User Manual

Automated Coolaroo Shade Screens

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Autoshade 2023

Table of Contents

Introduction

Autoshade is a conversion kit that lets you automate your Coolaroo crank style outdoor shade screens. It consists of two parts – a Motor Conversion Kit (#100114) that replaces the hand crank on the shades (one kit per shade) and a Controller Assembly (#100113) that drives up to six motors according to a programmable schedule. You will also need some hardware items available locally, an enclosure and low voltage cable available from McMaster-Carr, and of course the Coolaroo shades themselves.

Features of the Autoshade include:

- The controller calculates sunset and sundown based on your latitude and longitude. Shades are programmed to lower and raise based on a programmable time offset from sunset or sunrise.
- Shades may also be raised or lowered by pressing a Manual Command.
- Shades raise and lower sequentially to keep power consumption low.
- Each of the shades (6 maximum per controller) can be set for a different height.
- The controller (and motors) operate from a 12 VDC wall mount power supply (included).

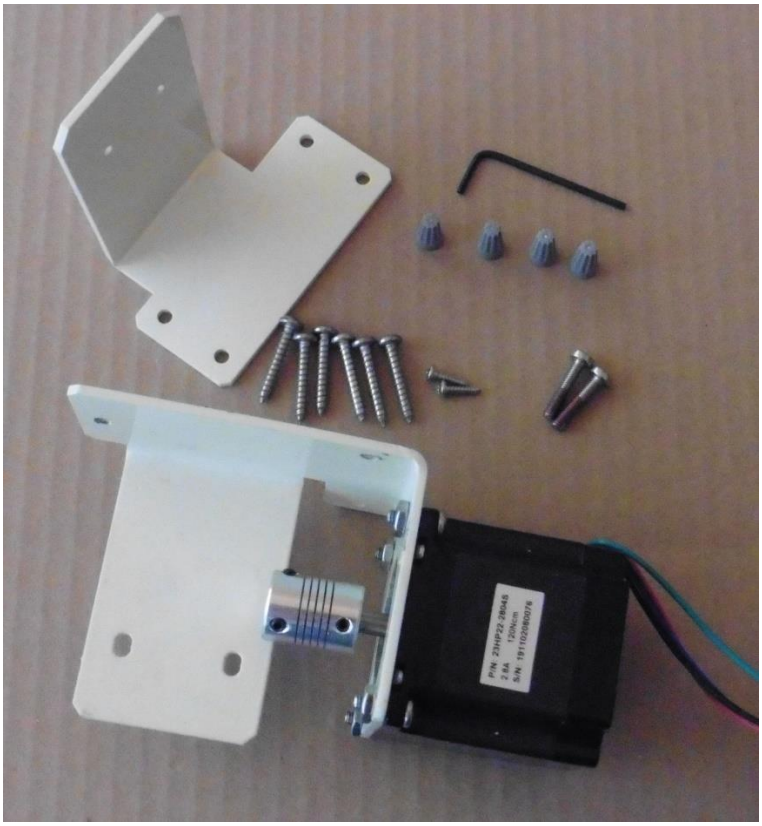

Figure 1 - Autoshade Motor Conversion Kit

Figure 2 - Autoshade Controller Assembly

Planning and Ordering

- The conversion kit only works with Coolaroo crank style outdoor shade screens. In particular, the motor adapts to the Coolaroo worm gear having a shaft diameter of 0.325±0.005 inches. This appears to be the standard used by Coolaroo, but if in doubt check this dimension before ordering.
- Each automatic shade screen should be mounted on the inside vertical surface of the patio. This is normally a wooden beam supporting the outer roof of the patio.
- The motors will be mounted on the right hand side of each screen as viewed from the patio. (If your current screens have the crank on the left side, this can easily be reversed).
- You need a vertical clearance of at least 6 inches to mount the motorized shade screen mechanism. 7 or 8 inches is better as it will allow for mounting low voltage cable conduit above the motors that will cover the motor cables. See Figure 3. You could just staple the cables but a much neater installation results from using the conduit.
- One controller can handle up to six shade screen motors.
- The controller panel needs to be located at eye level within 5 feet of an electrical outlet. This is normally the outside wall of the house under the patio roof. Separate control cables run from the controller to each of the motors.
- If you will be using low voltage conduit to contain these cables, decide which side of the controller you will use for running the cables up to the patio ceiling, then across to the beam supporting the motorized shades.
- Once the cable routing has been determined, measure the total length of all the motor cables you will need. Add an extra 3 feet to each cable for slack.
- If you are going to use plastic conduit, calculate how many feet you will need of this as well as the fittings required for L's, T's. etc.

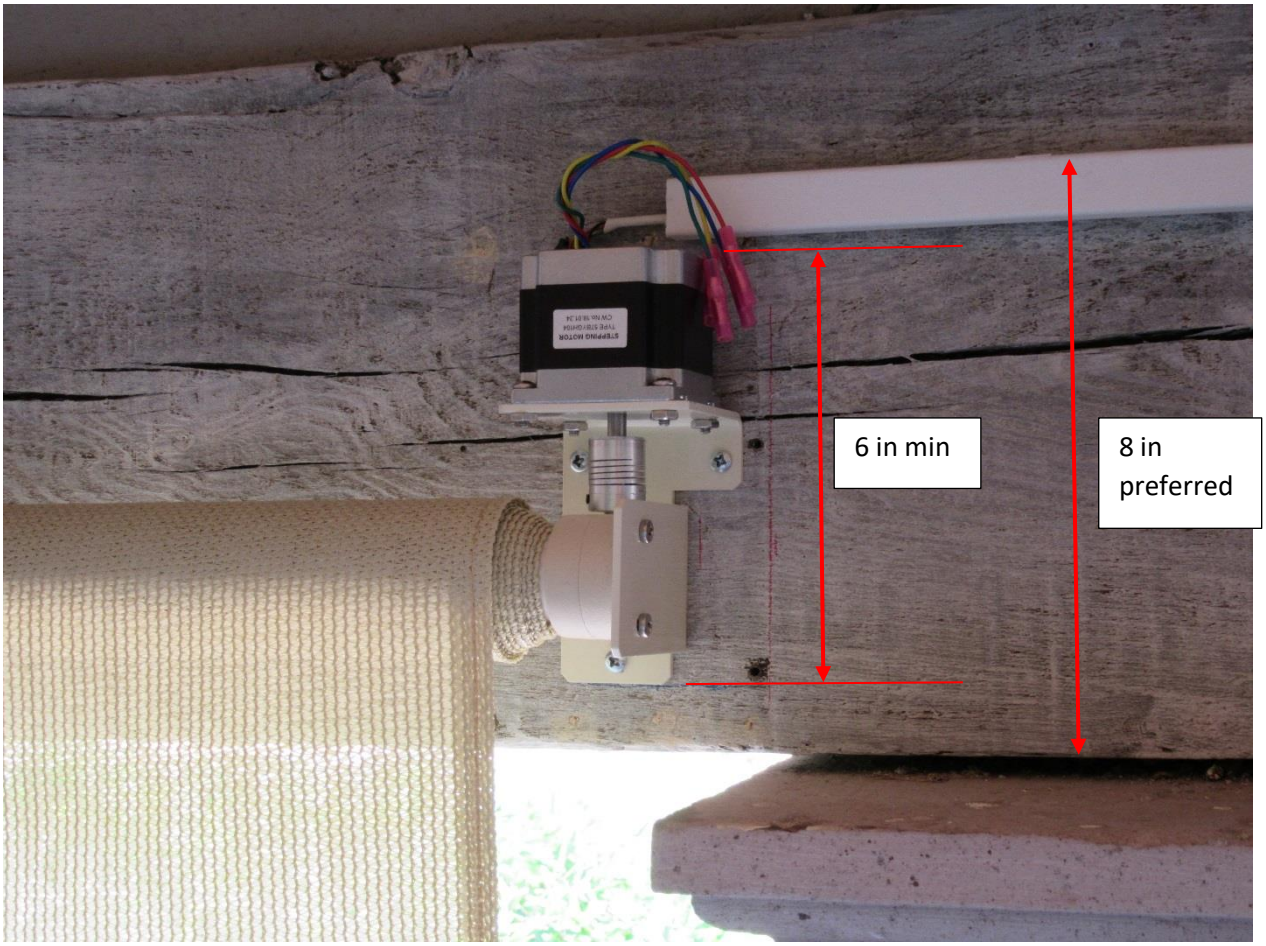

Figure 3 - Minimum and Preferred Vertical Clearances

Purchase the Coolaroo shades (if you do not already have them) from Home Depot, Lowes, Walmart, etc. They are available in 4, 6, 8 and 10 foot widths in a variety of fabric colors. You can also buy the low voltage conduit and fittings from Home Depot or Lowes. Try to find something that is about ½ x ¾ inches.

