have already verified that the arm is free to rotate 360 degrees without binding. Certain procedures below could cause the Motor Crank Arm to rotate fully 360°.

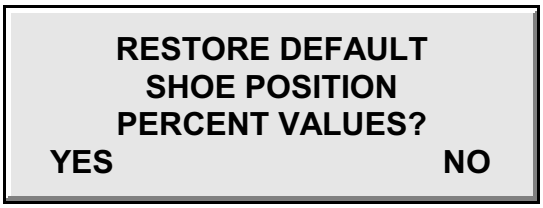
2. If the expression shoe contacts were connected to the Control Module, disconnect them by unplugging the Shoe Input Connector before proceeding.

If the motor has not been connected to the Control Module yet, you can press **RUN** to exit and then unplug the RC-150's line cord and Org +/- connectors before plugging the motor module's Interconnect Cable into the Control Module. After plugging on the Interconnect Cable, reconnect the line cord and Org +/- connectors. Wait for the word "**WAITING**", then press **ENTER** and then **PROG** to get back. If you select **NO**, you will jump to the prompt about factory *default* (standard) system values. If **YES**, continue.



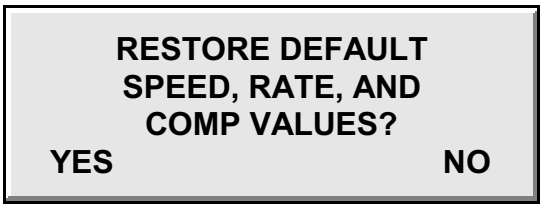
Insert a narrow tipped flat blade screwdriver through the hole in the Motor Module's perforated cover and into the slot in the end of the axle shaft on the feedback potentiometer. Turn the screwdriver slightly in the direction (Clockwise or Counterclockwise) opposite the direction that the Motor Crank Arm moves to open the shades. As the potentiometer's axle shaft is moved in small increments, the motor will move. When the arm is in the desired position, press the Enter button. NOTE: If the arm moves beyond the desired position, continue turning the screwdriver until the arm goes all the way around again. Do not back up by turning the screwdriver in the other direction. Disconnect the Shade Linkage Mechanism from the arm if rotating the arm a full 360 degrees would cause binding and possible damage. *This should be considered a gross adjustment of the fully closed position. Another procedure may be used later to set the position more precisely.*

Factory Standard Settings



Selecting **YES** for these two prompts will cause the system to keep the fully open and fully closed shade positions that are currently set into memory, but recalculate all intermediate shade positions (that is, position numbers 1 - 7 or 1 - 15) by treating each factory default position number as a percentage of the full range from fully closed to fully open. For example, if the full open position had previously been set to drive the Motor Crank Arm to a position 100° away from the fully closed

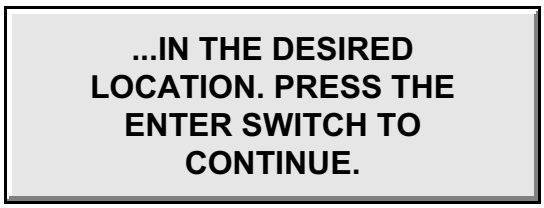
position, then position 1 on an eight-stage model would be calculated at 14% of 100° = 14° from the fully closed position. If you select **NO**, continue.



Selecting **YES** for these two prompts will restore all programmed values other than shade positions to factory default settings. Note that your selection of motor direction (**CW** or **CCW** direction to open the shades) will ***not*** be changed by restoring factory default values.

Setting Shade Locations

If you choose **NO**, you will skip to the prompt for "SETTING SPEEDS". If **YES**, continue.



The two message screens shown above will alternate until you press the **ENTER** button

If **SAVED** is selected, shades will slowly move to the fully closed position stored in memory. Choosing **PRESENT** will allow the shades to move only when one of the **JOG** buttons are pressed. Using **SAVED** could try to force shades to a position set in memory which is beyond their physical limit and is not recommended when setting up a new installation for the first time.

Use **JOG <** and **JOG >** buttons to position the shades, then press the **ENTER** button.

This confirming message will appear briefly.

If **SAVED** is selected, shades will slowly move to the fully open position stored in memory.

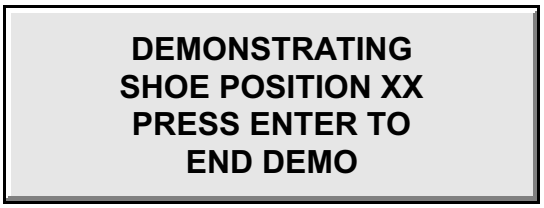
Use **JOG <** and **JOG >** buttons to position the shades, then press the **ENTER** button.

This confirming message will appear briefly.

This prompt will repeat for each shoe position between Fully Closed and Fully Open.

This confirming message will appear briefly.

If you press **YES**, then shades will move to the locations set for the fully closed shoe position, then repeatedly open and close through all shoe positions in order, pausing briefly at each position.

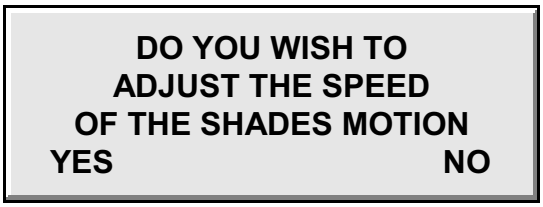


Software Version 2.16

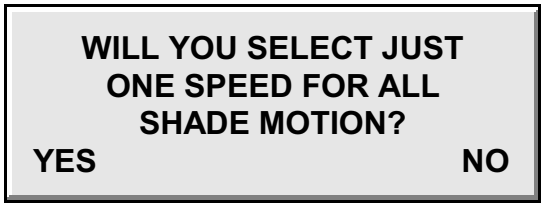
Software Version 2.19 and later

When **ENTER** is pressed, the shades will stop wherever they are and you will continue to the following prompt. On units with 2.19 or later software, press **EXIT** to continue or **CHANGE** to jump back to the beginning of the “Setting Shade Locations” section.

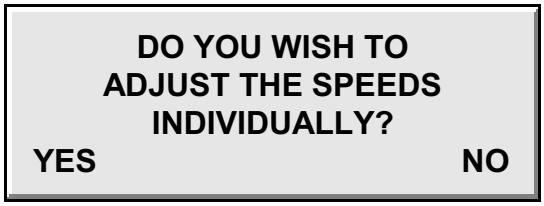
Setting Speeds



If you select **NO**, you will be returned to the Main Menu. If **YES**, continue.



If you select **YES**, you will be asked to choose one overall speed. If **NO**, continue.



If you select **NO**, you will be returned to the Main Menu. If **YES**, continue.

Select the desired speed to be used if the shoe is changed by 1 contact position or **N/C** for no change. Repeat this step for changes of 2, 3, 4, and additional contact positions.

If you choose **YES**, the two prompts above are repeated for shoe position changes in the closed direction. If **NO**, the closed speeds will be the same as the open speeds and you will be returned to the Main Menu.

MAIN MENU
PLEASE SELECT MODE
Software Rev. X.XX
PROG ADV RUN DIAG

If you choose **RUN** the RC-150 will return to its normal operating mode. Otherwise, continue.

Advanced Programming

- **SETTING "SYSTEM PARAMETERS"**
- **REASSIGNING RATE NUMBERS TO SPEEDS**
- **CHANGING THE COMPENSATION FACTOR**

The System Parameters ("**SYS**") section allows you to set what the shades do when the organ power is turned off, whether shoe contacts make or break to open shades, how the power shuts down when the motor is stalled (jammed), and whether the motor's electro-magnetic braking is applied upon deceleration. The Rate Number ("**RATES**") section lets you control speed and deceleration to match the inertial characteristics of the shade system. The Compensation Factor ("**COMP**") section gives you control over how quickly the system adjusts the power delivered to the gearmotor upon acceleration.

MAIN MENU
PLEASE SELECT MODE
Software Rev. X.XX
PROG ADV RUN DIAG

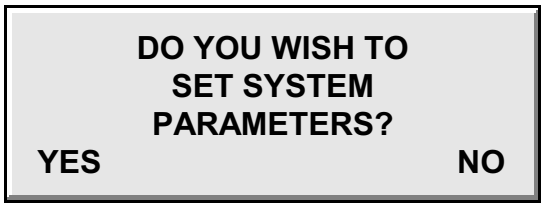
From the Main Menu, press the **ADV** button.

ADVANCED MENU
PLEASE SELECT MODE

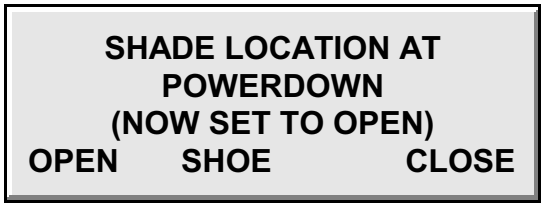
SYS RATES COMP MAIN

Setting System Parameters

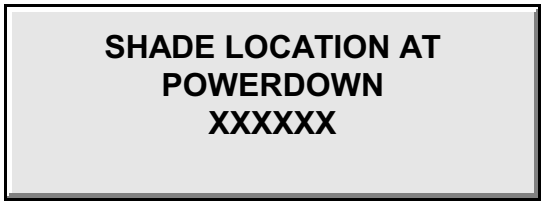
From the Advanced Menu press the **SYS** button.



