



Traffic Products and Warning Systems

RECTANGULAR RAPID FLASHING BEACON SOLAR SYSTEMS

INSTALLATION AND OPERATION MANUAL



www.ELTECCORP.com

Part No. 0SOLAR-RRFB

Rev. 0715A

TABLE OF CONTENTS

INTRODUCTION.....	1
COPYRIGHT.....	1
LIMITED WARRANTY.....	1
SYSTEM CONFIGURATION.....	2-3
Section 1—System Operation	
Summary.....	5
Solar Panel(s).....	5
Charge Controller.....	5
Flasher.....	5
Battery.....	5
Countdown Timer.....	6
Wireless Communications.....	6-7
Rectangular Rapid Flashing Beacons.....	7-8
Terminal Block and Circular Pin Connectors (CPC).....	8
Pedestrian Push Buttons.....	8
Power Inverters.....	8
Section 2—Installation	
Foundation.....	10
Installation of Base Assembly.....	10
Preparation of Pole.....	10-11
Installing the Pole.....	11
Installing the Solar Panel(s) and Mounting Rack.....	11-12
Installing the RRFBs.....	13
Connecting the Battery(s).....	13
Final Connection and System Checkout.....	13
Section 3—Appendices	
Appendix A	
Critical Parameters.....	15
Pre-Turn On Checks.....	15
Post-Turn On Checks.....	15
Appendix B	
Solar Panel(s).....	16-17
Appendix C	
Preparation of the Foundation.....	18
Appendix D	
RRFB Pole Mount Installation Guide.....	19
Appendix E	
Troubleshooting.....	20
Appendix F	
FS-2B Specifications and Warranty.....	21-23
Figures and Tables	
Typical Pedestrian Crosswalk Solar System Using RRFBs, Figure 1.....	2
Wireless Pedestrian Crosswalk Diagrams, Figures 2 and 3.....	3
Banner Radios, Figure 4.....	6
Linear Radios, Figure 5.....	7
RRFB Styles, Figure 6.....	8
Circular Pin Connectors (CPC) Male/Female, Figures 7 and 8.....	8
Solar Panel Connections, Figures 9 and 10.....	12
Solar Panel Connections (Parallel), Figures 11 and 12.....	12
Solar Panel Ratings, Table 1.....	16
Solar Panel Tilt Angles, Figure 13.....	17
North American Latitude Map, Figure 14.....	17
Square Base Template, Figure 15.....	18
Typical Pole Foundation, Figure 16.....	18
FS-2B Wire/Connector Pin Outs, Figure 17.....	21
FS-2B DIP Switch and Header Locations, Figure 18.....	22

INTRODUCTION

Solar power is a reliable, efficient, and effective method to power either Alternating Current (AC) or Direct Current (DC) loads. Since solar power systems provide DC current, DC outputs for DC loads are more efficient.

A solar system consists of three (3) major subsystems: the solar panels which convert solar energy to electrical energy, the batteries which store the electrical energy and release it on demand, and the load—the components that are being powered by the batteries.

Each system provided by Electrotechnics Corporation (ELTEC) has been sized for the specific application specified by the end user. We have considered the power consumed by the load, the power generated by the solar panels, and the geographic location of the installation.

Advantages of solar power systems include:

- Clean efficient power that does not generate pollutants
- Reliability of continuous power without worry about brown/blackouts
- Easy installation since conduits and power lines are not required
- No monthly utility bills

All equipment provided is standard, easily replaced if required. Your system is pre-wired to the maximum extent possible for easy assembly and installation.

Appendix A describes critical parameters that you should ensure are met during the installation. These parameters include solar panel tilt angle, system designation, and solar panel azimuth. In order to facilitate assistance, you should make note of your system parameters and checks.

If you experience difficulty during the installation or during operation of your solar system, call ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com for assistance.

COPYRIGHT

This publication may not be copied or reproduced in any manner or by any means without the express written consent of Electrotechnics Corporation. All rights reserved. Copyright 2015, Electrotechnics Corporation.

LIMITED WARRANTY

Electrotechnics Corporation (ELTEC) warrants your system to be free of defects in material and workmanship for a period of 25 months from the shipping/invoice date.

This warranty is valid for systems that are used within the design specifications originally submitted by the end customer. Systems used for periods longer than specified or with loads greater than specified, void the warranty. Systems not installed properly can also void the warranty. Some examples of improper installation include excessive shading, incorrect azimuth, and incorrect tilt angles. These examples are not inclusive. Misuse, abuse, physical damage and/or acts of God to the equipment are not covered by the warranty.

Electrotechnics Corporation will, at its discretion, repair system components returned with prior merchandise authorization (RMA) or refund the customer's money. In no event will Electrotechnics Corporation or its employees be liable for any direct, indirect, special, incidental, or consequential damages.

Some components used by Electrotechnics Corporation have warranty longer than the 25 month period specified by Electrotechnics Corporation. Following this 25 month period, Electrotechnics Corporation will, when practical, assist the customer in obtaining repair and/or service for these warranted components.

Electrotechnics Corporation wishes to provide exceptional service to our customers. Every effort will be made to ensure that your products are within specification and free from manufacturing defect.

SYSTEM CONFIGURATION

A typical system will consist of a cabinet, battery(s), solar controller, solar panel(s) with mounting rack, pedestrian push button, and pole. The Rectangular Rapid Flashing Beacon (RRFB) light bar works with DC (solar) or AC systems for pedestrian crosswalks. All solar powered systems are sized for each project taking into consideration the average number of crossings per day (hours of operation), latitude, local site conditions, and weather ensuring sufficient power during winter months.

As required by FHWA, the RRFB light bar(s) are mounted on poles between the pedestrian sign(s) and the diagonal downward pointing arrow(s) as illustrated in Figure 1. Figures 2 and 3 show control panel diagrams for a wireless pedestrian crosswalk system including the primary and secondary radio layout. Wireless radio communication will be discussed in Section 1.