Order the Autoshade #100113 Controller from Ebay. You will need one Controller for each 6 shades.

Order the Autoshade #100114 Motor Conversion kits from Ebay. You will need one kit for each shade.

Order an enclosure and cable grip for the controller from McMaster-Carr. The enclosure is part number 7649K11. The item number for the cable grip is 7529K433. Finally order the low voltage motor cable from McMaster-Carr. It is part number 8280T32.

Installation

Shade Screen Conversion

If your shade screens are already mounted, you must first remove them to make the conversion to the motor drive. Although Coolaroo provides a clip type removal feature at the idler end (the end opposite the crank), it is much easier to simply remove the entire idler mounting bracket. With the bracket loose, remove the shade assembly, then remove the drive bracket at the other end.

On the drive end, remove the plastic cover and the worm gear mechanism. It is held by two flat head metric screws. Remove the crank adapter from the worm gear using a punch and hammer to extract the retaining pin as shown in Figure 4.

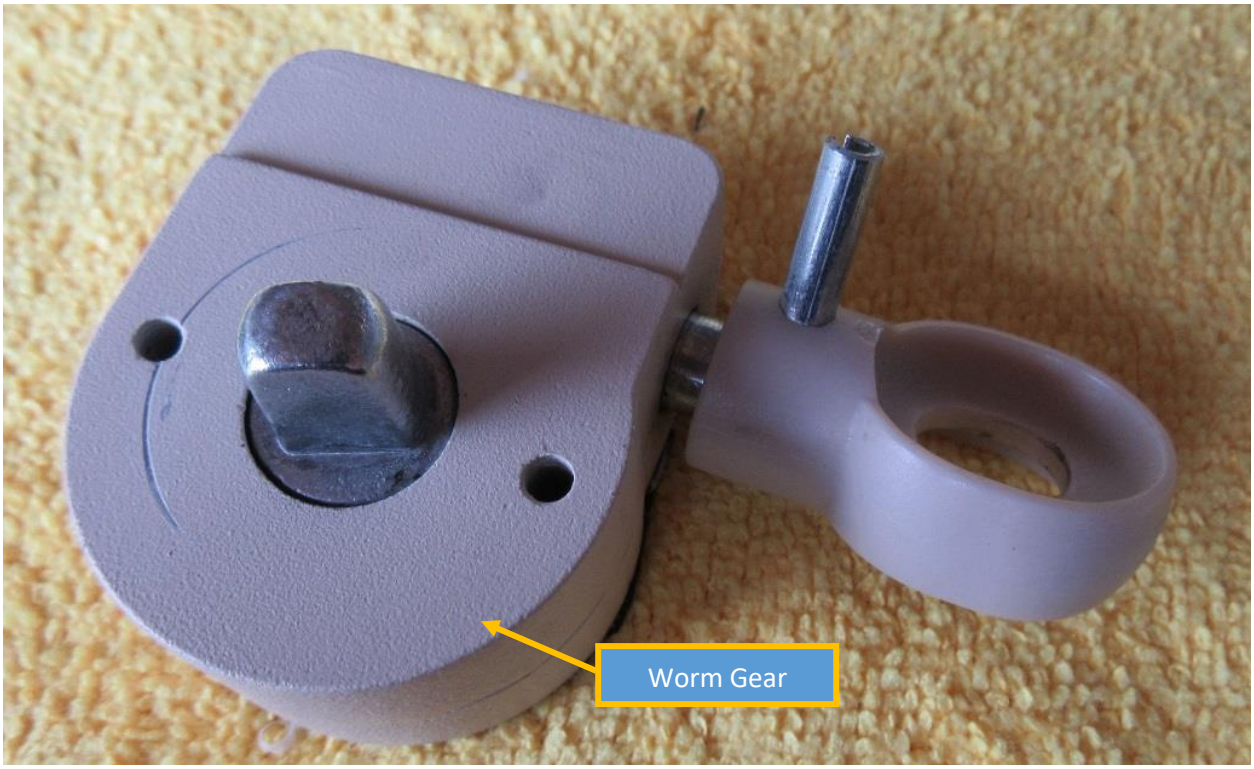

Figure 4 - Removing the Retaining Pin and Crank Adapter from the Worm Gear

You can discard all of the drive end Coolaroo parts including the screws except the worm gear.

Locate the parts needed to assemble the motor drive end. These are shown in Figure 5. Remove the vinyl cover used to protect the flex coupling during shipment and discard it.

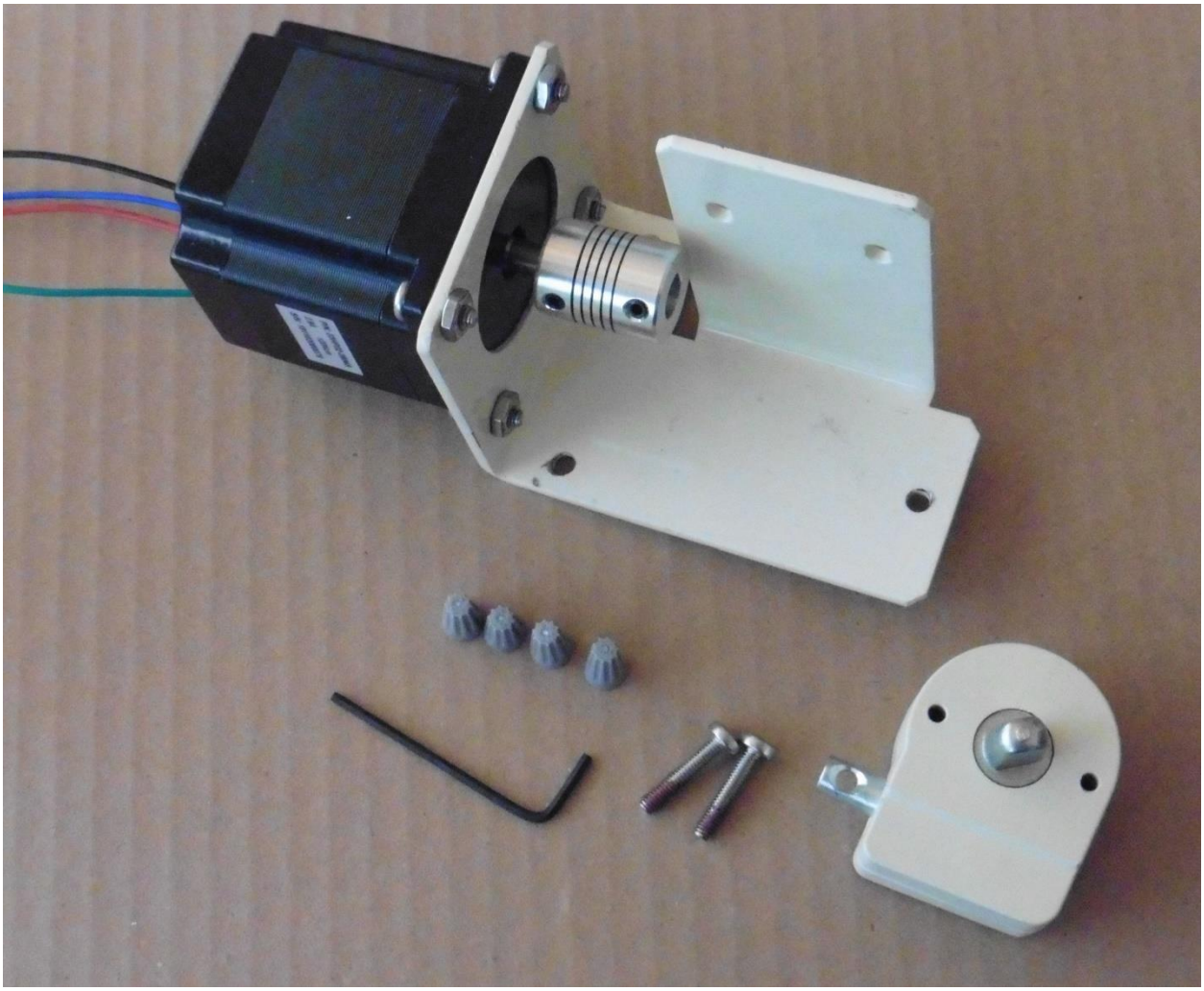

Figure 5 - Motor Drive Components

Use the Allen wrench to loosen the two set screws at the free end of the flex coupling so that they are not visible inside the shaft opening. Slide the shaft on the worm gear into the flex coupling. With the flat surface of the worm gear against the vertical bracket mounting surface, rotate the motor shaft as required so that the hole in the worm gear shaft previously used for the retaining pin is between the two set screws. Locate the two new mounting screws supplied and start these screws through the bracket into the worm gear housing. Finger tighten only.