If you select **NO**, you will be returned to the Advanced Menu. If **YES**, continue.



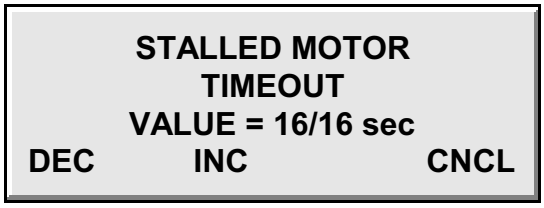
Select where the shades should move when the organ rectifier is turned off. Choosing **SHOE** will make the shades stay in whatever position they were in when the organ was turned off.



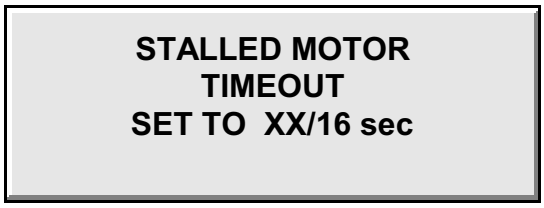
This confirming message will appear briefly.

Select the shoe contact configuration that applies to your installation. On Peterson expression shoes, closing the contacts should make the shades **OPEN**.

This confirming message will appear briefly.

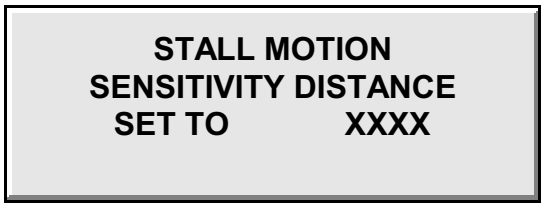


Press the **DEC**rement or **INC**rement button if you wish to change the amount of time that the motor may be stalled before power to the motor is automatically turned off. Press the **ENTER** button when you are satisfied with the number displayed. You may also press the **CNCL** (Cancel) button to continue without changing the Stalled Motor Timeout Value.

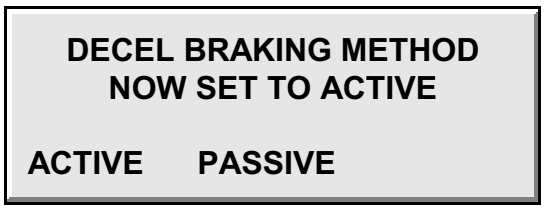


This confirming message will appear briefly.

Press the **DEC**rement or **INC**rement button if you wish to change the threshold of distance used to determine whether the motor is stalled. See the “Principles of Operation” section for more details. Press the **ENTER** button when you are satisfied with the number displayed. You may also press the **CNCL** (Cancel) button to continue without changing the Stall Motion Sensitivity Distance.



This confirming message will appear briefly.



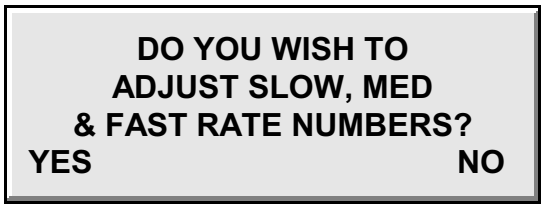
Select the desired method of deceleration. If **ACTIVE** decel is chosen, a magnetic brake is applied when the shades are approaching their destination position. This gives a more precise stopping position than passive deceleration. Passive decel may be chosen when the shade system has high inertia to provide a smoother stop when the exact positioning is not critical. *NOTE: Selecting* **PASSIVE** *braking will disable the "***DECEL RATE***" and "***DECEL DISTANCE***" settings found under the* Rates Menu *explained in the next section. Therefore, there is no need to adjust these parameters if* **PASSIVE** *braking is chosen.* After setting the method of deceleration, you will be returned to the Advanced Menu.

This confirming message will appear briefly.

Press the **MAIN** button if you wish to return to the Main Menu. Otherwise, continue.

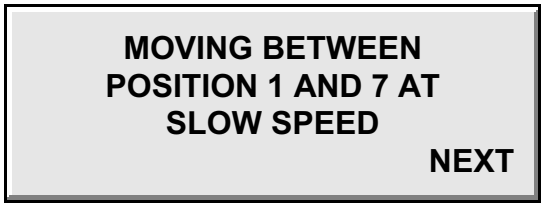
Assigning Rate Numbers to Speed Settings

From the Advanced Menu press the **RATES** button.

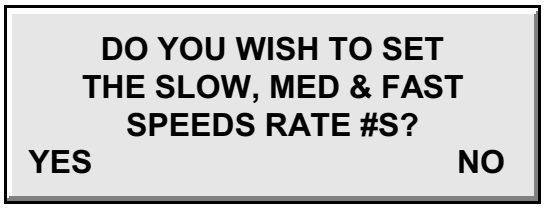


If you select **NO**, you will be returned to the Advanced Menu. If **YES**, continue.

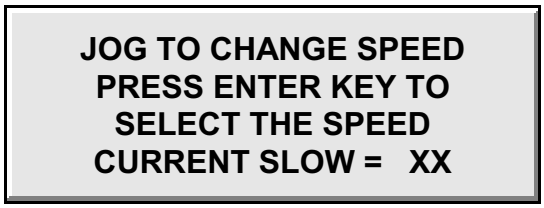
If you select **NO**, you will skip over the demo. If **YES**, continue.



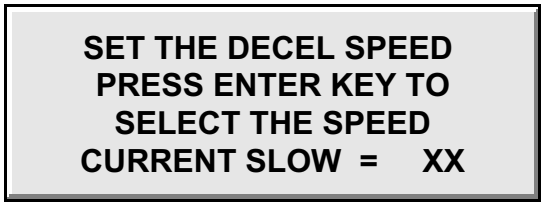
Advance to the demonstration of Medium and Fast speeds by pressing the **NEXT** button.



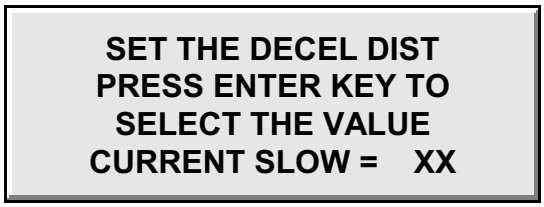
If you select **NO**, you will be returned to the Advanced Menu. If **YES**, continue.



Use the **JOG<** and **JOG>** buttons to display the desired rate number (1 to 100) for Slow Speed. Record the number selected in the "Blank Chart" on page 36, or at least make a mental note for use in the next step. Press the **ENTER** button when you are satisfied.



The Decel Rate number selected here will determine how much power is delivered to the motor when the arm position is within the Decel Distance of its destination position. This number should usually be 50% to 65% of the Main Rate Number. Making it lower will cause the shades to move more slowly when they are within the Decel Distance of their new shade location. Making it higher may cause the shades to stop abruptly.



The Decel Distance number selected here will determine at what angular distance before the final destination point the power to the motor is cut back to the lower power which is determined by the Decel Rate. Each time the Decel Distance number is increased by 1, the motor will begin decelerating about .0425° sooner. **For a more pronounced slowdown before the shades stop, *increase* this number**. The maximum value is 1000.

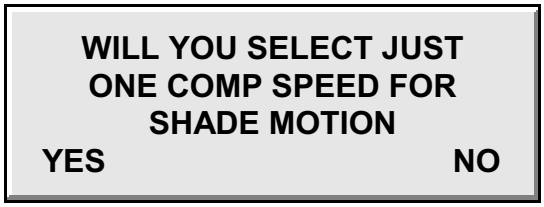
Repeat the same steps to assign Rate Numbers to Medium and Fast speeds. You will then be returned to the Advanced Menu.

Press the **MAIN** button if you wish to return to the Main Menu. Otherwise, continue.

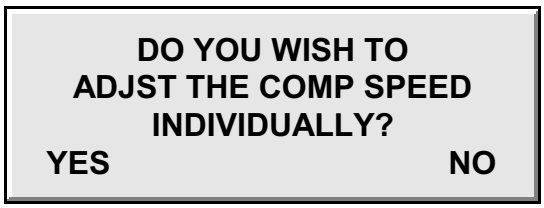
Setting the Compensation Factor

From the Advanced Menu press the **COMP** button.

The Compensation Speed is used to determine how quickly the motor adjusts to changes in its load. This affects acceleration and performance under some resonant conditions such as when a return spring is used on the shades. This is explained more completely in the "Principles of Operation" section of this manual. If you select **NO**, you will be returned to the Advanced Menu. If **YES**, continue.



If you select **YES**, you will be asked to select one overall Compensation Speed. If **NO**, continue.



If you select **NO**, you will be returned to the Advanced Menu. If **YES**, continue.

Select the desired Compensation Speed. Repeat this step for all 8 or all 16 possible numbers of position change. You will then be returned to the Advanced Menu.

This confirming message will appear briefly, followed by the Advanced Menu screen..

From the Advanced Menu press the **MAIN** button to return to the Main Menu.