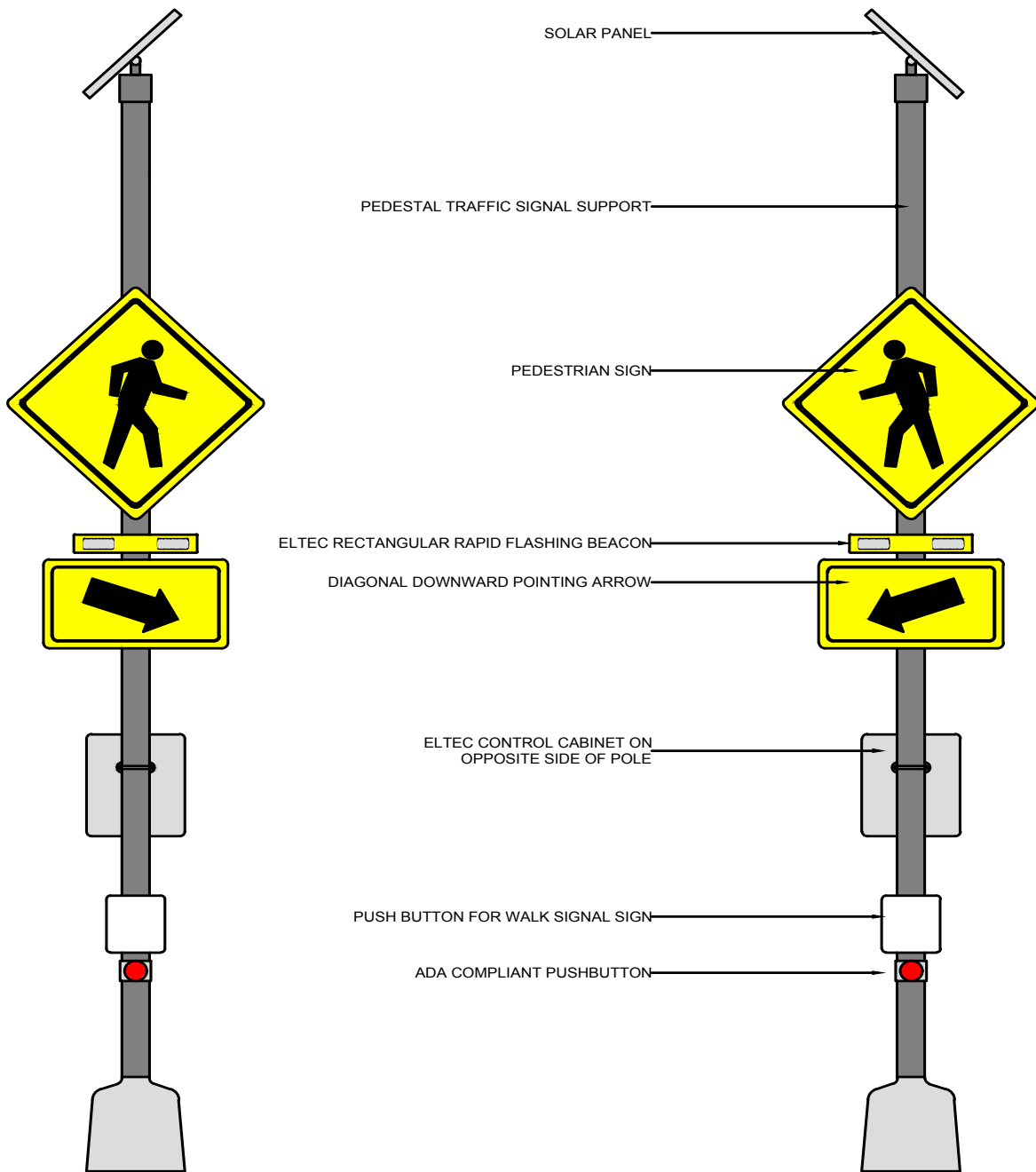


Figure 1 - Typical Pedestrian Crosswalk Solar System Using RRFBs

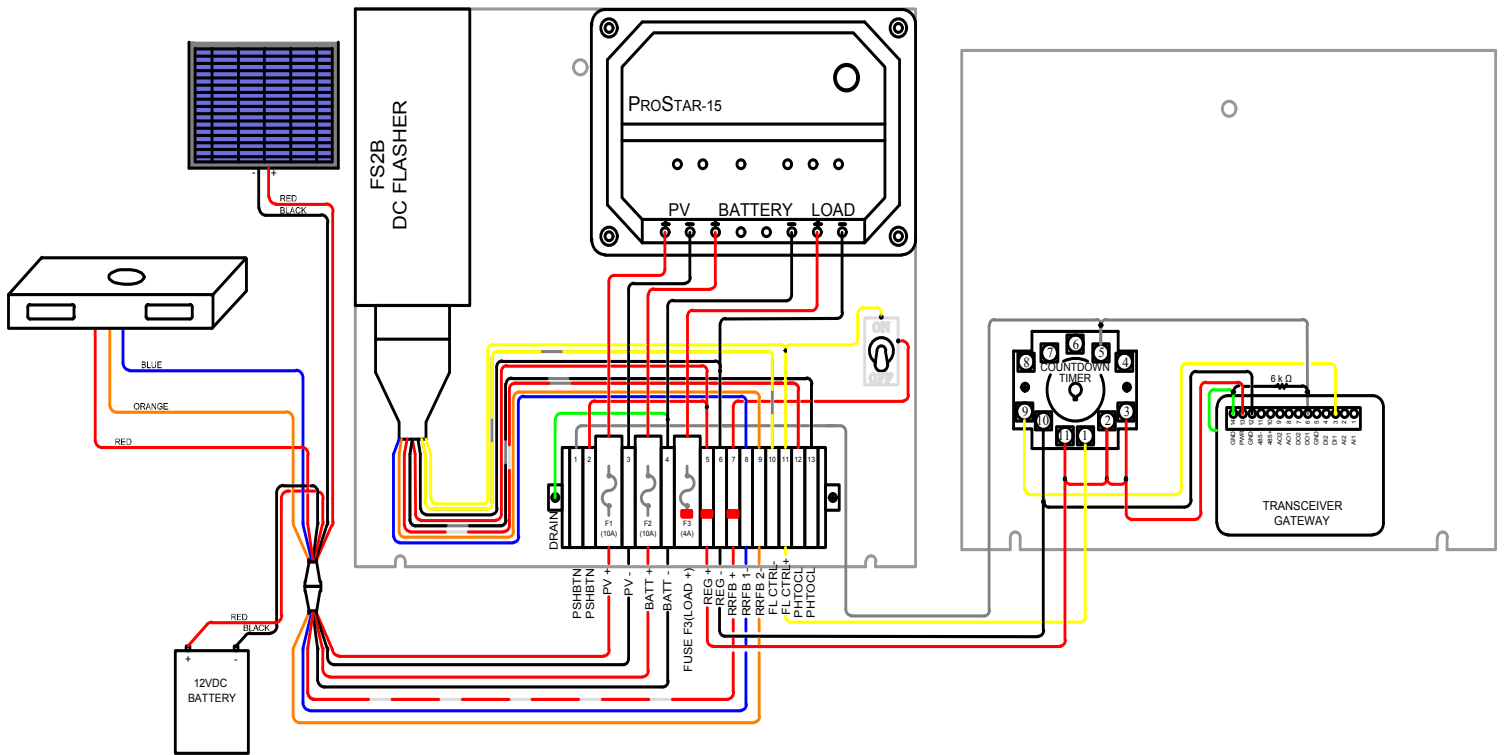


Figure 2 - Wireless Pedestrian Crosswalk Diagram (Primary)

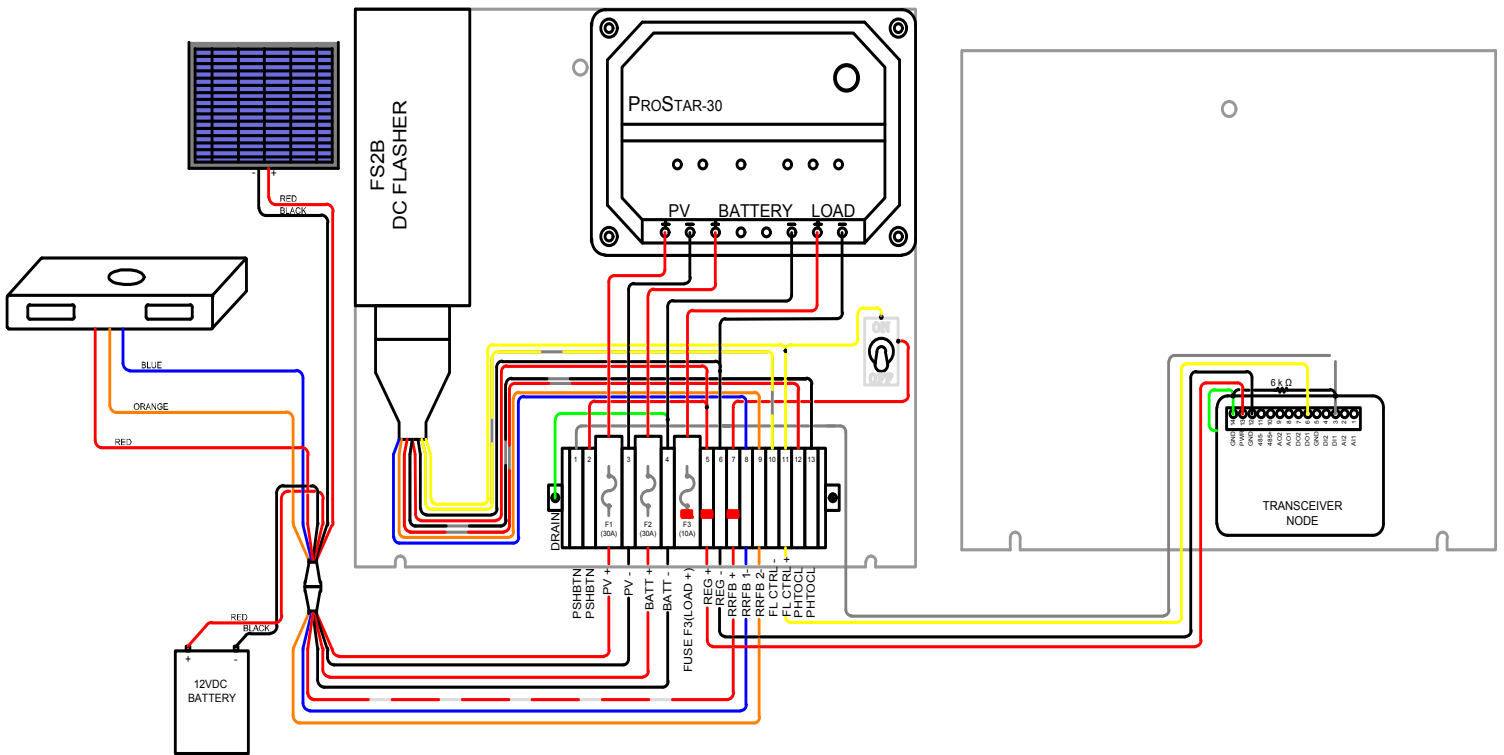


Figure 3 - Wireless Pedestrian Crosswalk Diagram (Secondary)

Section 1

System Operation

Summary	5
Solar Panel(s).....	5
Charge Controller	5
Flasher.....	5
Battery	5
Countdown Timer	6
Wireless Communication.....	6-7
Rectangular Rapid Flashing Beacons	7-8
Terminal Block and Circular Pin Connectors (CPC).....	8
Pedestrian Push Buttons	8
Power Inverters	8

Summary

Sunlight is converted by the solar panels to electrical energy while the batteries store the electrical energy. The solar panels are connected to the batteries through a controller which controls the charging and discharging rate of the batteries. The load is the portion of the system that consumes stored energy. The load is always powered from the batteries via the controller, never from the solar panels directly. Each of these major components is described in more detail.