Using the Allen wrench, tighten the two set screws on the worm gear shaft, then rotate the shaft while viewing the slots on the flex coupling. The worm gear housing can be adjusted on the bracket so that these slots remain open throughout the rotation of the motor shaft. Tighten the mounting screws slightly and check again from all visible angles. Readjust the position of the worm gear on the bracket as necessary and tighten the screws some more. Do not over tighten these screws such that the flex coupling is distorted during its rotation; the thread locker on these screws will keep the screws from loosening. See Figure 6.

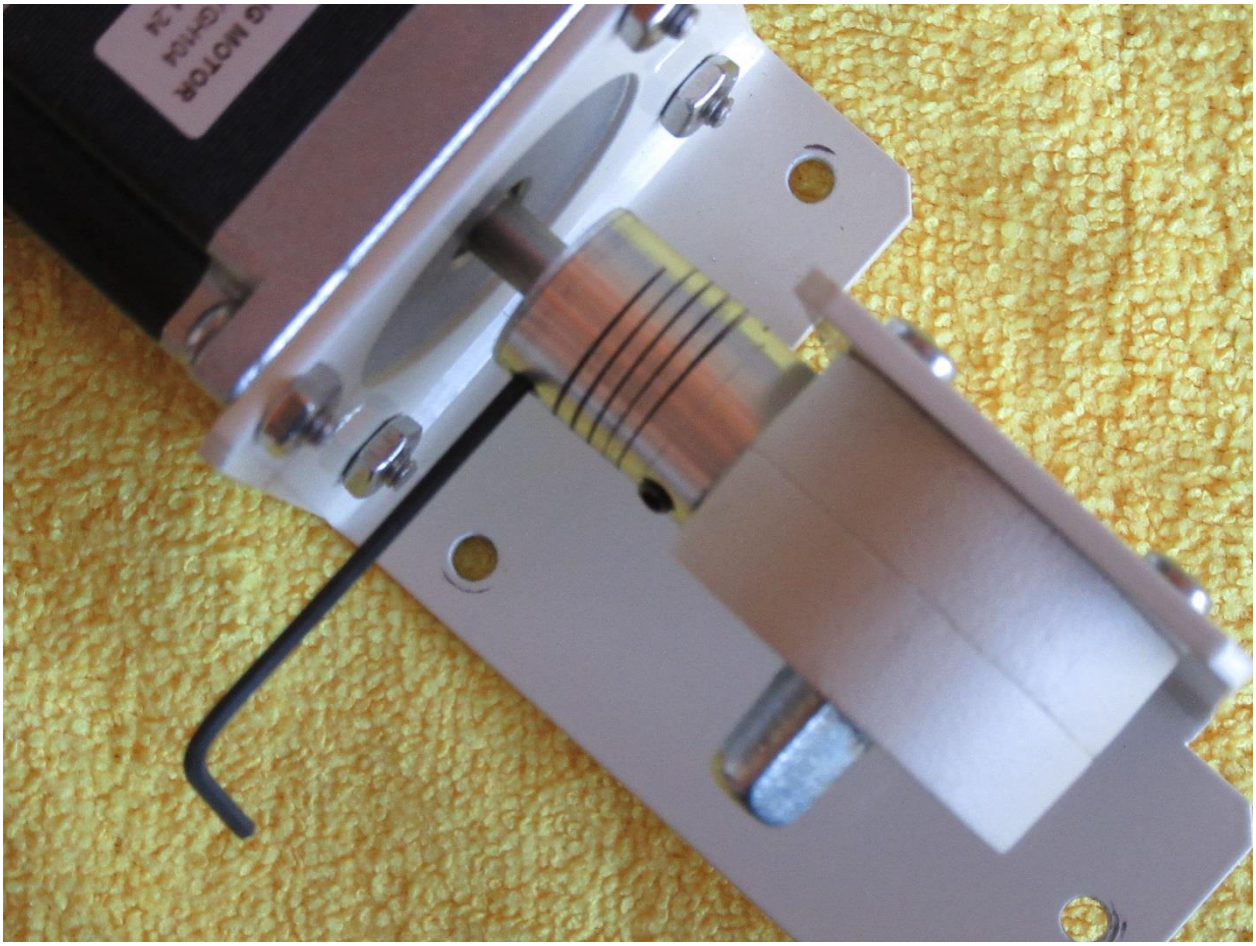

Figure 6 - Using Allen Wrench to Rotate Motor Shaft while Adjusting Worm Gear Position on Bracket

Mount the assembled motor bracket on the wall or beam using three #8 sheet metal screws. Use a level to be sure the bracket if vertical.

Now locate the original idler bracket. Remove the plastic cover and the three screws holding the plastic idler to the bracket.

The Coolaroo bracket, cover and screws will not be used, so they may be discarded.

Locate the parts used for the new idler support bracket shown in Figure 7. Note that the self-tapping screws are longer than those used in the Coolaroo bracket.