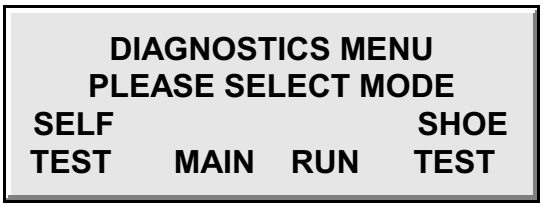
Press the **RUN** button if you wish to return to normal operating mode. Otherwise, continue.

Diagnostics Menu

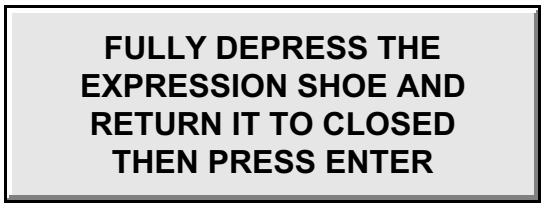
-SELF TEST (NOT IMPLEMENTED AT THIS TIME)
-SHOE TEST

From the Main Menu, press the **DIAG** button.

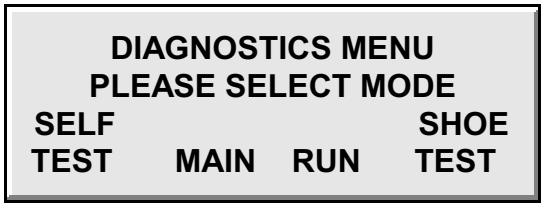
Performing the Shoe Test



From the Diagnostic Menu press the **SHOE TEST** button



This test verifies whether the shoe contacts and wiring correctly apply a voltage to the shoe input pins of the Control Module. Press **RETEST** to repeat, or **DIAG** to return to the Diagnostic Menu.



Press the **RUN** button to exit the menu system and return to normal operation of the RC-150. Press the **MAIN** button to return to the Main Menu for access to further configuration menus.

SUPPLEMENTAL INFORMATION

Glossary of Key Terms

CONNECTING LINK: Any rigid member that may be provided by the organbuilder to connect the Motor Crank Arm to the rest of the Shade Linkage Mechanism.

CONTROL MODULE: The part of the RC-150 containing the LCD Message Screen, main control circuitry, power transformer, and provisions for electrical connections.

DECEL DISTANCE. A number 0 - 1000, that may be assigned to SLOW, MED, and FAST.

DEFAULT: The terms “Default” or “Factory Default” refer to a normal “standard” setting that may be returned to as a typical setup starting point.

EXPRESSION SHADE TRACE: A member, usually made of wood, that spans between the Shade Arms on each individual expression shade, effectively connecting them all together so they move together.

FUNCTION KEY: Any one of the four buttons labelled "F1" through "F4" on the front panel of the Control Module. The word or abbreviation in the bottom row of the LCD Message Screen indicates the purpose of the Function Key below it when that particular message is displayed on the screen. *NOTE: WHENEVER IT IS NOT ASSIGNED TO SOME OTHER FUNCTION, FUNCTION KEY F4 SERVES AS AN ABORT FUNCTION TO STOP THE MOTOR FROM MOVING.*

INTERCONNECT CABLE: The heavy, shielded, 15 foot long "umbilical" cable that is connected to the Motor Module and designed to plug into the front panel of the Control Module.

LCD (LIQUID CRYSTAL DISPLAY) MESSAGE SCREEN: The 20 character by 4 row screen on the front panel of the Control Module used to present a variety of prompts and status information.

MENU: Any one of several groups of prompts that will be displayed on the LCD Message Screen to enable the organbuilder to configure the RC-150 for a particular installation. You may refer to the flow chart on page 42 to learn about the RC-150's menu system.

MOTOR CRANK ARM: The cast metal lever on the output shaft of the gearmotor that serves as a connection point to some part of the Shade Linkage Mechanism.

MOTOR MODULE: The part of the RC-150 consisting of a gear motor and position sensing potentiometer assembly inside a vented steel enclosure.

NEW USER'S GUIDE: Appendix A contains a step-by-step programming procedure that can be followed by installers who are not yet familiar or comfortable with setting up the RC-150. This is designed to lead new users through the process with a minimum of explanation of why they should take each step. There are numerous referrals to the specific sections where more information can be found, as well as notes at the end of these sections to guide you back to the correct place within the appendix.

PROMPT: A question or message on the LCD Message Screen that directs the organbuilder to take some action.

RATES: The numbers 0 - 100 that may be assigned to SLOW, MED, and FAST are called RATES

or RATE NUMBERS and specifically the **MAIN RATE** and the **DECEL RATE.**

SHADE ARM: The "bell crank", block or bracket mounted on each individual expression shade to allow attachment to and clearance for the Expression Shade Trace.

SHADE LINKAGE MECHANISM: The complete set of linkages, bell cranks, a Connecting Link, an Expression Shade Trace, and any other members that may connect individual expression shades to each other and to the Motor Crank Arm.

SHADE LOCATION: The position of the expression shades or Motor Crank Arm, or the number from 0 to 100 that represents this position.

SHOE INPUT CABLE: A cable containing a separate conductor from each expression shoe contact to a connector that may be plugged onto pins which protrude through the front panel of the Control Module.

SHOE POSITION: The position of the expression shoe or the number from 0 to 8 (or 16) that represents this position.

SPEEDS: The words SLOW, MED, and FAST in the context of how quickly the motor moves.

STALL INDICATOR LED: A red indicator on the front panel of the Control Module that illuminates when the RC-150 has interrupted power to the gearmotor after detecting that a stall condition exists. The stall indicator can be reset simply by moving the expression shoe after the cause of the stall is corrected.

WATCHDOG TIMER: A software-based provision built into all Control Modules that have the letter "W" in the serial number, which monitors whether the system's microprocessor is operating normally and automatically restarts the micro if external conditions should cause it to stop running.

Principles of Operation

Advanced microprocessor motor control circuitry and software are used in the Peterson Model RC-150 Swell Shade Operator. The Model RC-150 consists of two separate modules: the Control Module which contains the microprocessor circuitry, and a Motor Module (which is identical to the Motor Module we have been supplying with our Model RC-100 except for a new shielded Interconnect Cable). The two modules are connected together by this 15-foot long Interconnect Cable. The Motor Module contains a 24 Volt D.C. gearmotor and motor shaft position sensor. Signals from the expression shoe and motor shaft position sensor are sent to the microprocessor in the Control Module. The microprocessor performs very rapid calculations of the many motor operating factors whenever the expression shoe is moved, and regulates power to the motor so the expression shades will smoothly, precisely move to the desired full open position.

The microprocessor motor control provides very accurate positioning of the expression shades and excellent motion control for slow, medium and fast movement between shade locations. When the expression shoe position changes, the Control Module software examines first the difference in expression shoe position from where it was previously set. It then determines the appropriate motor speed based on the shoe position change. On an 8 stage shade system, a one or two position change in the expression shoe might typically suggest that the shades should move slowly. Expression shoe movements of three or four positions would most likely dictate a medium speed for shade movement, and shoe contact changes of five or greater suggest a fast speed for the shades. The "factory default" (standard) settings for the RC-150/ 8 stage follow this pattern. After determining a Slow, Medium or Fast speed for the shade motion, the memory is examined for the shade location corresponding to the new expression shoe position. The power required to move the shades to the new position at the desired speed is computed and sent to the motor.

Each of the three speeds is preprogrammed with either factory defaults or other values selected by the organ technician for a Main Rate, a Deceleration Rate, and a Deceleration Distance. The Main Rate is a number between 1 and 100 and is proportional to the maximum possible speed of the motor. The Motor Module will be operated at the Slow, Medium, or Fast Speed Main Rate for most of the distance of required motion. With input from the motor position sensor, the microprocessor always knows the location of the expression shades. When the shades are in motion, and reach a predetermined Deceleration Distance from the destination location dictated by the expression shoe contacts, the motor's rate is changed to the Deceleration Rate (which is usually a number between 50% and 65% of the Main Rate for each particular speed). Finally, as the shades almost reach their desired position, forward power is removed from the motor. For this very short fixed distance, magnetic braking and controlled deceleration is applied to the motor if **ACTIVE** Braking has been chosen. If **PASSIVE** Braking is selected, the shades are just allowed to coast to a stop after they reach the Decel Distance point.

The Deceleration Distance and the Deceleration Rate are very interactive factors and may be selected for the smoothest possible operation of the expression shades. This adjustment also helps to prevent the shades from banging into one another when closing to position zero. Deceleration Distance is selected as the shortest reasonable distance so that the shades may stop smoothly. Choosing a value of Deceleration Rate in the range of 50% to 65% of the Main Rate allows the shade movement to most smoothly decelerate down to almost zero, until the point of Active Braking. If the Deceleration Distance is too short, the shades may have more momentum than can be stopped smoothly. Conversely, too long a Deceleration Distance can have the effect of creating two distinct speeds before the shades stop moving. It is often useful to set the Decel Distance Number large enough to give two distinct speeds and then lower the number until very smooth deceleration is achieved.