The purpose of this manual is to describe the installation and functional criteria for a solar powered pedestrian crossing using a Rectangular Rapid Flashing Beacon (RRFB). The system is designed to operate 24 hours per day, 7 days per week.

ELTEC's pedestrian crossing system typically consists of two (2) or more poles with wireless communication between each for simultaneous activation of all RRFBs when activated by a pedestrian on either side of a curb. If a median exists, then activation from the median is optional based on the project specification.

Solar Panel(s)

The solar panel(s) are warranted for 20 years. A single panel can range from 40 to 140 watts. Depending on your system requirements you may have multiple panels. Appendix B explains solar panel configuration in more detail.

Charge Controller

The solar charge controller functions to control the charge on the batteries. The ProStar and SunSaver controllers are solid state devices which control the charging and discharging of the batteries. Controllers provide temperature compensated charging so that the rate of charge is controlled for both temperature and state of charge. The controller will shut off charging when the battery reaches a charge of 13.7 VDC. The controller will disconnect the load when the battery voltage reaches 11.4 VDC. These set points have been established to prevent damage to the battery from an overcharge condition or a low voltage condition. The controller also has a manual disconnect switch that allows you to electrically disconnect the batteries from the system.

The ProStar controller provides a LCD display that cycles through battery voltage, solar panel current, and load current. SunSaver controllers use three (3) colored LEDs to indicate conditions.

Flasher

The ELTEC model FS-2B is a 12/24 VDC, solid state, dual circuit flasher which controls the rapid flashing sequence WW+S (Wig-Wag plus Simultaneous) of the yellow indications on each side and end of the RRFB. A (2/4-1) rapid flash pattern can also be selected. For the dimming circuit to work a photocell must be installed. Photocells should be positioned where street lamps and traffic lights do not affect them.

Refer to Appendix F for the FS-2B specifications and warranty.

Battery

The battery stores the electrical energy which powers the load. Batteries are maintenance-free sealed gel or absorbed glass mat (AGM) technology. If your system is 'knocked down' by accident and your battery punctured, you will experience little to no acid spilled due to the sealed gel and AGM technology.

Countdown Timer

The countdown timer is a multi-function, multi-range, DC timer with a DPDT relay output and LED status indicator. The timer operates upon activation to control the flash duration of the RRFB. The timer provides seven (7) field selectable ranges of timing from 0.1s to 100h activation duration. ELTEC configures timers to function C (triggered latched delay) and a dial set point of approximately 25 seconds. Dial settings can be adjusted by the end user to give pedestrians the necessary crossing time.

Specifications for the Crouzet Chronos PU2R4 timer relay:

- Operating Voltage12 VDC Nominal (10.2V – 14.4V)
- Max Power Consumption0.6W
- Repetition Accuracy.....+/- 0.5%
- Operating Temp Range-20° C to +60°
- Relay Output Rating10A – 250V
- Fixing: Plug-in Base11-pin

Wireless Communication

900 MHZ Spread Spectrum

The most widely used (wire replacement) radios supplied with ELTEC pedestrian crossing systems are the Banner SureCross DX80 Performance Series gateways and nodes. The units on each side of the road plus any optional units in the median or elsewhere can communicate by a wireless signal. The radio transceivers use Frequency Hopping Spread Spectrum (FHSS) technology to ensure reliable data delivery within the unlicensed Industrial, Scientific and Medical (ISM) band.

Specifications for Banner DX80 Series radios:

- Operating Voltage10 VDC – 30 VDC
- Operating CurrentTyp - <100mA, Max – <200mA at 12 VDC
- Operating Frequency.....900 MHz
- RF Transmit Power1 Watt
- Network IdentificationMAC ID Binding
- Antenna Impedance50 Ω

The initiation of the signal for the flashers to commence is most commonly achieved by a pedestrian push button. Activation from a pedestrian triggers the system countdown timer located in the primary unit to operate the crossing indications at every unit via the wireless radios. Each time a pedestrian pushes a button, the countdown timer will reset to the start of the delay time, thus allowing the beacons to flash for a full cycle for each initiation.

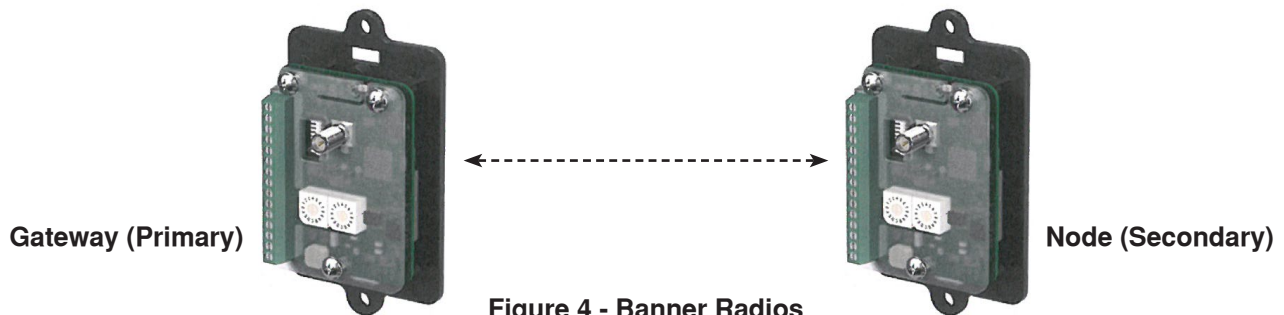


Figure 4 - Banner Radios

Wireless Communication (optional)

27.255 MHZ FSK Modulated

Optionally, pedestrian crossings can utilize Linear XT-1 and XR-1 extended range transmitters and receivers on an unlicensed frequency. When triggered by pedestrian push button activation the transmitter will send a digitally encoded, FSK (Frequency Shift Keying) modulated signal to its companion receiver(s). The receiver will verify the digital code, activate it's output and trigger the countdown timer(s) to operate the crossing indication for the programmed duration.

Specifications for Linear XT-1 and XR-1 radios:

- Operating Voltage12 VDC – 15 VDC
- Operating CurrentStandby – 15 μ A, Transmit – 2A at 12 VDC
- Operating Frequency.....27.255 MHz
- Bandwidth6 kHz
- RF Output Power10 Watts Typical
- Code Setting MethodDIP Switch Programming
- Transmit Time1s
- Antenna Impedance50 Ω

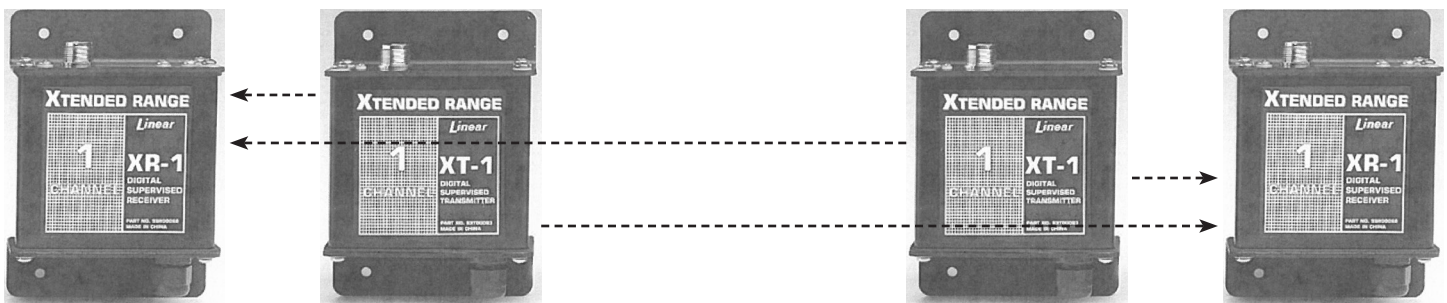


Figure 5 - Linear Radios

Rectangular Rapid Flashing Beacons (RRFB) - One-Sided Light Bar

A one-sided RRFB light bar contains two (2) rectangular rapid-flashing yellow indications. The one-sided light bar can also have one (1) pedestrian verification LED on the end. The RRFB housing is constructed of brushed aluminum. All housings can be powder coated in federal yellow or custom colors upon request.

One-sided RRFBs will fit standard 4½” OD poles with a mounting bracket and U-bolt. They can also be fitted with universal banding brackets to accommodate various pole sizes or back to back mounting.

Rectangular Rapid Flashing Beacons (RRFB) - Wraparound Light Bar

The RRFB wraparound light bar contains four (4) rectangular rapid-flashing yellow motorist indications; two (2) for each direction of traffic. RRFB light bars can also have one (1) pedestrian verification LED on the end(s).

The RRFB wraparound light bar is assembled and wired as a unit. The unit’s two-piece housing includes a quick-disconnect plug between the wiring harness of each side to allow for ease of installation and maintenance. Wraparound housings will mount to standard 2¾” or 4½” OD poles and Telespar poles with universal mounting brackets and U-bolts. Figure 6 shows the RRFB styles.