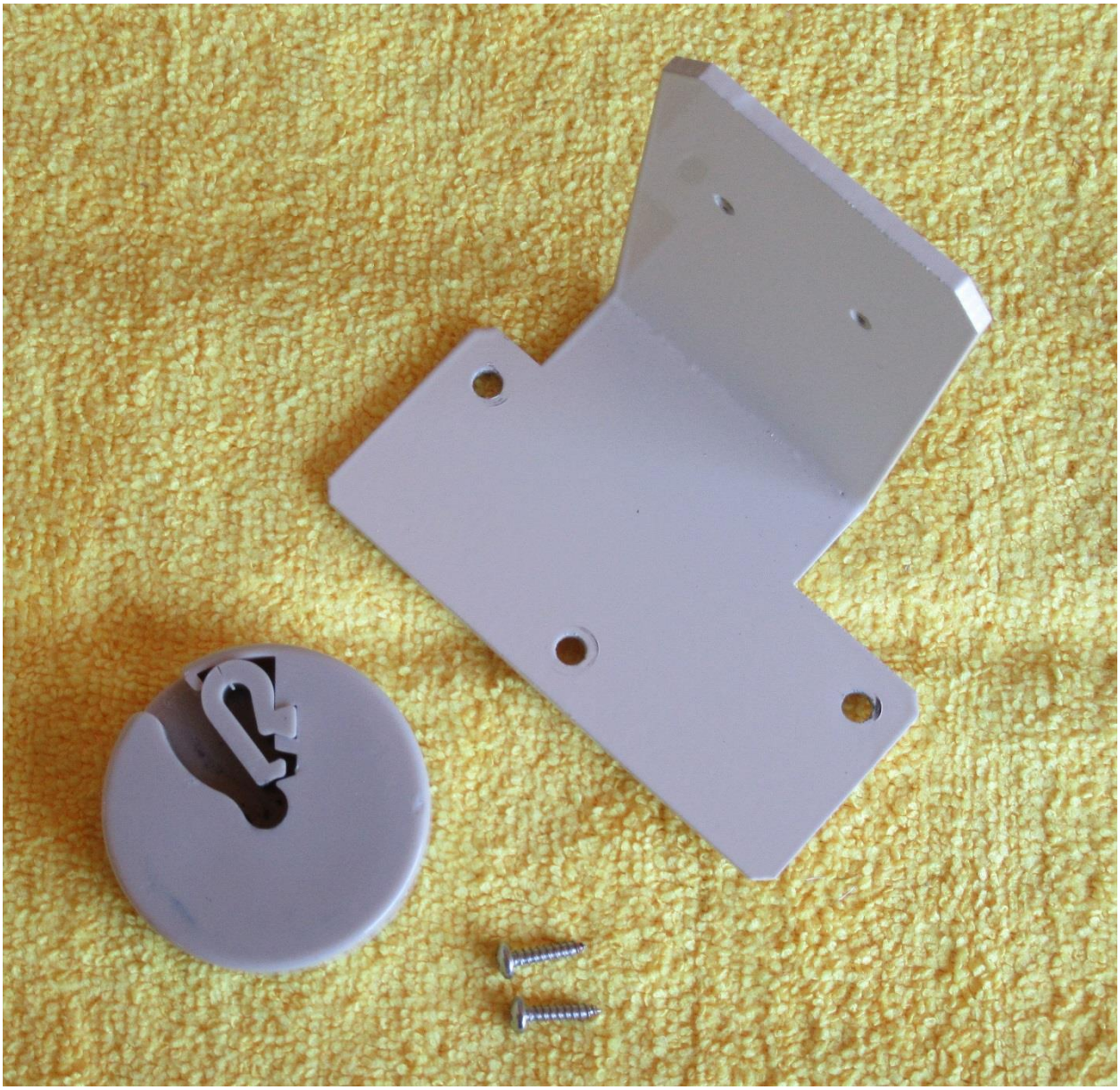

Figure 7 - New Idler Bracket Components

Attach the plastic idler support to the idler bracket using the three pan head sheet metal screws provided. Be sure the guide is oriented with the open end out as shown in Figure 8. Tighten the screws, but do not overtighten them into the plastic.

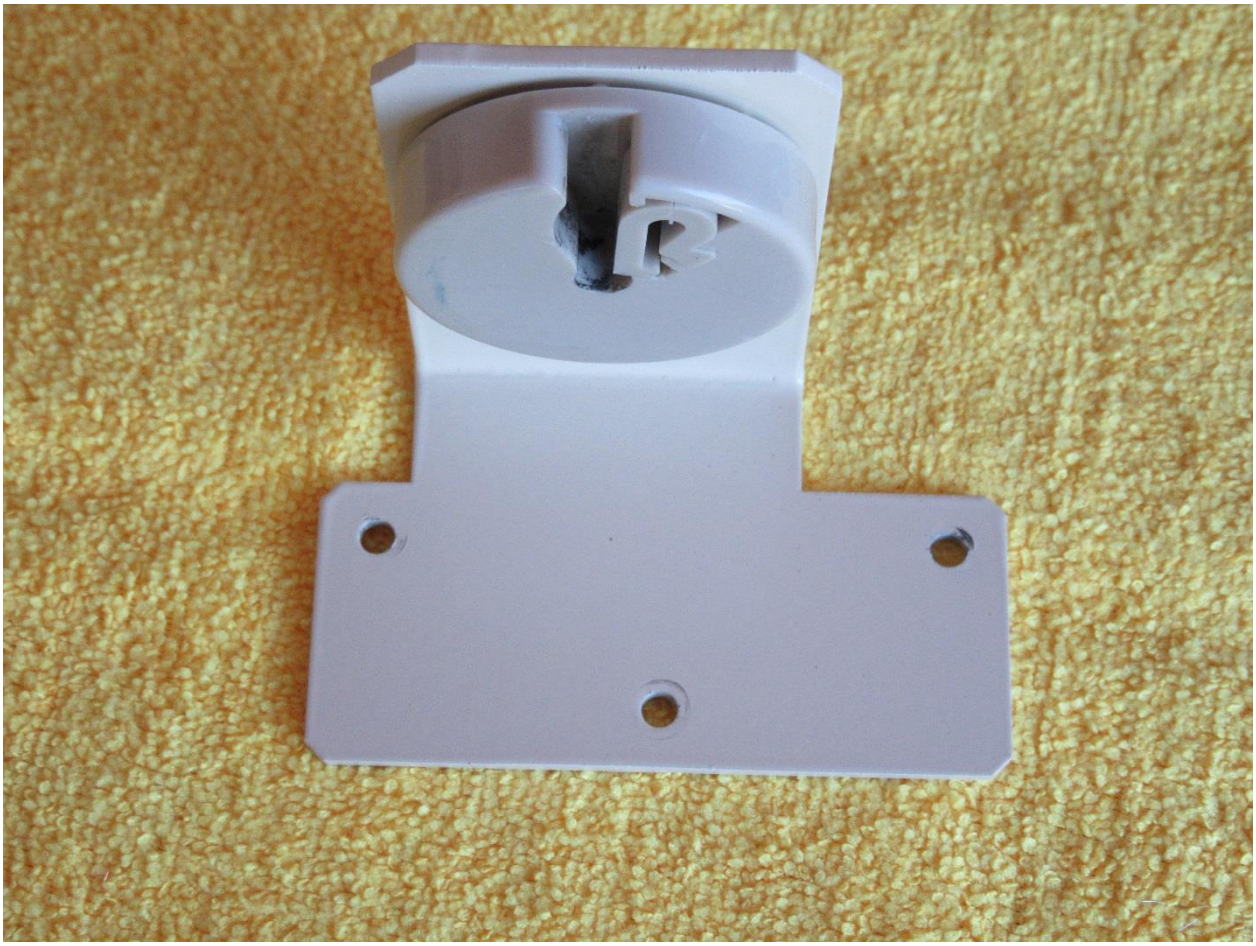

Figure 8 - Assembled Idler Bracket

It is important when mounting the idler bracket on the wall to have it level with the motor bracket and to provide about 1/8 inch spacing along the axis of the shade so that it does not bind. Use a long level to mark the location of the bottom of the idler bracket using the bottom of the motor bracket as a reference. Then use the shade itself inserted into the worm gear drive shaft and into the loose idler bracket to position the idler bracket left to right. Mark the location of three mounting holes, set the shade aside and mount the idler bracket.

Reverse the direction of winding of the shade on its roller if required so that with the drive end on the right, the shade rolls off the roller on the near side. Snap the shade into place. See Figure 9.

Figure 9 - Installed Shade with Motor Drive

Cabling

The recommended motor cables are 4 conductor AWG22 stranded with a relatively thin jacket since this is a low voltage application. When cutting the cables, be sure to leave about 1 ft extra at the motor end and at least 3 ft extra at the controller end. Mark both ends of each cable using a felt tip pen and white or yellow electrical tape. Cable #1 will be connected to the first shade to be raised or lowered, #2 the second, etc.

You can staple the cable or use low voltage plastic channel which will look much neater. The channel should be 20x12mm (3/4x1/2 inch) which will hold 6 of the cables. See Figure 10.

Figure 10 - Channel for Routing Motor Cables

Remove about 3 inches of jacket from the motor end of the cables, then strip each conductor about 1/4 inch. Twist the strands together and tin them with solder as shown in Figure 11. (This step is not absolutely necessary, but tinning the strands helps keep them together when using the wire nut). The leads supplied on the motor are longer than needed, but these should not be cut shorter until the system is fully wired and tested. Twist the cable conductors around the motor conductors as shown in Figure 12 and use the wire nuts supplied to hold them together. The connections should be as shown in Figure 12. Note that several motor models are used. The white and black wires on the 57BYGH104 motors are not connected.