While the motor is moving, the operating parameters are constantly being monitored by the control

circuitry. Depending upon the various loading conditions of shade resistance and inertia, whether or not a spring or hanging weight return system is installed, and other possible factors, these conditions may dictate that the power sent to the motor be varied while the shades are moving. Close monitoring of the motor position sensor permits the microprocessor to send correction signals to the motor and to vary the power which it is sending to compensate for any varying load conditions. Selection of how quickly this COMPENSATION occurs is built into the Advanced Menu section of the software.

Factory default values have been provided which should give very satisfactory performance in typical installations. The operating parameters of the Full Open and Full Closed shade positions will always have to be set when first installing the Model RC-150, along with adjusting the initial position of the Motor Crank Arm. These are adjusted in the PROG section under the Main Menu as described above in the PROGRAMMING section of these instructions. In that same sequence, the choice may also be made for Slow, Medium, and Fast speeds for all possible expression shoe increments of Shade Opening and Shade Closing.

The RC-150 includes a safety factor for both the Motor Module and the mechanical integrity of your shade linkage system should anything block their intended range of travel. Whenever the shades are supposed to be moving and the motion sensor detects that shades are not in motion, it removes power to the Motor Module and illuminates a STALL INDICATOR LED on the Control Module. To recover from a stalled motor shutdown condition, simply move the expression shoe to a new position. The motor will again attempt to move the shades to the predetermined location.

NOTE: In the early part of the installation procedure, you are requested to answer some questions (prompts) from the menu screens of the Control Module while the Motor Module is disconnected. If you then continue through the prompts for the setting of the shade locations before connecting the Motor Module, the Control Module will attempt to move the motor. Due to the Interconnect Cable being disconnected, a stall condition will be sensed by the Control Module because it will not be receiving any motion position information. At this point, first ensure that the Motor Crank Arm is disconnected from the Shade Linkage Mechanism. Then carefully plug the Interconnect Cable into its receptacle on the Control Module. The RC-150 will now function correctly.

STALL information is determined from the position sensor and sent to the Control Module via the Interconnect Cable. When the motor is supposed to be moving but no changing position information is sent to the Control Module, it will indicate a STALLED MOTOR condition. There are two parameters which the Control Module uses to determine the STALL condition. STALL SENSITIVITY DISTANCE corresponds to a very small value of Motor Crank Arm rotation. Values for the STALL SENSITIVITY are input in single digit numbers which each correspond to approximately .0425 degrees of Motor Crank Arm rotation. When the shades are supposed to be moving, and the motion being sensed is less than the Stall Sensitivity Distance setting for a duration of time greater than the value of the Stalled Motor Timeout, the Control Module shifts into the Stalled Motor Mode and removes power from the motor. The Stalled Motor Timeout value may be selected in increments of 1 / 16 of a second. The factory default values are 8 for Stall Sensitivity Distance, and 16 (/16ths of 1 second) for the Stalled Motor Timeout.

If you would like to optimize the settings of the RC-150 for the specific characteristics of your shade system, the Advanced Menu provides the choices for the System Parameters (Shade Location at Powerdown, Closing the Shoe contacts to make the shades open or close, setting the values for a Stalled Motor Timeout [with increments of 1/16 second], Stalled Motor Sensitivity Distance, and the choice of Active or Passive motor braking). The Slow, Medium and Fast Speed values for Main Rate, Deceleration Rate and Deceleration Distance may be set from the RATES choice in the Advanced Menu. Choosing COMP from the Advanced Menu gives the choice of Extra Slow, Slow, Medium, and Fast Compensation in the motion control circuitry. Compensation may be chosen as one value for all increments of expression shoe changes, or on an individual basis according to how many

positions of change are detected from the expression shoe.

Whenever choosing to optimize the RC-150 for a specific installation, if you find that your settings have made the shades move in a jerky or undesirable manner (particularly if you find that the performance continues to get worse as you input new changes), you may always return the RC-150 to the factory default settings. The performance should always be reasonably good using these numbers, and this may be a better starting point for continued adjustments.

RC-150 Control Modules having serial numbers containing the letter "W" in the form "XXXX **W** 8" or "XXXX **W**16" incorporate a "**WATCHDOG TIMER**" provision designed to automatically restart, or "reboot", the system's microprocessor if an external disruption should ever cause the unit to stop operating normally. Another provision built into "type W" Control Modules causes a reboot each time the organ rectifier voltage provided to the RC-150 rises through a threshold of approximately 7.5 Volts. When the RC-150 is being rebooted, a series of introductory messages are displayed on the LCD Message Screen, and start up of the device is delayed by approximately 20 seconds. Beginning in May, 2005, the letter "W" in the serial number was replaced by the letter "U" to signify a further internal design change.

You are welcome to telephone us for assistance at any time during normal business hours at 1.800.341.3311 or 1.708.388.3311.

(New users return to step 15 G, H, or I on page 32)

Appendix A- Guide for New Users

Step-By-Step Installation Instructions for New Users of the Peterson RC-150 Swell Shade Operator. ***Please read and understand the sections entitled "Personal Safety Precautions" and "Important Precautions for Proper Operation" at the beginning of this manual before beginning your installation.*** Refer to specific sections elsewhere in this manual for more details about installing and configuring your Swell Shade Operator. After some experience working with this product, you will find that getting through the various programming steps is fast and easy, especially if you refer to the flow chart near the end of this instruction booklet. However, we believe that using the following systematic approach the first few times will minimize confusion and yield the best results.

1. Set the voltage selector switch on the Control Module front panel to the AC voltage that the operator will be plugged into; either 110 or 220 Volts (nominal).

2. Plan how you intend to connect the Shade Linkage Mechanism to the Motor Crank Arm. It is recommended that you carefully read the sections of this manual entitled "RECOMMENDED LINKAGE AND CRANK ARM ORIENTATION", "MINIMIZING NOISE", and "LINKAGE CONNECTIONS" on pages 4 and 5 at this time.

3. Select locations for mounting the Control Module and Motor Module. The Control Module must be installed within 6 feet of an unswitched AC outlet and within reach of the 15 foot long Interconnect Cable from the Motor Module. (The Interconnect Cable length must not be changed by cutting or extending it. Contact the Peterson factory for more information if a greater length is needed.)

4. Securely mount the Control Module and Motor Module as described in the sections entitled "INSTALLING THE CONTROL MODULE" and "MOUNTING THE MOTOR MODULE" on page 5.

5. Construct the Shade Linkage Mechanism (mechanical linkage and/ or cable and pulley system) in preparation for connecting it to the Motor Crank Arm. If it is necessary to move the Motor Crank Arm to check alignment and fit, manually turn the Knurled Shaft End on the Motor Module with power to the RC-150 disconnected, to move the Motor Crank Arm. ***This Knurled Shaft End should never be turned by hand after power is connected to the Swell Shade Operator because doing so could cause the motor to move unexpectedly, creating a risk of personal injury.*** *The Knurled Shaft End should not be turned by hand after the system has been programmed for your installation because doing so could disrupt your settings.* Do not connect the Shade Linkage Mechanism to the Motor Crank Arm at this time.

6. With the organ rectifier power off, connect the Organ Positive and Organ Negative busses from the organ rectifier to the connector on the lower left corner of the Control Module front panel, using #24 AWG or larger wire. Use red wire for Positive and black wire for Negative. Observe the labelled polarity carefully. Do not turn on the organ rectifier yet.

7. Plug the Interconnect Cable from the Motor Module into the connector on the Control Module firmly until it snaps in place.

8. Double check the position of the voltage selector switch on the Control Module front panel, then plug the supplied line cord into the unswitched outlet. Users outside of the USA will likely need to purchase a plug-in line cord that is compatible with their particular recepticals from a local source or use a stepping transformer. After a brief introductory message on the LCD Message Screen, the Motor Crank Arm will move and the display will read

"**POWERDOWN OPEN ***WAITING*****". This is called the *Power Off Operational Screen*.

9. Determine whether the Motor Crank Arm must move in a clockwise or counterclockwise direction (as defined by the diagram on the Control Module front panel just to the left of the circuit breaker) to move the Expression Shade Trace in the direction that will open the shades.

10. Set this direction of Motor Crank Arm motion by doing the following. The organ rectifier need not be on for this procedure.

From the Power Off Operational screen:

A) Press the **MODE/ ENTER** key once.
B) Press FUNCTION KEY F1 (labelled "PROG") once.
C) Press Function Key F1(labelled "CCW") for counterclockwise, or Function Key F2 (labelled "CW") for clockwise, once.
D) After a brief message on the LCD Message Screen confirming your choice, press FUNCTION KEY F3 (labelled "RUN") once.
E) Indicate the direction selected by circling one of the following: CW CCW

11. Turn on the organ rectifier power. A green LED in the lower left corner of the Control Module front panel will illuminate, and the Motor Crank Arm will usually move to a different position. The LCD Message Screen will read "**THE RC-150 IS OPERATIONAL**" and the current shoe position and current shade location will be shown. This is called the *Power On Operational Screen*. Both shoe position and shade location will be "00" because the Shoe Input Cable will not have been connected to the Control Module.