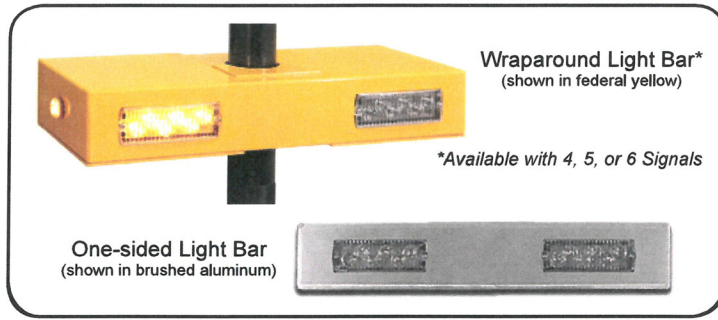


Figure 6 - RRFB Styles

Terminal Blocks and Circular Pin Connectors (CPC)

Fully labeled terminal blocks are provided to facilitate termination of solar panels, batteries, and various external components. Power terminals will be clearly identified as to positive (+) or negative (-). Most systems are pre-wired with circular pin connectors for ease of component replacement (See Figures 7 and 8).

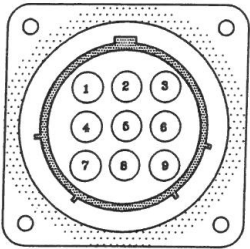


Figure 7 - Male CPC END
(Attached to Cabinet Terminal Block Wires)

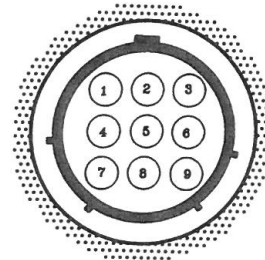
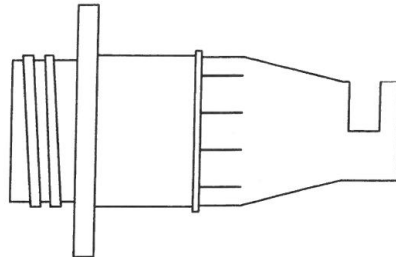


Figure 8 - Female Backbone CPC END
(Attached to Solar Panel, Battery, and RRFB Wires)

Pedestrian Push Buttons

A pedestrian push button will be provided for each pole location to activate the flashing beacons. All push buttons used with ELTEC systems are ADA and MUTCD compliant.

Specifications for ADA compliant push buttons:

- SwitchPiezo Electric Solid State
- Operating Voltage12-24V AC/DC
- Rated Life.....300 Million Operations
- Operating Pressure<5 lbf
- Degree of ProtectionSealed IP68
- Operating Temperature-40°C to +80°C

ADA compliant push buttons are commonly mounted along with a plaque reading 'PUSH BUTTON TO TURN ON WARNING LIGHTS'. Various push button plaques and stations are available.

Power Inverters

Solar powered systems can be properly sized to provide AC load power when needed. The end user may need to power an AC component ranging from 120 to 12 VAC. If you specify a requirement for AC load power, your solar system will have an inverter installed.

Section 2

Installation

Foundation..... 10

Installation of Base Assembly..... 10

Preparation of Pole..... 10-11

Installing the Pole 11

Installing the Solar Panel(s) and Mounting Rack..... 11-12

Installing the RRFBs..... 13

Connecting the Battery(s)..... 13

Final Connections and System Checkout..... 13

CAUTION: THESE INSTRUCTIONS ARE FOR GUIDANCE ONLY AND ARE NOT TO BE CONSTRUED AS ENGINEERING APPROVED DOCUMENTS. YOU SHOULD CONSULT A LICENSED PROFESSIONAL ENGINEER FOR APPROVAL OF YOUR SITE AND ERECTION PLANS.

Foundation

It is important that a proper foundation be prepared. Appendix C shows a typical foundation. Your installation will be subject to winds and other environmental considerations, so a proper foundation is critical to the successful and correct installation of your solar equipment.

Installation of Base Assembly

Most installations will use a breakaway base. The base should be installed on a level surface. If the surface is not level, use leveling processes such as grout, shims, or similar tools to level the foundation surface. Your foundation should have four (4) anchor bolts installed when the foundation is prepared. These anchor bolts are usually ¾” x 18” J-bolts that come with your breakaway base. Anchor cages are also available for foundations which include a vertical rebar assembly (See Appendix C).

Preparation of Pole

Normally the pole is prepared before it is erected. When you receive the pole, it typically does not have any mounting holes. You will need to drill the mounting holes in the desired locations.

Tools required:

- Drill and unibit or hole saws (ranging from ¾” to 1¼”)
- Fish tape to fish the leads through the pole
- De-burring file
- Pipe wrench
- Measuring tape
- Hammer

The user must decide upon the desired mounting of the cabinet and beacon(s). Typically the cabinet is on one side of the pole with the beacons on the opposite side. Unless the user is concerned about vandalism, we suggest that the cabinet be mounted so that the control panel in the cabinet is eye level. The control panel shelf is approximately 15 to 30 inches from the bottom of the cabinet. The leads from the solar panel and from the RRFB(s) (the ‘backbone’ harness assembly) will enter the cabinet from inside the pole through the mounting bracket on the back of the battery cabinet. We suggest that the user drill the cabinet lead entry hole approximately 4 to 4½ feet from the bottom (threaded end) of the pole. The base is approximately 14 inches high; thus a hole 4½ feet from the bottom will place the control panel shelf approximately 5½ feet above the foundation. The drilled hole should be 1 inch in diameter.

If vandalism is an issue, the user may want to mount the battery cabinet at a height so that it is only reachable with a lift bucket truck. In this instance, the user will want to ensure that the top of the battery cabinet does not interfere with the tilt of the solar panels nor the signage and RRFBs. The next step is to drill the holes for the leads that will connect to the RRFB(s). RRFBs typically mount above the arrow placard(s) and below the pedestrian sign(s). Recommended height for RRFB(s) is approximately 8 to 9 feet.

NOTE: When measuring the pole to drill the RRFB lead holes, remember that the base adds approximately 14 inches to the height of the hole above the foundation.

If an acorn cap is provided, the user must drill an exit hole near the top of the pole for the solar panel leads. We

suggest a ¾” hole for these leads. This hole should be approximately 9 to 12 inches below the top of the pole.

All holes should be de-burred to ensure that chaffing or cutting of harness insulation does not occur. ELTEC harnesses come with a circular pin connector for easy mating to the back of the control panel.

Mount the cabinet onto the pole using the U-bolts provided for the mounting bracket(s) on the back of the cabinet. If instead of mounting brackets with U-bolts, you are provided brackets for banding, band the cabinet to the pole. Remember the hole in the bracket should be directly over the hole that you have drilled in the cabinet.

Thread the leads of the backbone harness into the pole from inside the cabinet. The leads of the backbone harness will go through the hole in the back of the cabinet, through the mounting bracket, and through the hole drilled in the pole. Using the fish tape, pull the red, blue, and orange leads through the hole(s) for the RRFB and pull the solar panel leads (the jacketed grey cable) out the top of the pole—either through the end of the pole or through the hole if one was drilled. If an acorn cap is provided for the top, install the cap.

At this point you should have the backbone harness circular pin connector extended from the hole to the battery cabinet (inside the battery cabinet), the red, blue, and orange leads into the RRFB light bar, and the solar leads to the top of the pole. Refer to Appendix D for ‘RRFB Pole Mount Installation Guide’.

You may want to install the solar panel(s) and mounting rack prior to installing the pole in the base. If so skip to the section ‘Installing the Solar Panel(s) and Mounting Rack’. After completing the installation of the solar panel(s) and mounting rack, then return to section ‘Installing the Pole’. Be careful that you do not damage the solar panel(s).

Installing the Pole

Raise the pole over the base and thread the pole into the base. Tighten the pole so that it is secure. Assure that the lead wire hole located at the RRFB housing is facing the oncoming traffic.

Most units will be provided with a base collar. Install the collar around the pole and tighten the collar to the base.

Installing the Solar Panel(s) and Mounting Rack

Warning: To avoid electrical shock while installing and connecting the solar panels, remove the PV fuses in the control cabinet.

Important: Your solar panel is designed to convert sunlight into electrical energy. Your panel should be located so that it is exposed to the sun at all times and is not shaded by trees, buildings, or similar things.

Instruction sheets for assembling and installing the mounting rack will be found in an envelope with the mounting rack. If instructions are not provided, please call ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com and they will be sent to you.

Tools you will need are:

- Flat head screwdriver
- Compass
- Protractor
- Ball peen hammer

Attach the solar panel(s) to the mounting rack. Instructions should be in the solar panel box. If they are not, and you need instructions, please contact ELTEC as previously discussed.