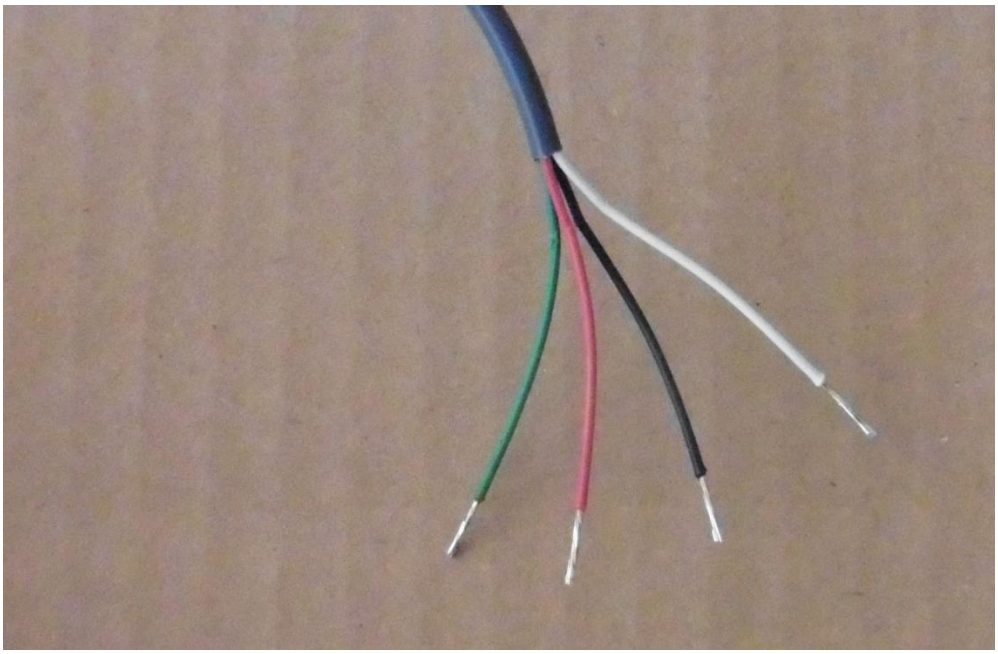

Figure 11 - Motor End Cable Prepared for Connection to Motor

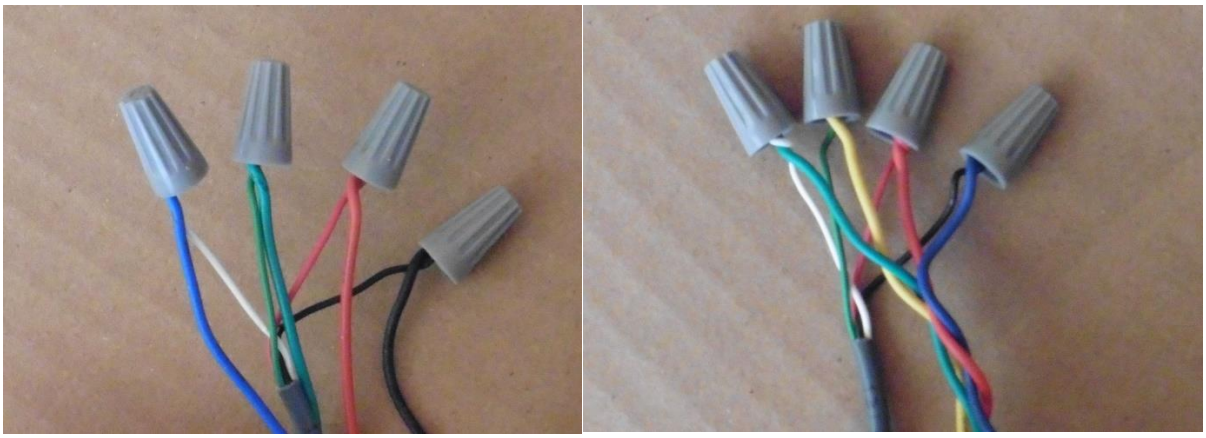

Figure 12 - Motor End Cable Connections with 23HX22-2804S or 23HX30-2804S Style Motor (Left) and 57BYGH104 Style Motor (Right)

Controller Installation

Remove the ½ inch knockout from either the left or right side bottom of the controller box closest to the side where the motor cables are located. Mount the box at eye level and install the cable clamp.

To fit the power cable through the cable clamp, you will need to cut the cable about 3 inches below the ferrite, run the cable through the clamp, then reconnect the two conductors using the wire nuts provided. Before cutting the cable, note that one of the conductors is marked by a white stripe to mark its polarity. Be sure to connect this same conductor back together inside the box.

Route all of the motor cables through the clamp. See Figure 13.

Remove the blank panel inside the box. You can discard the panel, but retain the four 10-32 mounting screws.

Figure 13 - Control Panel Box with Wires Routed through Cable Clamp

It is easiest to connect the motor cables before mounting the circuit card assembly. Note the connections for the odd numbered shades are on the left and the even numbered shades are on the right.

When cutting off the excess cable, be sure to leave a service loop outside the box and enough extra inside the box to allow future rerouting if necessary. Remove about 2 inches of jacket and strip ¼ inch of insulation from each of the conductors. Although you do not have to do so, it is also easier if the conductors are tinned with solder before connecting them to the motor terminals on the circuit board. See Figure 14. Use a small bladed screw driver to tighten each of the motor wires as they are connected to the terminal blocks. The color coding for the motor cables is indicated on the panel above each of the terminals. See Figure 15.