12. You will now set the Motor Crank Arm to the position where it will need to be so that when connected to the Shade Linkage Mechanism, the shades will be in approximately their fully closed position. Read through the section entitled "ADJUSTING THE INITIAL POSITION OF THE MOTOR CRANK ARM" on page 7 first to get familiar with the procedure. Then follow these steps in the order shown:

From the Power On Operational screen:

A) Press the **MODE/ ENTER** Key once.
B) Press Function Key F1 (labelled "**PROG**") once.
C) Press Function Key F4 (labelled "**N/C**" for No Change) once. A brief message will then confirm your choice.
D) Press Function Key F1 (labelled "**YES**") once.
E) Refer to the direction of arm motion circled in step 10E above. Using a narrow blade screwdriver, turn the center shaft of the Position Sensing Potentiometer in the direction opposite what you marked in 10E, in small increments until the arm is in the desired position. For example, if you marked CW in 10E, turn the shaft Counterclockwise. Refer to the detailed instructions on page 7 and Figure 2 for more information.
F) Press the **MODE/ ENTER** Key once when the arm is in the desired position.
G) Press Function Key F4 (labelled "**NO**") once to skip restoring factory standard settings.
H) Press Function Key F4 (labelled "**NO**") once to skip setting shade locations.
I) Press Function Key F4 (labelled "**NO**") once to skip a demonstration of shade positions.
J) Press Function Key F4 (labelled "**NO**") once to skip setting speeds.
K) Press Function Key F3 (labelled "**RUN**") once. The LCD Message Screen will display the *Power On Operational Screen*.

13) After the above steps have been completed, connect the Shade Linkage Mechanism to the Motor Crank Arm. ***For safety, this must be done with the AC and DC power OFF.***

14) Turn on the AC and DC power to the Swell Shade Operator. After a few seconds the Motor Crank Arm will move to the fully closed position and the Power On Operational Screen will be displayed. Take the following steps to enter the Program Menu, skip over adjustments that have already been completed or are not necessary to change, and set the shade positions that are right for your installation.

A) Press the **MODE/ ENTER** Key once to display the Main Menu Screen.
B) Press Function Key F1 (labelled "**PROG**") once.
C) Press Function Key F4 (labelled "**N/C**" for No Change) once. Wait for a brief confirming message.
D) Press Function Key F4 (labelled "**NO**") once. You have already set the initial position of the Motor Crank Arm in Step 12 above.
E) Press Function Key F1 (labelled "**YES**") once. This will set factory-determined values for the relative distance between Motor Crank Arm positions for various shoe positions.
F) Press Function Key F2 (labelled "**YES**") once to confirm your intentions.
G) Press Function Key F1 (labelled "**YES**") once. This will set factory-determined values for most other parameters of the Swell Shade Operator.
H) Press Function Key F2 (labelled "**YES**") once to confirm your intentions.
I) Press Function Key F1 (labelled "**YES**") once.
J) Press the **MODE/ ENTER** Key once. Until you do this, two message screens will continue to be displayed alternately.
K) Press Function Key F4 (labelled "**PRESENT**").
L) Use the "**JOG <**" or "**JOG >**" Keys to move the shades to the exact fully closed position desired.
M) Press the **MODE/ ENTER** Key once to "lock in" your selected fully closed position. Wait for a confirming message to appear briefly.
N) Press Function Key F4 (labelled "**PRESENT**").
O) Use the "**JOG <**" or "**JOG >**" Keys to move the shades to the exact fully open position desired.
P) Press the **MODE/ ENTER** Key once to "lock in" your selected fully open position. Wait for a confirming message to appear briefly.
Q) The shades will now automatically move to each factory-determined position, which will be proportional to the full range between fully closed and fully open settings that you have just entered. After the shades stop at each position, use the "**JOG <**" or "**JOG >**" Keys to move the shades if desired. When the shades are at the desired position each time, press the **MODE/ ENTER** Key once to "lock in" your selection. A confirming message will be displayed briefly when shoe position selection has been completed.
R) Press Function Key F1 (labelled "**YES**") once for an automatic demonstration of the shoe positions. Press the **MODE/ ENTER** Key or the F4 Key (labelled "EXIT", on Software V.2.19 and later only) to end the demonstration.
S) Press Function Key F4 (labelled "**NO**") once to return to the Main Menu Screen without adjusting the speed of the shades' motion at this time.

15) In this step, you may set the RC-150 to accommodate shoe contacts that "make" sequentially to close more shades as the organist's heel moves downward (make-to-close configuration), rather than the more conventional standard configuration where contacts "make" to open the shades as the organist's toes move downward (make-to-open configuration). If a Peterson expression shoe or other make-to-open expression

contact system is being used, skip to step 16. Otherwise, follow these steps to configure the RC-150 for make-to-close.

From the Power On or Power Off Operational Screen:

A) Press the **MODE/ ENTER** Key once to display the Main Menu Screen.
B) Press Function Key F2 (labelled "**ADV**") once to display the Advanced Menu Screen.
C) Press Function Key F1 (labelled "**SYS**") once to enter the Systems Menu.
D) Press Function Key F1 (labelled "**YES**") once.
E) Press Function Key F1, F2, or F4 (labelled "**OPEN**", "**SHOE**", or "**CLOSE**") once to select your choice for where the shades will automatically move each time the rectifier is turned off.
F) Press Function Key F4 (labelled "**CLOSE**") to select the Make to Close configuration. Wait while a confirming message appears briefly.
G) Press Function Key F4 (labelled "**CNCL**" for Cancel) to continue without changing the Stalled Motor Timeout. (See the Section entitled "PRINCIPLES OF OPERATION" beginning on page 24 if you want more information on this). Wait while a confirming message appears briefly.
H) Press Function Key F4 (labelled "**CNCL**" for Cancel) to continue without changing the Stall Motion Sensitivity Distance. (See the section entitled "PRINCIPLES OF OPERATION" beginning on page 24 if you want more information on this). Wait while a confirming message appears briefly.
I) Press Function Key F1 (labelled "**ACTIVE**") to select the Active Deceleration Braking Method. See the section entitled "PRINCIPLES OF OPERATION" beginning on page 24 if you want more information on this). Wait while a confirming message appears briefly.
J) Press Function Key F4 (labelled "**MAIN**") to display the Main Menu Screen.
K) Press Function Key F3 (labelled "**RUN**") to display the *Power On Operational Screen*.

16) Wire the expression shoe contacts to the white Peterson EZ-Wire connector supplied with the RC-150 on the Control Module connector pins labelled "Shoe Input Cable". Refer to the section entitled "WIRING THE EXPRESSION SHOE TO THE CONTROL MODULE" on page 6 for more information. ***This should be done with the Organ Rectifer power off and the Control Module unplugged.***

Note that if the "Make to Close" configuration has been chosen, the first contact to make must be wired to the highest numbered pin (pin 8 on an eight stage model or pin 16 on a sixteen stage model). In this configuration, all contacts must make cumulatively. That is, to close shades by three steps from the fully open position, the top three shoe input pins must ALL be connected to Organ Positive.

17) At this time, plug the Control Module in once again, and turn on the Organ Rectifier. Move the Expression Shoe and verify whether the shades move swiftly yet smoothly. If further adjustments are needed, refer to any of the following sections of this manual in order.

A) To make basic adjustments to the speed, refer to the section entitled "BASIC PROGRAMMING", especially its sub-section entitled "SETTING SPEEDS"on page 15.
B) To make adjustments for fine control of the speeds or the deceleration, refer to the section entitled "ADVANCED MENU", especially its sub-section entitled "ASSIGNING RATE NUMBERS TO SPEED SETTINGS" on page 19.

C) If an oscillation problem exists in shade systems containing a spring, refer to the section entitled “ADVANCED MENU”, especially its sub-section entitled “SETTING THE COMPENSATION FACTOR” on page 21.

D) To change the position that the shades automatically move to when the Organ Rectifier is turned off, or to deal with unusually massive and inertial shade systems that are difficult to decelerate smoothly, refer to the section entitled “ADVANCED MENU”, especially its sub-section entitled “SETTING SYSTEM PARAMETERS” on page 17.

E) To have the Swell Shade Operator test the expression shoe contacts and the wiring to the Swell Shoe Input Pins, refer to the section entitled “THE DIAGNOSTICS MENU”, especially its sub-section entitled “PERFORMING THE SHOE TEST” on page 23.