You are now ready to install the mounting rack with solar panels on the pole. If the mounting rack has U-bolts, it goes near the top of the pole, just under the pole cap. If the mounting rack is a post top style using a slip fitter cap, slip and fasten the cap over the top of the pole. If it is a side of pole mounting rack, follow the rack installation instructions. The orientation of the solar panels should be South.

For ideal generation of electricity, your system should be optimized for your location. You must rotate the panels from the horizontal to the optimal angle. Use Appendix B to determine the angle. Use a protractor to tilt the solar panels until they are at this angle. Tighten the nuts on the bolt to lock panels in place.

Locate the junction box under the panel(s). Remove the cover(s) and locate the terminal block. Figures 9 and 10 show typical junction box configurations. Diode arrays are included to prevent unwanted power feedback.

NOTE: If more than one panel is being used, connect the panels in parallel by installing a red jumper between the positive terminals and a black jumper between the negative terminals (Figures 11 and 12).

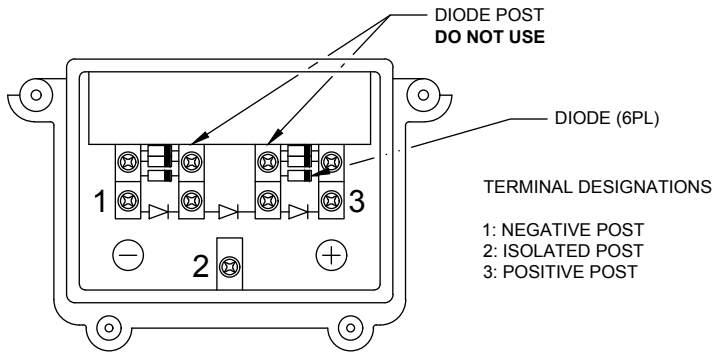


Figure 9 - Solar Panel Connections (Type 'M' Junction Box)

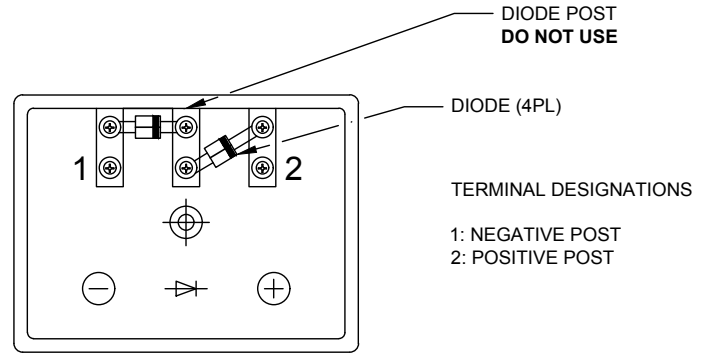


Figure 10 - Solar Panel Connections (Type 'G' Junction Box)

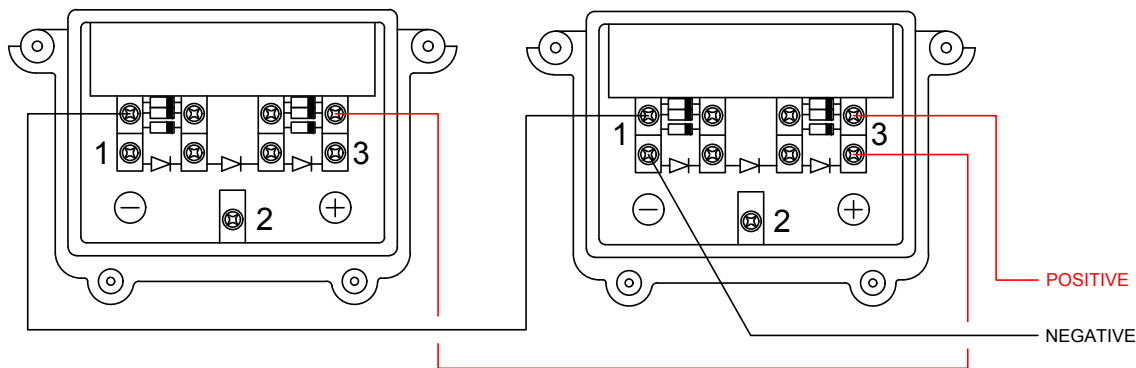


Figure 11 - Two Type 'M' Junction Boxes in Parallel

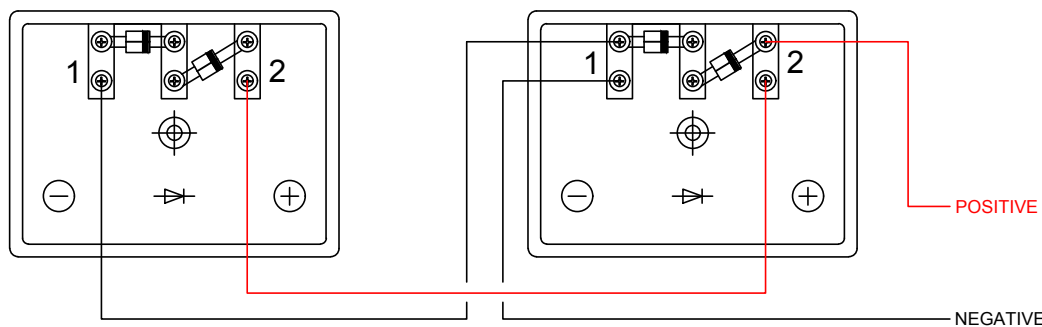


Figure 12 - Two Type 'G' Junction Boxes in Parallel

Earlier you installed the battery cabinet and inserted the solar panel lead (jacketed grey cable into the pole) and fished it out the top of the pole. Now insert the two cables in the jacketed cable into solar panel junction box. The white lead goes to the positive connection and the black lead goes to the negative connection.

After making this connection, you have now completed the wiring connections from the solar panel to the solar controller. Fuses should remain disconnected until just prior to system checkout. If you did not install the pole into the base earlier, now is the time to install the pole into the base. Return to the section 'Installing the Pole'.

Installing the RRFBs

Warning: Remove the fuse marked load inside the battery cabinet prior to connecting the RRFB(s).

If you have already drilled the pole for the RRFB then skip the next paragraph. If you have not drilled the holes for the RRFB, you will need to do so at this time.

ELTEC provides mounting hardware pre-selected for the RRFBs that we provide. Normally this mounting hardware includes a bracket which mounts to the pole either through U-bolts or banding. Should the mounting hardware differ from what is described in this section, please contact the dealer who sold you the system for installation details.

Pull the leads previously fished from the battery cabinet into the RRFB housing and make wire connections per wire color code. Insert the U-bolts around the pole and/or clamp provided. Install and secure the U-bolt nuts and the screws for the RRFB assembly (See Appendix D).

Connecting the Battery(s)

Warning: Remove the battery fuse in the battery cabinet prior to connecting the battery(s).

If you have been provided with more than one (1) battery, you will also have red and black jumpers with ring terminals to connect the batteries in parallel. Unscrew the wing nuts from the battery terminals and attach the rings to the battery connection. The red jumper goes to the positive terminal and the black jumper goes to the negative terminal.

Thread the red and black wires of the backbone harness through the hole in back left corner of the control compartment in the battery cabinet. These wires should have rings on the ends of them. Unscrew the wing nuts from the battery terminals and attach the red wire to the positive battery terminal and the black wire to the negative battery terminal.

Final Connections and System Checkout

You should perform system checks to ensure that your wires and connections have been made correctly by referring to Appendix A. These checks should be written down by the installer for technical support purposes.

After you have completed your wire connections, connect the backbone harness assembly from the solar panels and battery to the circular pin connector on the back of the control panel. Re-install all fuses. There are three (3) fuses: the load fuse, the battery fuse, and the solar panel fuse.

The ProStar controller should have a status LED illuminated indicating that battery voltage is present at the controller. If all wiring has been made correctly, the display will also cycle on the ProStar controller. You should see battery voltage with a reading greater than 11.4 volts, array current, and load current. You will have to wait 2 minutes after system initialization before the load current is displayed. If the load is not turned on, the reading will be 0.0 amps. Refer to the provided manual for the ProStar controller to ascertain battery charge state.

If your system has power to the countdown timer, the timer LED should be on. Refer to provided radio manuals for your radio model LED indicators if radios do not link with one another. Refer to Appendix E for troubleshooting your system. If you still have problems with system operation, please call ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com.

Section 3

Appendices

Appendix A

Critical Parameters	15
Pre-Turn On Checks	15
Post-Turn On Checks	15

Appendix B

Solar Panel(s)	16-17
----------------------	-------

Appendix C

Preparation of the Foundation	18
-------------------------------------	----

Appendix D

RRFB Pole Mount Installation Guide	19
--	----

Appendix E

Troubleshooting	20
-----------------------	----

Appendix F

FS-2B Flasher Specifications and Warranty	21-23
---	-------

APPENDIX A - *(Fill in at the time of installation. Please print legibly.)*

Technician: _____ Date: _____

Company Name: _____

Critical Parameters

System Designation and Model Number: _____

Solar Panel Tilt Angle (From the Horizon): _____

Solar Panel Azimuth: _____
(180° is Due South in the Northern Hemisphere, and 0° is Due North in the Southern Hemisphere)

Pre-Turn On Checks

1. On the solar panel leads, check the voltage between the two leads. This voltage should read approximately 16-20 volts with proper sunlight. Your reading is _____.
2. On the terminal block marked 'BAT+' and 'BAT-' check the voltage between the 2 terminal blocks. This voltage should read between +11.4 volts and +13.7 volts. Your reading is _____.