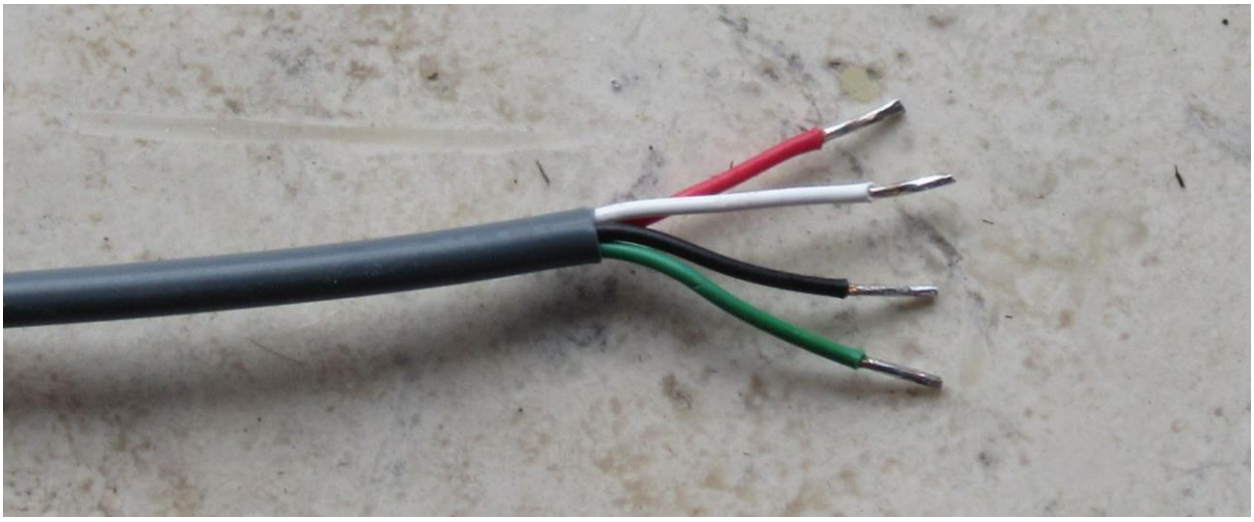

Figure 14 - Controller End Cables Stripped and Tinned

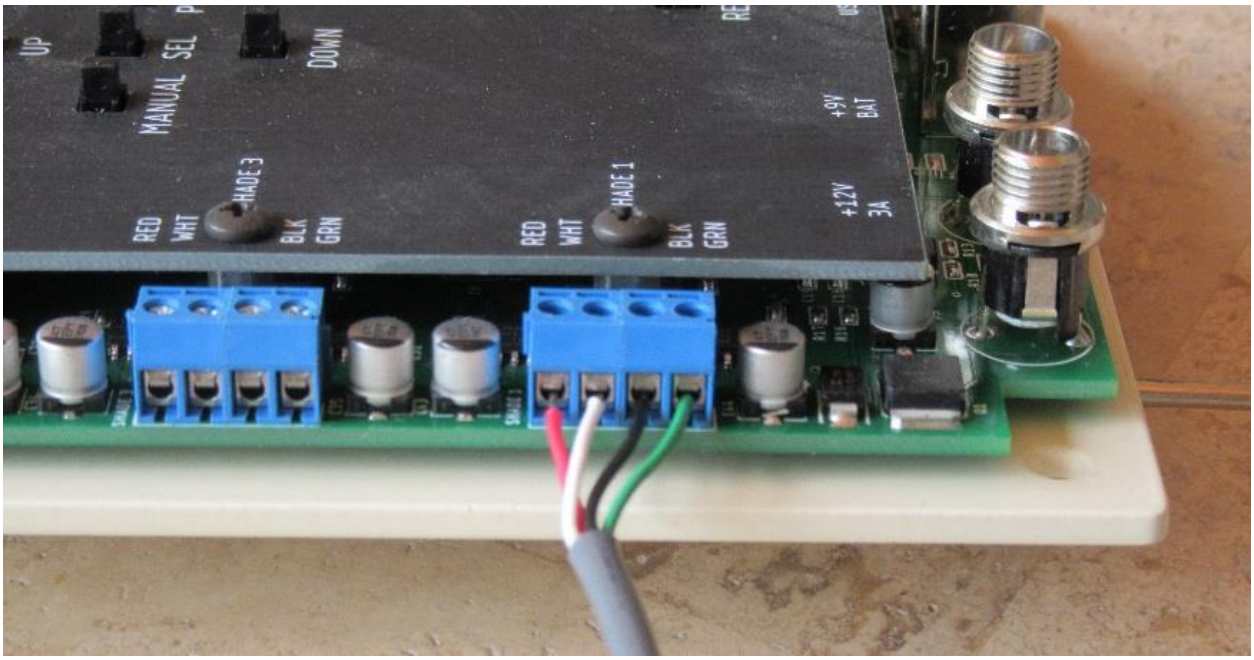

Figure 15 - Connecting Cable from Shade to Controller

Now mount the circuit board to the back side of the box using the four 10-32 screws supplied with the box, and check that all the motor wires are securely connected.

Note there are two identical power connectors. The one on the left is for the main 12 VDC power supplied by the wall mount power supply. The one next to it is for a backup 9 VDC battery. Plug in both power supplies into the controller. See Figure 16.

Figure 16 - Controller Installed and Connected

Programming the Controller

The screen may display a message about the battery being changed. Press the center SEL key to clear this message. The screen will now display the time of day and that will probably be wrong. This will be fixed in the following steps.

Figure 17 - Control Panel Display and Buttons

The controller uses 5 push buttons to program all the settings inside the controller. These same buttons may also be used to manually raise and lower the shades. During programming, the right (PROG) and left (MANUAL) buttons are used to advance or back up the selection of the parameter to be programmed while the UP and DOWN buttons are used to increase or decrease the value of the selected parameter. However, the change does not go into effect until the SEL button is pressed. The screen will show the original parameter value in green until it is changed with the UP or DOWN key. The new parameter is then shown in red until the SEL key is pressed. Then it is shown in green.

Setting the up position of the shades (PROGRAM ZEROSET)

There is a special controller mode that is used to set the up position of the shades. This should normally only be required once, but if for some reason a step motor loses sync (due to a shade jam, for example), this mode can always be used to re-zero the up position of the shades.

From the normal RUN mode display (time of day) press the PROG button once to enter the PROGRAM TIME MODE. Then press the DOWN button once so PROGRAM ZEROSET is displayed.

Press the PROG button once more so that the display shows SET SHADE1 UP. Now press the UP switch once and note how Shade #1 moves. It should move upward about ½ inch. This indicates the wiring to Shade #1 is correct. If the shade moves the wrong way or does not move at all, check the connections at both the controller and motor ends of the cable. Press the UP or DOWN switches repeatedly so as to place the bottom of the shade at the correct top position. This would normally be about 2 inches below the top roller.

Press the PROG switch again so that the display indicates SET SHADE2 UP. Using the UP and DOWN switches, set Shade #2 to its top position. If you take too long waiting between switch presses, the display will revert to the RUN mode. If this happens before you are finished setting all the up positions, just repeat the above instructions to reach the shade screen that needs adjusting.

Repeat this process for as many shades as are installed. When you are done, you can just wait one minute for the RUN mode to be re-enabled.

Location and time zone (Program Location)

Before programming the controller, you will need to know the UTC OFFSET for your time zone, and the latitude and longitude for your location. You can easily look these up on line by searching for your town in Wikipedia, for example. You also need to know the current date, time and whether or not you are under daylight savings time. Following are two examples.

Example 1 – Phoenix, Arizona, USA. The Wikipedia site shows:

Latitude is entered to the nearest one degree with positive being N and negative S. So we would enter 33 (rounding the 27 minutes down to the nearest degree). Longitude is similarly entered to the nearest one degree with positive being E and negative being W. So we would enter -112 (rounding the 04

minutes down to the nearest degree). Phoenix does not go on daylight savings time, so the UTC offset is -7 throughout the year and the DST option will be set to OFF.

Example 2 - San Miguel de Allende, GTO, Mexico. The Wikipedia site shows:

Latitude is entered to the nearest one degree with positive being N and negative S. So we would enter 21 (rounding the 54 minutes up to the nearest degree). Longitude is similarly entered to the nearest one degree with positive being E and negative being W. So we would enter -101 (rounding the 44 minutes up to the nearest degree). San Miguel uses Mexican daylight savings time, which runs between 2:00 AM on the first Sunday of April and ends at 2:00 AM on the last Sunday in October. So if we are programming the controller during the summer DST period, the UTC offset is -5, but if is the winter period when DST is not in effect, the UTC offset is -6. The DST option will be set to MEX. Date and time are always the local values in effect at the time of programming. Use your cell phone for these.

Setting the time parameters in the controller (PROGRAM TIME)

The shade controller contains a precision real time clock that has its own battery. This battery should last for many years without requiring replacement. The YEAR, MONTH and DAY will probably be correct so you can just skip the steps that change these.

From the RUN mode press the PROG switch once to display PROGRAM TIME, then press PROG once more so the display reads SET YEAR. Press the up or down switches to set the year. Note that the color

of the displayed year changes from the original set value of green to red when a change is made. The red color indicates the new value has not yet been saved. Press the SEL switch to save the correct year.

Now press the PROG button to advance the time parameter to SET MONTH. Press the UP or DOWN switches to select the month. Press SEL to save the month.

Press PROG to advance to SET DAY. Press UP or DOWN to select the day. Press SEL to save the day. The programmer will not allow you to program a day that does not exist; for example, February 30th.

Press PROG to advance to SET HOUR. Press UP or DOWN to select the hour. The controller uses a 24 hour format, so 1:00 pm is shown as 13:00. Press SEL to save. The hour is the current local hour at your location and includes any daylight savings time offset.

Press PROG to advance to SET MINUTE. Press UP or DOWN to select the minutes between 0 and 59. Press SEL to save.

Press PROG to advance to SET UTC OFFSET. Press UP or DOWN to select the offset for your time zone relative to Universal Time (GMT). Negative values indicate time zones East of London, England. Press enter to save. Note the UTC OFFSET includes any offset due to daylight savings time. Refer to the examples above for determining the UTC Offset for your location.

Press PROG to advance to SET DST. Press UP or DOWN to either US DST, MEX DST or NO DST. Press enter to save. If US DST is selected, the hour is advanced forward between the second Sunday in March and set back on the first Sunday in November. If MEX DST is selected, the hour is advanced the first Sunday in April and set back the last Sunday in October. If NO DST is selected, there is no daylight savings time adjustment during the year.

Note at any time you can press the left (MANUAL) button to return to the previous setting. For example, if you are setting the MINUTES and the HOUR changes, you can back up to SET HOUR, fix and save the value, then advance again to SET MINUTE.

Pressing PROG once more after setting the DST parameter returns the system to PROGRAM TIME. Pressing UP will advance the controller to PROGRAM LOCATION.

Setting the location parameters in the controller (PROGRAM LOCATION)

The controller requires the latitude and longitude of its location in order to calculate sunrise and sunset times. See the examples above for how to obtain the latitude and longitude.

From the RUN mode press the PROG switch once to enter the PROGRAM TIME, then press UP once so the display reads PROGRAM LOCATION.