Chart of Standard "Factory Default" Settings

8 STAGE		16 STAGE	
OPENING SPEEDS	**CLOSING SPEEDS**	**OPENING SPEEDS**	**CLOSING SPEEDS**
1 position - slow	1 position - slow	1 position - slow	1 position - slow
2 position - slow	2 position - slow	2 position - slow	2 position - slow
3 position - med	3 position - med	3 position - slow	3 position - slow
4 position - med	4 position - med	4 position - med	4 position - med
5 position - fast	5 position - fast	5 position - med	5 position - med
6 position - fast	6 position - fast	6 position - med	6 position - med
7 position - fast	7 position - fast	7 position - fast	7 position - fast
8 position - fast	8 position - fast	8 position - fast	8 position - fast
		9 -16 position - fast	9 -16 position - fast

COMPENSATION FACTOR	
1 position - fast	2 position - med
3 position - med	4 position - med
5 position - med	6 position - med
7 position - med	8 position - med
9 -16 positions - med	

RATES		
Slow Speed = 8	Med Speed = 24	Fast Speed = 40
Slow Decel = 5	Med Decel = 14	Fast Decel = 25
Slow Decel Dist = 50	Med Decel Dist = 80	Fast Decel Dist = 200

POWERDOWN SHADE LOCATION = OPEN
CLOSING (the shoe) CONTACTS = OPEN (the shades)
STALLED MOTOR TIMEOUT = 8 / 16 SECOND
STALL SENSITIVITY DISTANCE = 8
DECELERATION BRAKING = ACTIVE

16 STAGE		8 STAGE	
STEP	**INCREMENT**	**STEP**	**INCREMENT**
0	0	0	0
1	12	1	14
2	14	2	18
3	16	3	22
4	18	4	29
5	20	5	39
6	22	6	47
7	25	7	60
8	29	8	100
9	37		
10	39		
11	43		
12	47		
13	53		
14	60		
15	72		
16	100		

Blank Chart to Record Custom Settings

If your RC-150 is ever returned to the factory for service, part of the repair department procedures are to return all devices to their factory default values. Below is a blank chart for your entry of any custom values you have set for the RC-150 during the installation. You may refer to this chart and restore any custom settings rapidly:

POSITION	OPENING SPEED	CLOSING SPEED	COMPENSATION FACTOR
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

RATES			
Slow Speed =	Med Speed =	Fast Speed =	[max = 100]
Slow Decel =	Med Decel =	Fast Decel =	[max = 100]
Slow Decel Dist =	Med Decel Dist =	Fast Decel Dist =	[max = 100]

POWERDOWN SHADE LOCATION = OPEN / SHOE / CLOSE

CLOSING (the shoe) CONTACTS = OPEN / CLOSE (the shades)

STALLED MOTOR TIMEOUT = / 16 SECONDS (increments of 1/16 sec)

STALL SENSITIVITY DISTANCE = (default = 8)

DECELERATION BRAKING = ACTIVE / PASSIVE

STEP	INCREMENT	STEP	INCREMENT
0	0	0	0
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	100
9			
10			
11			
12			
13			
14			
15			
16	100		

RC-150 Troubleshooting Guide

If you have a problem with an RC-150 Swell Shade Operator, the following information should help you identify the cause and in many cases will allow you to fix the problem quickly. Often, the reason behind an RC-150 not working is actually something other than a fault with the Swell Shade Operator.

Basic Indicators

First observe the basic "vital signs" of the RC-150. Verify whether the Green LED, Red LED, and LCD Message Screen are operating normally as follows:

1. The Green LED on the control module should be illuminated whenever the organ rectifier is turned on. If it is not, suspect that there is not a DC voltage of at least 10 VDC applied in the correct polarity to the Organ + and - screw terminals.

2. The Red LED labelled "Stall" on the control module should NOT be illuminated. If it is, suspect that either the Interconnect Cable is not plugged in firmly to its receptacle on the Control Module, or the Shade Linkage Mechanism or Motor Trace Arm is unable to move freely. The stall mode is a safety feature designed to interrupt power to the gearmotor when the microprocessor does not detect that the motor is turning. Moving the shoe again will automatically reset the RC-150, causing it to work normally until the microprocessor detects a stall condition again.

3. The LCD Message Screen should show the current shoe position and the corresponding shade position when the organ rectifier is on. When the shoe is moved, the displayed position numbers should change accordingly. When the organ rectifier is turned off, the LCD should display either "Powerdown Open", "Powerdown Closed", or "Powerdown Shoe" . If the LCD displays are not correct, refer to the following section.

Select the problem you are having from the choices that follow.

Incorrect, Unchanging, or Cycling Displays on LCD Message Screen

A. If the screen is solid grey or green, without any letters or numerals on it at all, verify that the Control Module is plugged into a live AC receptacle and that the voltage selector on the front panel of the Control Module is set to the correct voltage, nominally either 110 or 220 VAC.

B. If the message on the LCD screen falsely indicates that the shoe is fully open (position #8 or position #16, depending on the model of RC-150), regardless of where the shoe is moved, follow these steps in order:

i. Unplug the Shoe Input Cable from the Control Module. If the message now changes to indicate that the shoe is in position 0, suspect a problem with the shoe contact system or its cabling. The problem may then be diagnosed using a volt meter. If the message continues to falsely show that the shoe is in the fully open position, plug the shoe input cable back on and proceed to the next step.

ii. Turn the organ rectifier off for 20 seconds and back on again. If the RC-150 resumes normal operation, this may indicate that some environmental disturbance caused the system's microprocessor to stop running until it was "rebooted" in this manner. If the problem returns periodically, contact Peterson customer service for assistance. If temporarily turning off the rectifier doesn't clear the problem, go on to the next step.

iii. It is now likely that there exists an electrical connection between the organ rectifier's DC Positive and earth ground. This can be verified by using a DC volt meter to measure between Organ Negative and the bare metal edge of the Control Module's front panel with the rectifier power on. If DC Positive is connected to earth ground, the meter will read a voltage approximately equal to the organ rectifier's output voltage. If this is found, look for an obvious point of connection to a water pipe, conduit, etc. near the rectifier or contact Peterson customer service for assistance.

C. If the LCD Message Screen repeatedly displays a fixed or changing shoe position momentarily, then reverts to the series of introductory messages, suspect that there may be a significant AC voltage on the DC supply which is essentially causing the RC-150 to turn off and back on again in rapid succession. The introductory messages occur as the microprocessor is automatically rebooted on each cycle. The same symptom can also result from plugging the Control Module's line cord into an improperly grounded outlet so that AC ripple appears on the Control Module's chassis. To narrow this down, follow these steps in order.

i. Select "AC Volts" on a voltmeter and measure across the Organ + and - terminals on the front panel of the Control Module. A reading greater than about 1 Volt may indicate an inadequately filtered rectifier. If your meter indicates an AC voltage, it is useful to check your meter by measuring the voltage across a battery to be sure the meter is not falsely indicating the AC voltage. A battery from a flashlight, portable radio, or automobile should read 0 Volts AC. If you verify that the meter works correctly and you still measure a significant AC voltage across the organ rectifier, this may be able to be reduced by adding large filter capacitors near the load. The preferred solution is to replace an old, poorly filtered and poorly regulated rectifier.

ii. Use an "AC Outlet Checker" to verify that the outlet you are using is wired and grounded correctly. A common device for this purpose is available from Radio Shack and similar retailers for less than ten dollars and is designed to plug into any 117 Volt AC receptacle that you wish to check. The device indicates via LEDs whether any fault condition exists.

D. If the LCD Message Screen shows that the shoe position is "0" regardless of where the shoe is actually positioned, first check to be sure that the Shoe Input Cable is firmly pushed onto the pins of the Control Module and that it is not shifted by one or more pin positions to the left or right. Then follow the instructions on page 23 to use the "SHOE TEST" procedure in the Diagnostics Menu to determine whether a voltage is being properly applied to each shoe input pin as the shoe contacts make. If not, check all wiring and verify that the shoe contact common is energized with Organ Positive voltage from either the pin labelled "Shoe Feed" on the front panel of the Control Module or from another source of Organ Positive.

E. If the LCD Message Screen seems to be "frozen" on some shoe position after working normally for some time, the microprocessor may have stopped operating due to some external cause. Try rebooting the micro by turning off the organ rectifier for 20 seconds, then turning it back on again. If this does not clear the problem, unplug the line cord and then plug it in again. If the problem persists or recurs periodically, contact Peterson customer service for assistance.

F. If the LCD Message Screen displays a message from one of the programming menus or the Diagnostic Menu, this simply indicates that someone has recently pressed the **Mode/Enter** button on the Control Module front panel, which prepares the RC-150 for custom configuration by the installer. To return to the normal operational mode, press any button labelled "**MAIN**" or "**RUN**", or simply wait 45 seconds for the RC-150 to automatically return to normal operation.

G. If the LCD Message Screen shows fixed random characters instead of legible messages, try turning off the organ rectifier for 20 seconds, then turning it back on again to reboot the RC-150's microprocessor. If that doesn't clear the problem, unplug the AC line cord and then plug it back

in. If the screen continues to display random characters after doing this, please contact Peterson customer service for assistance.

H. If the LCD Message Screen and corresponding movement of the shades occasionally stops responding altogether to changing shoe inputs, and is soon followed by a series of introductory messages and then a return to normal operation, this indicates that the microprocessor is being rebooted. This will happen if the organ rectifier voltage falls, even instantaneously, below a threshold of approximately 7 Volts for reasons such as overloading of the rectifier or inadequate voltage regulation often present in rectifiers that were manufactured several decades ago. A voltmeter, oscilloscope, or Peterson Power Supply Fault Detector may be used to determine whether the rectifier voltage is falling below an appropriate threshold. If so, the preferred solution is to install an adequate rectifier, but sometimes the use of large capacitors near the Control Module will help the situation.

Abrupt Motion of the Gearmotor Arm and Shade Linkage Assembly

A. This symptom is often caused by poor design of the Shade Linkage Mechanism geometry. For smooth operation of the RC-150, it is very important that the Motor Crank Arm travel through as great an angle as possible, up to the maximum of about 170 degrees of rotation. It has been our experience that most difficulties with achieving smooth, quiet shade movement is caused by having the full travel of the shades occur with only 90 degrees or less of Motor Crank Arm motion. It is also very helpful to orient the length of the Motor Crank Arm in a straight line with the Connecting Link (the rigid member that connects the Motor Crank Arm to the Expression Shade Trace, as explained on page 3 and shown in the associated figures on that page. Use the hole on the Motor Crank Arm that is as close to the axis as possible while still providing adequate travel of the Shade Linkage Mechanism.