Post-Turn On Checks

1. Verify the LED that is lit on the solar controller. Record the color of the LED that is lit _____.
2. Record the solar voltage being displayed on the controller _____ V. (ProStar models only)
3. Record the array current being displayed on the controller _____ amps, the time of day _____ and weather status (sunny, cloudy, raining) _____. (ProStar models only)
4. Turn on the load and record the load current being displayed on the controller _____ amps. (ProStar models only)

APPENDIX B

Solar Panel(s)

The power output of your solar panel is proportional to sunlight intensity. It is important to install your solar panel so that it is not shaded during daylight hours. In the Northern Hemisphere your panel should be facing 180° Azimuth (directly South). Solar panels should also be tilted with respect to your known location. The optimal tilt angle can be determined in this section (See Figure 14) and recorded in Appendix A.

Figure 13 shows examples of tilt angles for solar panels. The angle to choose is the angle from the horizontal plane. Figure 14 (map) shows regional latitudes for North America. Optimal tilt angles for solar panels correspond with regional latitude.

A general ‘rule of thumb’ is to use a horizontal tilt angle of 60° if you are located in a region above the 40th parallel and 45° if you are in a region below the 40th parallel (See Figure 13). If you are uncertain about the best tilt angle, you should contact ELTEC at 800-227-1734/ 903-938-1901 or e-mail company@elteccorp.com

Solar panels are composed of crystalline cells interconnected to effect the wattage rating of the panel. Furthermore the connection is such that damage to single cell(s) only reduces the output of the panel by the power lost from the cell(s). Thus if only one cell is damaged your panel will still continue to produce power close to the rated output of the panel. The crystalline cells are encapsulated between tempered glass and an EVA (ethylene vinyl acetate) pottant with PVF (polyvinyl fluoride) back sheet to provide the maximum protection from environmental factors. The panel is housed in an anodized aluminum frame for strength and ease of handling.

Typical output ratings of panels are shown in Table 1.

Panel Rating	I Typical	V Typical	I Short Circuit	V Open Circuit
30 Watt	1.78	16.8	1.94	21.0
40 Watt	2.37	16.8	2.58	21.0
50 Watt	2.97	16.8	3.23	21.0
55 Watt	3.33	16.8	3.69	21.0
60 Watt	3.56	16.8	3.87	21.0
65 Watt	3.77	16.8	4.06	21.0
70 Watt	4.14	16.8	4.35	21.0
75 Watt	4.54	16.8	4.97	21.0
80 Watt	4.75	16.8	5.17	21.0
85 Watt	4.97	16.8	5.30	21.0
140 Watt	7.91	17.8	8.68	22.0

Table 1

If you have multiple panels they will be connected in parallel. The total typical current out will be multiplied by the number of panels in your array.

APPENDIX B (continued)

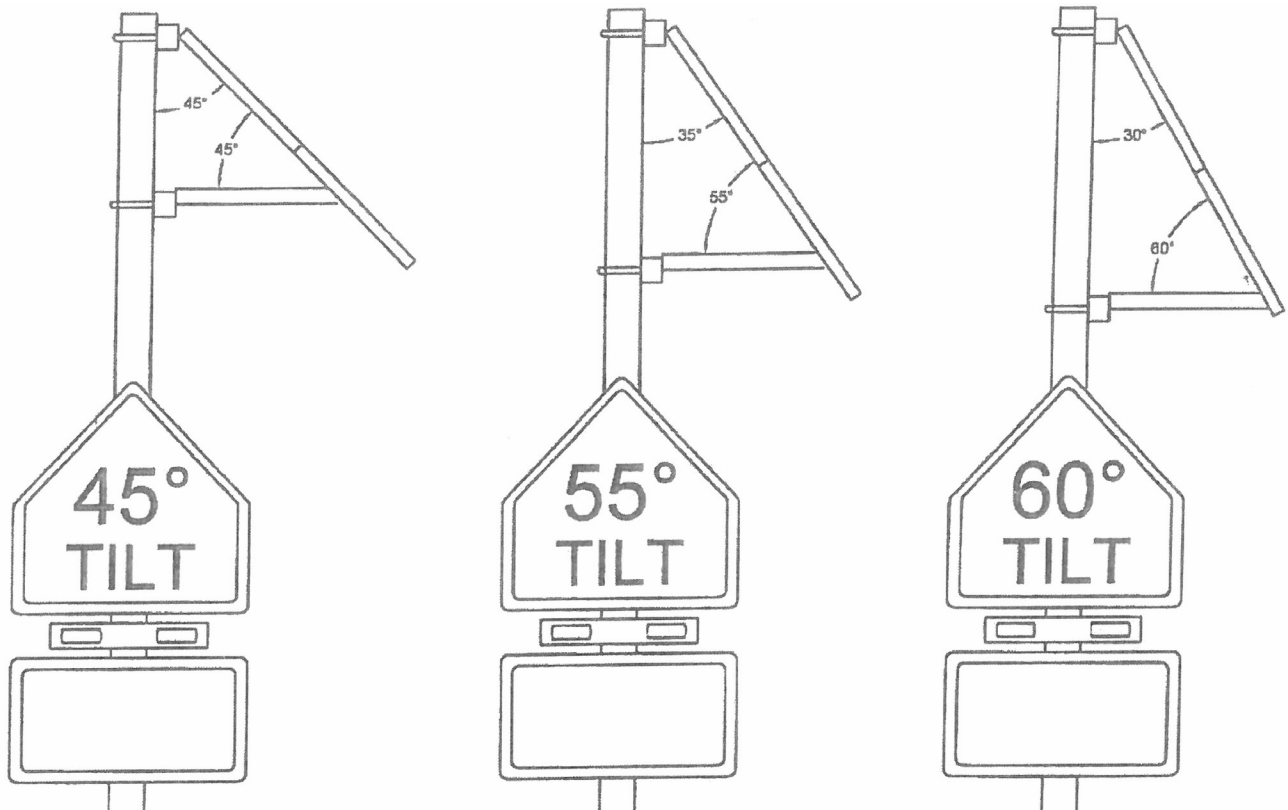


Figure 13 - Solar Panel Tilt Angles

Solar Panel Tilt Angles

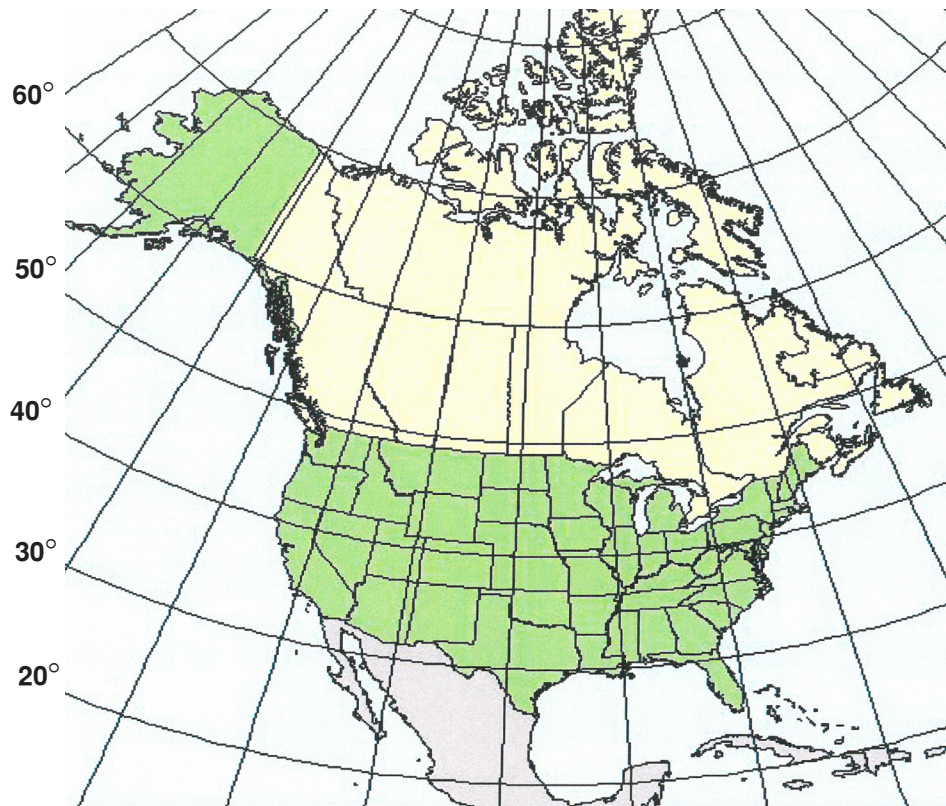


Figure 14 - North American Latitude Map

APPENDIX C

Preparation of the Foundation

Caution: This appendix is provided for reference only. Electrotechnics Corporation is not licensed to provide engineering services in your state. You should consult a licensed professional engineer for approval of your plans and your site.