Press the PROG button once to select SET LONGITUDE. Use the UP or DOWN buttons to enter the correct value. In North or South America, this will always be a negative number. Press SEL to save the value.

Press the PROG button again to select SET LATITUDE. Use the UP or DOWN buttons to enter the value. In the Northern Hemisphere, these will be positive values. Press SEL to save.

Pressing the PROG button once more will return the system to PROGRAM LOCATION. Press UP once to advance to PROGRAM SHADES.

Setting the shades parameters in the controller (PROGRAM SHADES)

From the RUN mode press the PROG button once to enter PROGRAM TIME, then press UP twice so the display reads PROGRAM SHADES.

Press PROG to select SET UPTIMEOFFSET. This is the offset from sunset or sunrise at which the shades will move to their up positions. The value should be between -1 and +5. If the value is negative or zero, the offset is relative to sunset. This would normally be the setting if your shades are on the West side of the house. If the shades are on the East side, you would want shade in the morning. Enter a positive value (between 0.25 and 5.0) for UPTIMEOFFSET in this case. This value changes in 1/4 hour increments. Press SEL to save it. This setting determines whether the RUN display shows the time for sunset or sundown.

Press PROG to select SET DNTIMEOFFSET. This is the offset from sunset or sunrise at which the shades will move to their down positions. If the shades are set relative to sunset (as determined by the UPTIMEOFFSET above) the DNTIMEOFFSET must be between -5 hours before sunset and the UPTIMEOFFSET. If the shades are set relative to sunrise (as determined by the UPTIMEOFFSET above) then the DNTIMEOFFSET must be between 0 (sunrise) and the UPTIMEOFFSET. This value also changes in 0.25 (quarter hour) increments. Press SEL to save.

Figure 18 and Figure 19 below summarize the constraints on UPTIMEOFFSET and DNTIMEOFFSET.

NOTE: Beginning with Version 3.16 the +/-5 hour offsets were changed to +/-8 hours.

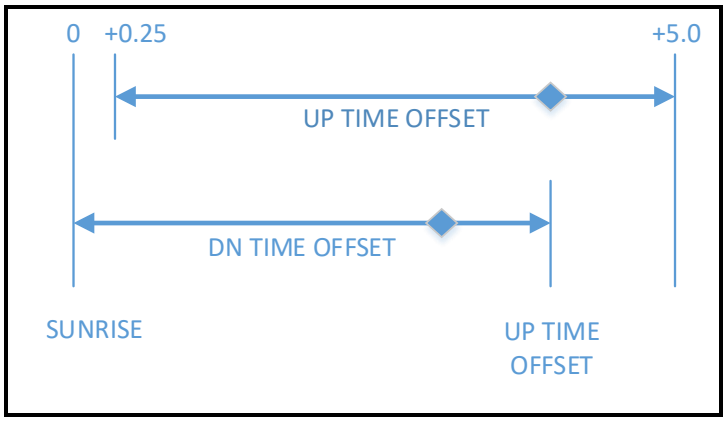

Figure 18 - Up Time and Down Time Offsets Relative to Sunrise

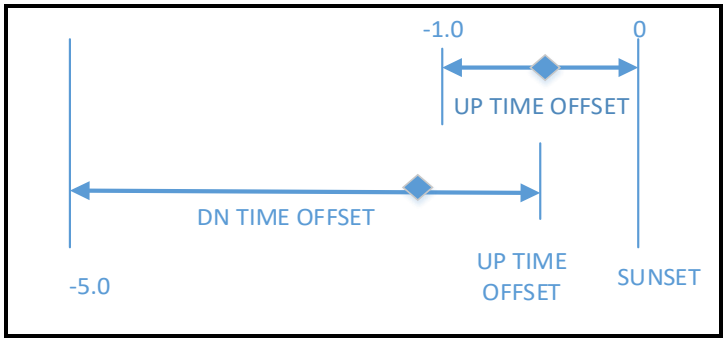

Figure 19 - Up Time and Down Time Offsets Relative to Sunset

If the DOWNTIMEOFFSET is set to be the same as the UPTIMEOFFSET (either positive or negative), the controller will not automatically lower the shades. You can still raise and lower them using the MANUAL commands however. And if you forget to manually raise the shades, they will raise automatically at the programmed UPTIMEOFFSET.

After setting the UPTIMEOFFSET and DOWNTIMEOFFEST, press PROG again to select SET SHADE1 DOWN. This is the down position of shade #1 relative to its up position. It is the distance measured in feet and changes in 0.25 increments (1/4 ft or 3 inches). It can have a value between 0 (no movement) to 12 (12 feet down). Use UP or DOWN buttons to program the position, then SEL to save it.

Press PROG once to select SET SHADE2 DOWN. This is the down position of shade #2 relative to its up position. Use UP or DOWN buttons to program the position, then SEL to save it.

Continue the previous steps for each of the shades. If a shade is not connected, program its down position to be 0. Otherwise, the system will treat it as connected and attempt to lower it anyway.

Selecting optional parameters (Program Options)

From the RUN mode press the PROG button once to enter PROGRAM TIME, then press DOWN once to enter PROGRAM OPTIONS.

Press PROG to select SET MANUAL OPTIONS. There are three different manual modes of operation which are described more fully in the section Manual Operation below. Press the UP or DOWN keys to select which mode you want, then press SEL to save this selection.

- ALL is the default manual mode that requires only a single key press to cause all shades to lower to their preset positions if they are up and raises them to the zero position if they are down.
- INDIVIDUAL is a manual mode that allows a single shade to be selected. Once selected, pressing the SEL key causes only this shade to lower or raise.
- ADJUSTABLE is a manual mode that allows a single shade to be selected, then its down position changed using the UP and DOWN keys. Pressing SEL then causes it to raise or lower to reach this new position.

From the SET MANUAL OPTIONS menu, pressing the right arrow brings up the SET POS RESOL screen. The positions resolution is the amount the target down position of the shades changes each time the up or down arrows are pressed in the SET SHADEx DOWN menus. It is normally preset to 0.25 feet, but in the SET POS RESOL menu this may be changes to 0.5, 0.75 or 1.0 feet. About the only reason for changing this value from the default 0.25 is to save repeated button pushing when using the ADJUSTABLE manual mode.

Command Tree

Figure 20 summarizes the commands discussed above. The arrows show the possible transitions between each of the setup states.

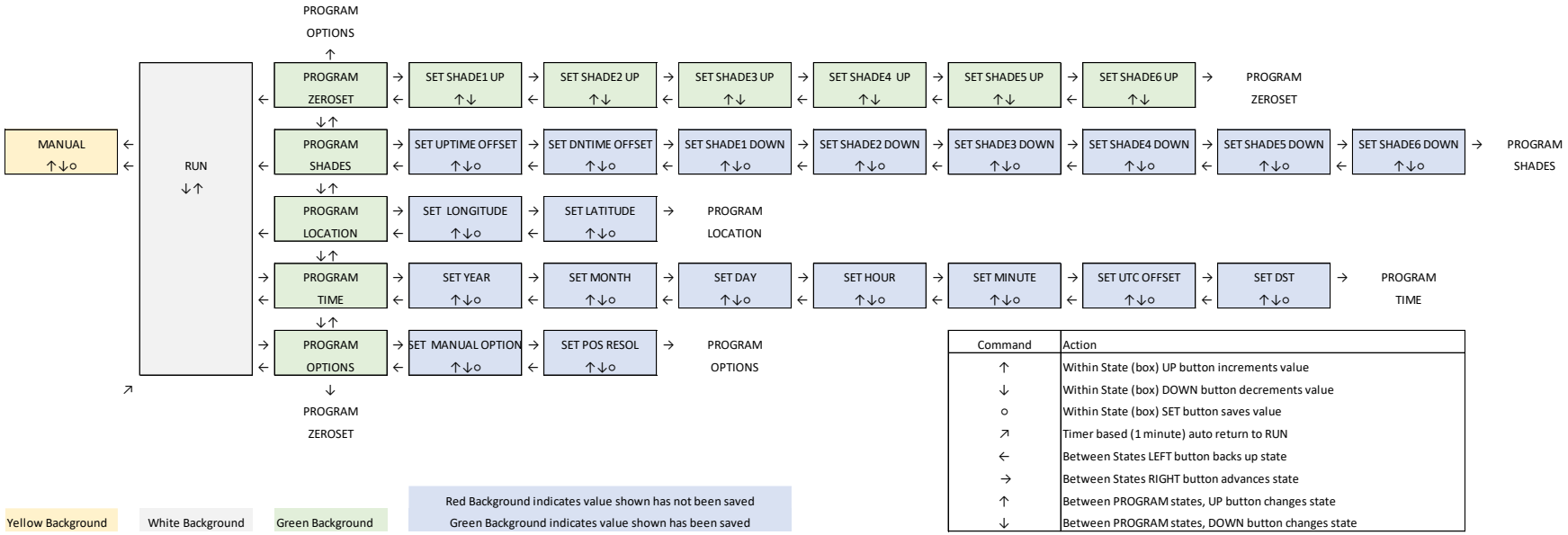

Figure 20 - Command Tree for the Shade Screen Controller.