B. Abrupt motion can also occur if the speeds are set too high. While the RC-150 is capable of moving large banks of shades very rapidly, smoother and quieter motion occurs when the speed is set as slow as practical, consistent with adequate expression response. When setting speeds in the Program Menu as explained on page 15, try selecting **SLOW** as the speed that applies when the number of shoe positions of change is 1 or 2 on an 8 stage unit and 3 or fewer on a 16 stage unit. Select **MEDIUM** when the number of shoe positions of change is a bit more, then choose **FAST** for only rather large gradients of change.

C. Smoother motion can sometimes be obtained by refining the Rate Number settings. If adequate smoothness of motion cannot be achieved by following the recommendations of A and B above, refer to the section called "**Advanced Programming; Setting Rate Numbers**" on page 19. Set the main rate numbers for **SLOW**, **MEDIUM**, and **FAST** speeds to as low a number as you can, consistent with adequate expression response. Select the **DECEL RATE** number to be 1/2 to 5/8 the value of the **MAIN RATE**. Then set the **DECEL DISTANCE** to be just low enough to avoid a stairstep-like, two stage response. This procedure is explained thoroughly on page 18.

Shades Don't Move To Intended "Powerdown" Position

If the shades do not move to the desired fully open or fully closed position (as programmed in the **"SYS"** section of the Advanced Menu) when the organ rectifier is turned off, it is likely that the Control Module's line cord is plugged into an outlet that is switched with the organ rectifier. Be sure the Control Module is plugged into an outlet that is always on, so power will be available to move the shades after the rectifier voltages dies away to signal powerdown of the organ.

Oscillation of Shades in Shade Systems with a Cable and Spring

On occasion, the installer's choice of a return spring paired with the particular inertial characteristics of the shades and the rate at which the RC-150 adds increasing power to the gearmotor upon acceleration all combine to make the shades speed up and slow down at a resonant frequency. It is usually easy to move the resonant frequency by selecting a different Compensation Factor for the RC-150. This is done by pressing the button labelled **COMP** from the Advanced Menu, as explained in the section of this manual called "**Setting the Compensation Factor**", beginning on page 21. If various choices of compensation factor do not eliminate the resonance, try using a different spring or replacing the spring with a weight suspended on a cable from a pulley.

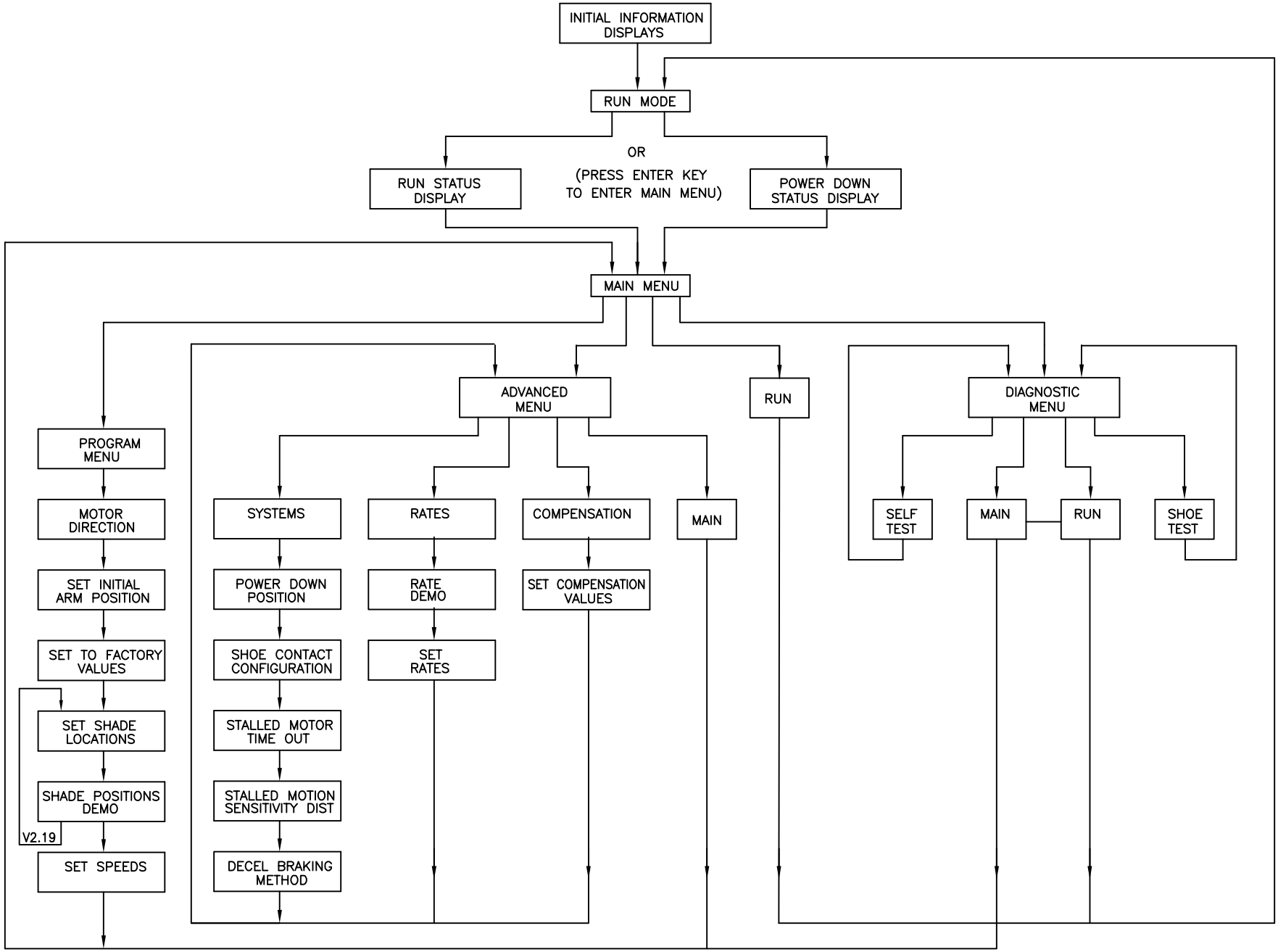
Longer Time Required to Start Working after Rectifier Powerup

Previous users of Peterson Swell Shade Operators may notice that Control Modules with a "W" in the serial number take longer to begin working when the organ rectifier is first turned on. This delay of approximately 20 seconds is normal and is the result of provisions that automatically reboot the system's microprocessor each time the rectifier rises through a threshold of about 7 Volts.