The concrete foundation should be sufficiently sized to allow the installation of the anchor bolts or anchor cage and base. The base will typically be (13³/₄ x 13³/₄) inches if supplied by ELTEC. (See Figure 15)

Figure 16 depicts a typical pole foundation. Usually the foundation is square although it can also be circular. Remember that the foundation will house the anchor bolts or anchor cage to which the breakaway base mounts. The foundation must have a size that will accommodate the breakaway base, which should be at least a square that is (2 x 2) feet, or if circular it should have a diameter of at least 2 feet.

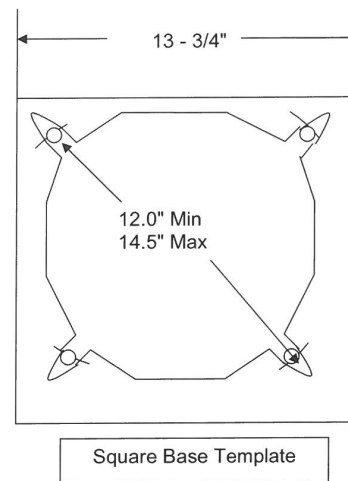


Figure 15

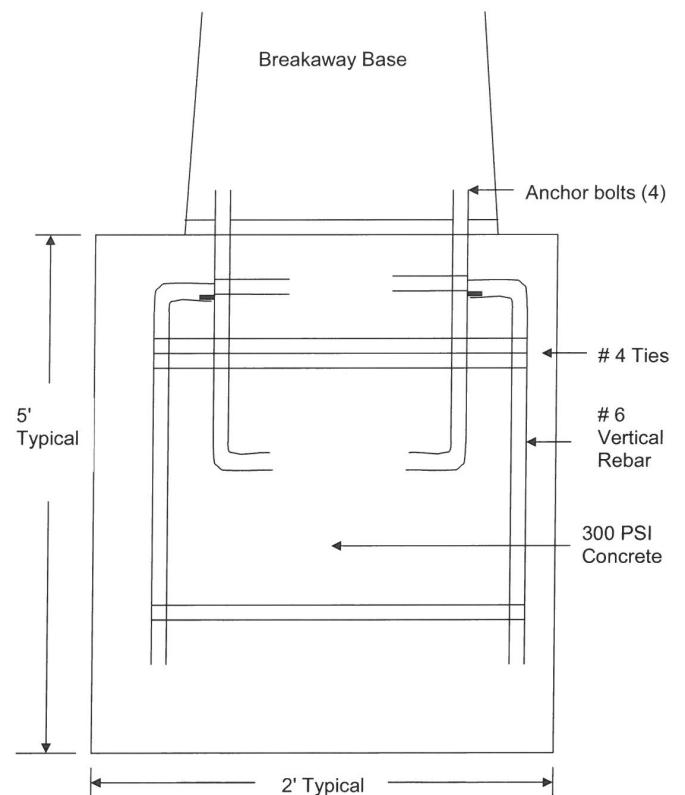


Figure 16

APPENDIX D

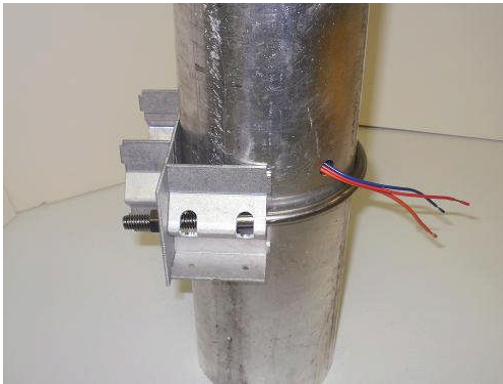
RRFB POLE MOUNT INSTALLATION GUIDE

with REVERSIBLE POLE CLAMP for 4" and 2.5"

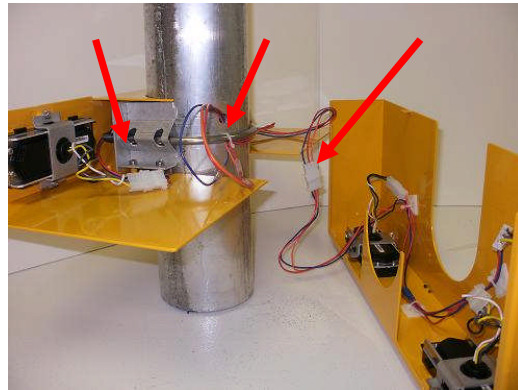
(4¹/₂ and 2³/₈ nominal outside diameter)

(All mounting hardware included)

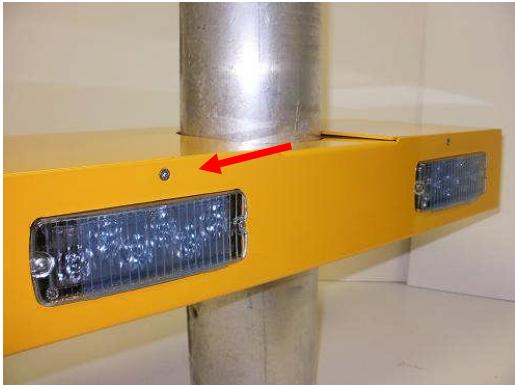
Attach and tighten 4" clamp on pole at RRFB mounting position.



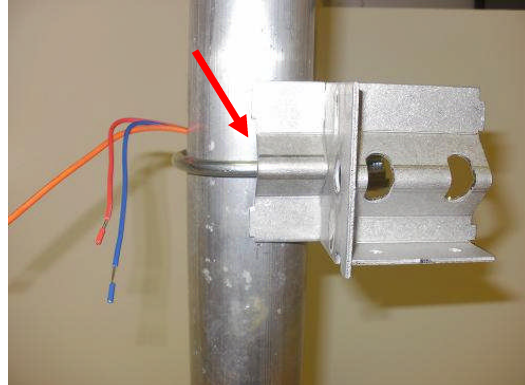
Attach bottom of RRFB using large screws
Make wire connection per wire color code.
Plug top to bottom harness



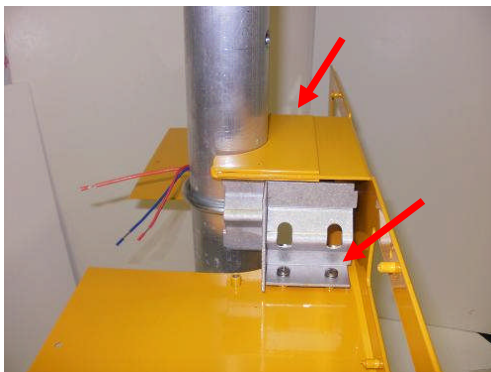
Attach top RRFB unit
Using flat screws



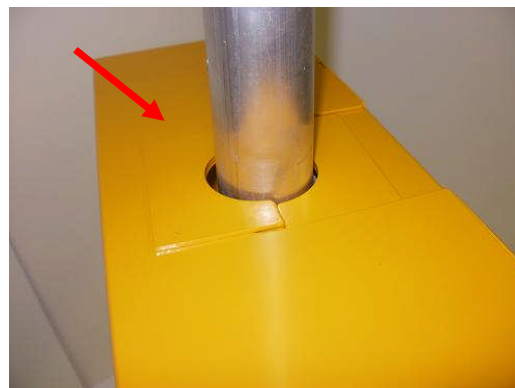
Attach and tighten 2.5" clamp on pole at RRFB mounting position.



Install adapter shims for 2.5" pole
Attach bottom of RRFB using large screws
shown without lights for detail



Shims will be installed on the top and bottom
RRFB covers, four (4) shims.
Wire connection same as a 4" RRFB.



APPENDIX E

Troubleshooting

If the troubleshooting guide does not enable you to resolve your problem, please call ELTEC at 800-227-1734/903-938-1901 or e-mail company@elteccorp.com

No LEDs are lit on Solar Controller (ProStar)

Verify with a multimeter that you have voltage at the battery connection to the controller. If you have voltage of at least 11.5 volts DC, press the 'on/off' (large button in upper right corner of controller).

Lights do not Flash

Verify that the red LED on the controller is not lit with a solid display. If it is flashing, your lights should be flashing if wired correctly, but the flashing means that your battery voltage is low.

Verify that your radios are active. Validate that your wiring is correct by turning on the RRFBs manually with the switch. Verify that your program in your countdown timer is correct.