Manual Operation

There are three different manual modes which can be selected from the Program Options Menu.

The default mode is called ALL and is very easy to use. Simply press the MANUAL button once. If the shades are up, they will move down and if any of them are down, they will move up. The automatic mode will also raise or lower the shades according to the times programmed.

The second manual mode is called INDIVIDUAL. In this mode, the MANUAL button selects which shade to raise or lower. Press it repeatedly until the shade you want to control is indicated, then press SEL to cause it to raise (if it is down) or lower (if it is up).

The third manual mode is called ADJUSTABLE. In this mode, the preprogrammed values for the shade down positions can be changed while the shades are down. Press MANUAL once and the display shows the target (down) position of Shade #1. The shade may be up or down at this position. Press the UP or DOWN buttons to change this position. If this is the only shade you want to change, just press SEL. The shade will move to the new position which we be stored as the new down position for Shade #1. Repeat the process for Shade #2 by pressing MANUAL twice to select Shade #2. You can also use MANUAL followed by UP/DOWN to change several shade target positions, then press SEL to have all of them move sequentially.

Power Monitoring and Battery Replacement

Under normal conditions, the entire system (motors, logic, display, etc.) operates from the 12 VDC, 3 A power supply. If 12 VDC power is lost, the system will continue to operate from the 9 VDC backup battery. This battery however will NOT operate the motors.

If the shades are moving when the 12 VDC power is lost, the position of the shades is immediately saved to a non-volatile memory. When the 12 VDC power is restored, the controller will automatically raise any of the shades that are not already in the UP position.

The system will operate from the 9 VDC battery for about 2 hours. At that time, the battery voltage will be low and the system will turn off. If this happens, and the 12 VDC power is restored, a message is displayed saying that the 9V battery must be replaced. Replace the battery with a 9 VDC alkaline battery. If the 9V battery level is low, the shades will NOT operate automatically from the timer.

The real time clock uses its own special battery for operation and backup. Power consumption is very low so this battery should not require replacement for many years. If the real time clock becomes erratic or stops, replace its battery. The battery is a Lithium coin cell type CR1220.

Customizing the Software

The shade screen controller uses open source software for many of the features (sunset and sunrise calculation, motor drivers, real time clock, etc.) In accordance with the license free use of this software, the program that was written to control the shade screens is also provided as open source. This means that you can modify it and customize it yourself if you are familiar with C language used with Arduino type hardware. See the website AutoShade.mx/downloads for information on downloading and

customizing the software. The same site provides the latest version of the controller software and instructions on how to upgrade it.

Reset

There is a reset button on the front panel which is equivalent to removing both the 12 VDC power and the backup 9 VDC power. You should never need to press this, but if a cosmic ray or software error should result in the system entering a failed state, it allows you to recover. If you press this button while the shades are moving, the positions of the shades will be “lost” in the computer’s memory and you will need to physically reposition them to the “up” position.

Preventing Shade Flapping

The controller of course does not know whether the wind is blowing when it lowers the shades.

There is a small ring attached to each end of the lower aluminum tube. You can run picture hanger wire between eyebolts located at the bottom and top of each shade and passing through the rings. See Figure 21. This will constrain the shades to remain nearly vertical in the presence of wind. But this only works if there is a place to install the eyehooks and wire where they will not interfere with normal patio traffic. A porch with a railing is a good example of where this could be used.

Figure 21 - Using Wire Guides on Shades

If you are leaving for a period of time and are worried about wind damaging the screens, unplug both the 12 VDC supply and the 9 VDC battery. You will not lose any of the programmed settings, and the real time clock will continue to operate.

Eliminating Telescoping

Telescoping is the term that refers to the shade screens "walking" to the left or right on the top roller while they are being raised. Figure 22 shows an example of telescoping. This is not a problem unless it causes the shades to rub against the supporting hardware. To eliminate telescoping, first check that the upper roller is level. If it not, fix it. If the roller is level but the shade still telescopes, lower the shade all the way to the bottom so the aluminum roller is exposed. Then add a piece of tape to the roller on the side that looks like Figure 22. Command the shade up and see whether the telescoping has been eliminated. If not, add a second or third layer of tape over the top of the original tape.

Figure 22 - Telescoping at Idler End of Shade

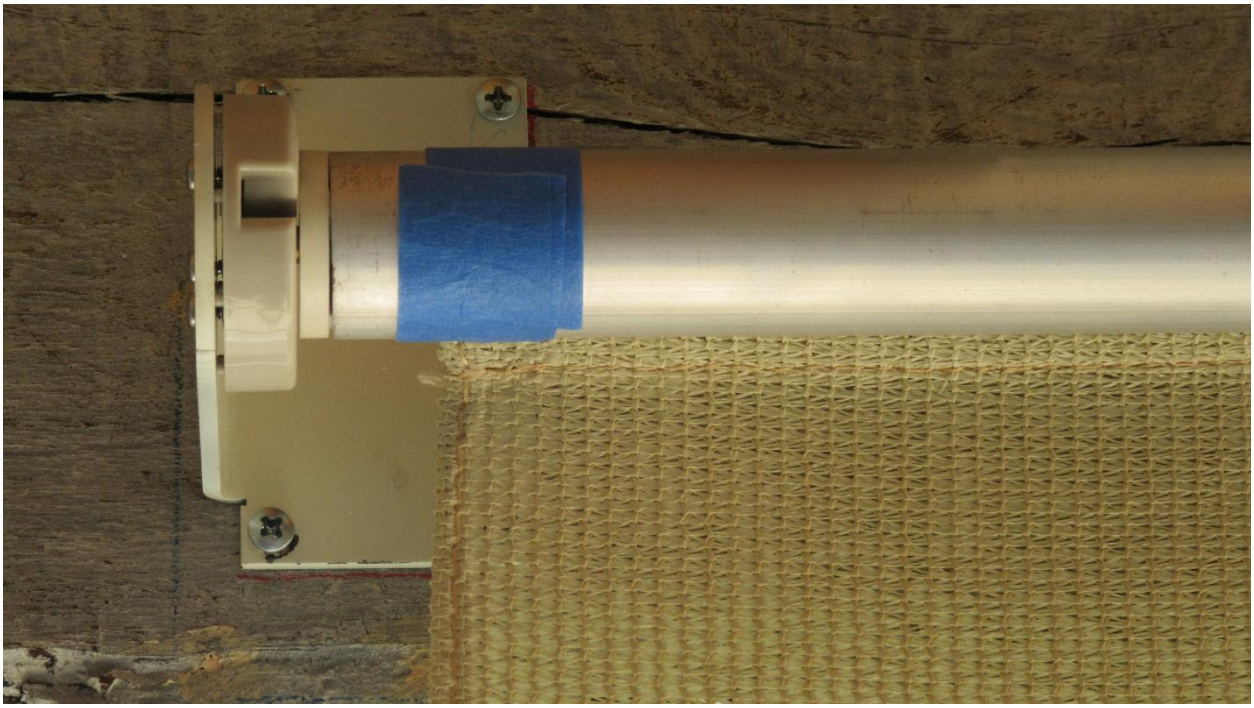

Figure 23 - Adding Tape under Telescoping Shade