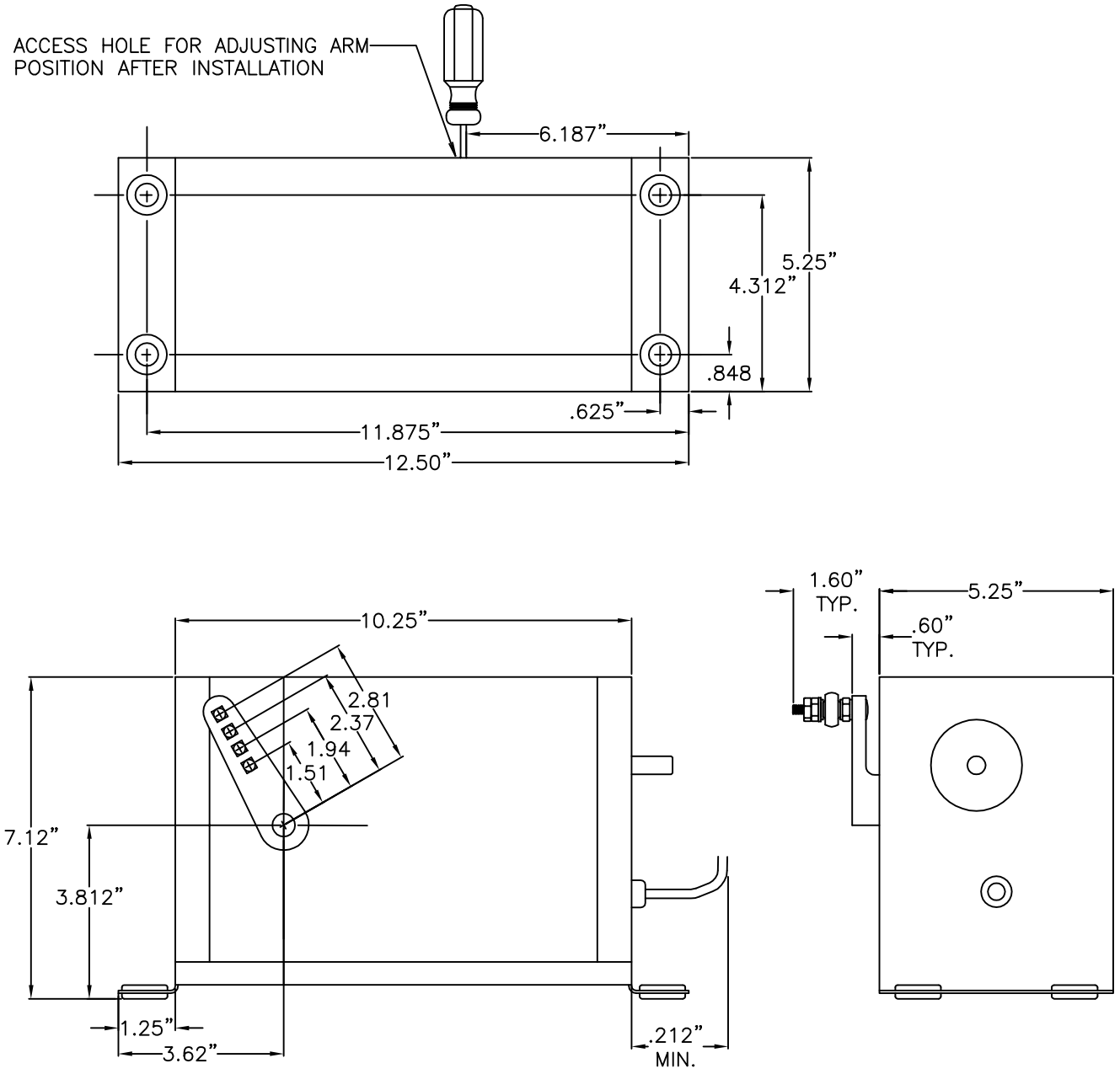
Lightning

It is extremely unusual for a properly installed RC-150 to be damaged by lightning. Many protective measures have been built into each unit and extensive testing and field experience has verified a high level of immunity to lightning damage. However, many of the protective measures depend on a solid electrical connection between the grounding prong on the control module's line cord and earth ground. We strongly recommend verifying that the outlet used is properly grounded. Never cut off the grounding prong on the RC-150's line cord.

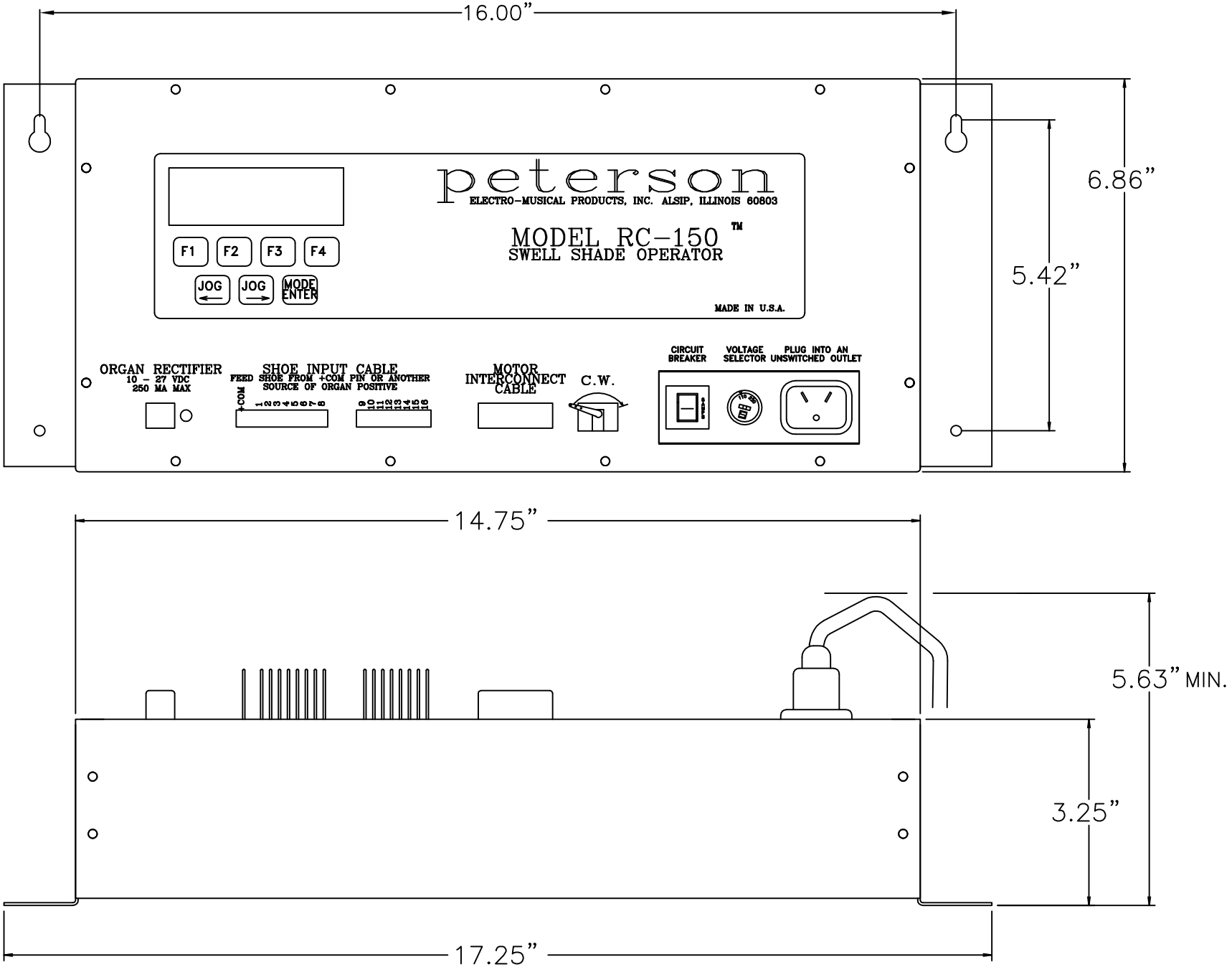
FLOW CHART
PETERSON RC–150
SWELL SHADE OPERATOR



190792



PETERSON RC–150 MOTOR MODULE DIMENSIONS

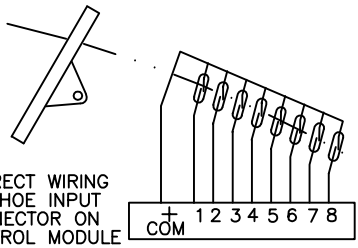


PETERSON RC-150 CONTROL MODULE DIMENSIONS

DWG 190779

STANDARD "MAKE TO OPEN" CONTACT CONFIGURATION

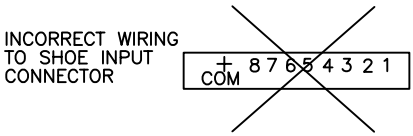
FOR THIS SHOE CONFIGURATION, SELECT "CLOSING SHOE CONTACTS WILL MAKE SHADES: OPEN". THIS IS SOFTWARE SELECTED IN THE "SYS" SECTION OF THE "ADV" MENU



HIGHEST CONTACT MADE	SHADE POSITION
NONE	CLOSED
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

SHADE POSITION IF SHOE CONTACT #4 DOES NOT MAKE

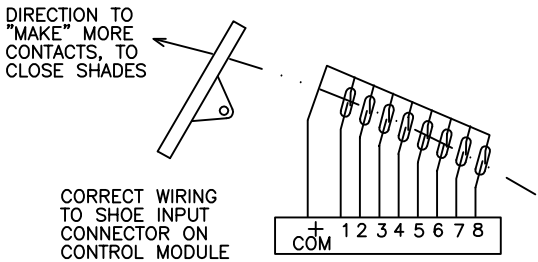
CLOSED
1
2
3
3
5
6
7
8



HIGHEST CONTACT MADE	SHADE POSITION
NONE	CLOSED
1	8
2	8
3	8
4	8
5	8
6	8
7	8
8	8

"MAKE TO CLOSE" CONTACT CONFIGURATION

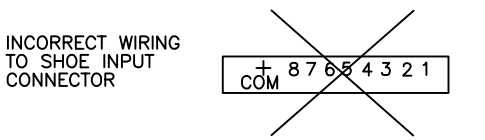
FOR THIS SHOE CONFIGURATION, SELECT "CLOSING SHOE CONTACTS WILL MAKE SHADES: CLOSE". THIS IS SOFTWARE SELECTED IN THE "SYS" SECTION OF THE "ADV" MENU.



LOWEST CONTACT *	SHADE POSITION
NONE	OPEN(8)
8	7
7	6
6	5
5	4
4	3
3	2
2	1
1 (ALL)	CLOSED

SHADE POSITION IF SHOE CONTACT #4 DOES NOT MAKE

CLOSED
8
7
6
5
4
4
4
4



LOWEST CONTACT MADE	SHADE POSITION
NONE	OPEN
8	CLOSED
7	CLOSED
6	CLOSED
5	CLOSED
4	CLOSED
3	CLOSED
2	CLOSED
1 (ALL)	CLOSED

* NOTE: FOR "MAKE TO CLOSE" CONFIGURATION, THE CONTACTS MUST BE MADE CUMULATIVELY. FOR EXAMPLE, THE SHADES WILL NOT MOVE TO POSITION 5 FROM THE FULLY OPEN POSITION UNLESS SHOE CONTACTS 8,7, AND 6 ARE ALSO MADE.