Check that the wiring in the RRFB head is positive to positive. The leads in the backbone harness should be marked '+' and '-'. RRFB leads have a three wire connection. Red is 12 VDC+, blue is switched ground output 1, and orange is switched ground output 2. If the wiring is correct, verify that you have 12+ volts cycling to the RRFB terminal block connections. If there is no voltage reading, verify that the FS-2B is displaying a flashing sequence to the on board LEDs (See Appendix F, Figure 18).

Battery Voltage is Low or Low Voltage Disconnect is 'On' (ProStar)

If the low voltage disconnect is not 'on', verify that the solar panels are charging the batteries. Read the LCD display on the controller. The array current will be displayed as the display cycles through its displays. Use the table in Appendix B to approximate what the array current should be on a sunny day. If the array current is not approximate to expected value, then you most likely have a problem with your solar panel(s). Check your wiring at the panels (in the junction boxes) to ensure that the wiring to the battery cabinet and the jumpers from panel to panel are correct. If they are correct, then measure the voltage at the controller (at the PV + and -) to ensure that you have at least 16 volts present. If voltage is present, then the controller may be bad.

APPENDIX F

FS-2B Specifications

ELECTRICAL

- Input voltage range.....11.4 VDC to 30 VDC
- Max load power.....40 Watts per output circuit at 11.4 VDC to 30 VDC
- Operating temp.....-20°C to +74°C

PHYSICAL DIMENSIONS

- Length.....5.5”
- Width.....2.625”
- Height.....1.64”

FUNCTIONALITY

Three (3) Flash Patterns:

1. Standard Wig-Wag: 75 cycles/minute
2. Rapid Flash Pattern 1: (2/4-1) ref: FHWA 4(09) (I)
3. Rapid Flash Pattern 2: (WW+S) ref: FHWA 4(09)-41 (I)

Slow Flash Mode – for visualizing Rapid Flash patterns

Night Dimming – Automatic via Photocell (may be disabled)

Operation Modes:

1. 24-Hour flash (Yellow and White/Yellow wires not used)
2. Flash when control input line taken high (5-12 VDC applied to Yellow wire)
3. Flash when control input grounded (Yellow grounded to White/Yellow wires)

The FS-2B is microcontroller-based which gives it tremendous versatility and low power consumption. The FS-2B is intended for use in solar power applications, or in any application where there is a ready source of 11.4 VDC-30 VDC.

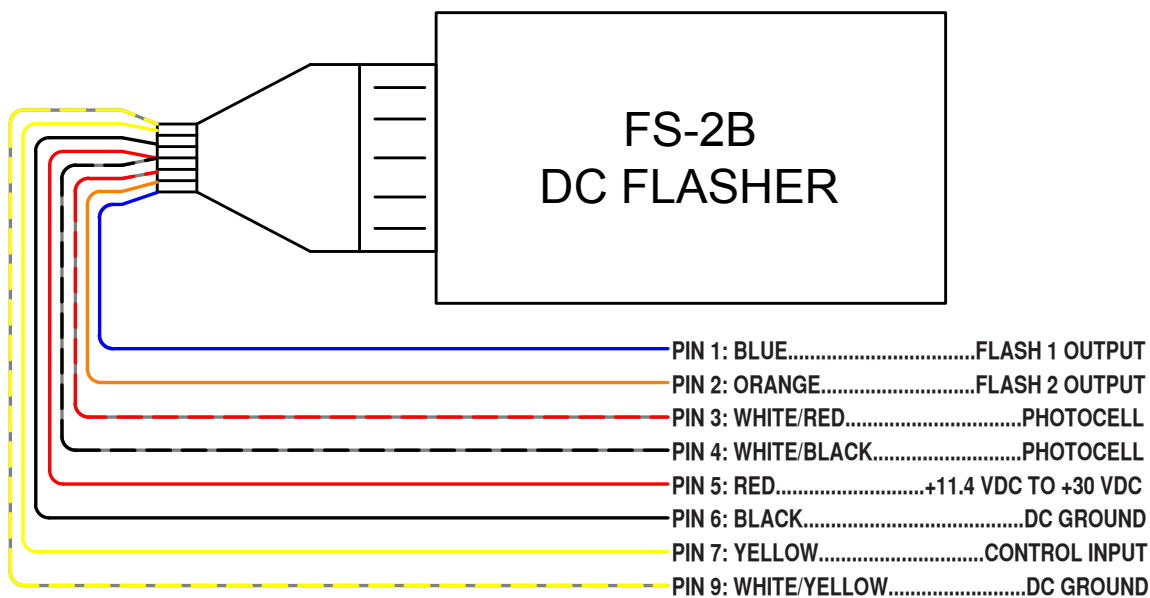


Figure 17: Wire/Connector Pin Outs

APPENDIX F (continued)

Configuring the Flasher

To configure the FS-2B first remove the case cover. With a Phillips screwdriver, remove the two cover retaining screws. The cover should easily slide off.

User configurable features are accessed through

1. DIP switch for flash-related options and
2. A 5-pin header for control options.

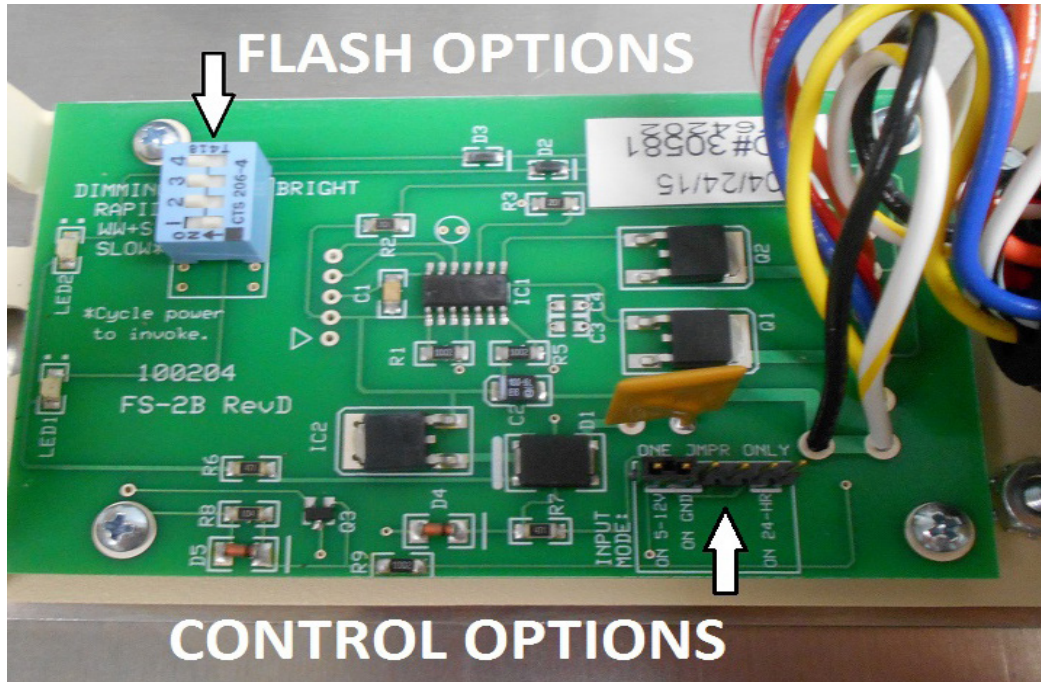


Figure 18 - DIP Switch and Header Locations

Control Options

The 2-pin jumper provided should be positioned on the header for the desired mode of operation.

The three (3) modes of operation are:

1. Continuous flash or **ON 24-HR**. The jumper selections are shown in Figure 18 above.
2. Flash when control input wire (yellow) brought high (5-12 VDC) – see **ON 5-12V** in Figure 18.
3. Flash when control input wire (yellow) is grounded – see **ON GND** in Figure 18.

Flash Options

The 4-position DIP switch is used to configure flash-related options as follows:

SWITCH	ON	OFF
1	Quarter Speed (Power cycle is required)	Full Speed
2	Wig-Wag+Sync (WW+S) Rapid Pattern	Pattern Set via Switch 3
3	Standard (2/4-1) Rapid Flash Pattern	Wig-Wag
4	Night Time Dimming Enabled	Full-Time Bright

APPENDIX F (continued)

FS-2B Limited Warranty

Electrotechnics Corporation (d.b.a ELTEC) warrants devices manufactured by ELTEC to be free of defects in material and workmanship for a period of 25 months from the date of purchase.

To determine if the FS-2B is within warranty, locate the serial number (SN) on the white decal. The letter determines the month (A–L = January through December) it was manufactured followed by the year. Example: C12xxxxx = March '12.

ELTEC will repair or replace any FS-2B flasher returned prepaid within the warranty period as long as there is no evidence that the unit has been misused, abused, damaged by input over-voltage, output overloads, lightning or water or altered in any manner without the express written permission of ELTEC. ELTEC disclaims any warranties expressed or implied, including warranties of merchantability and/or fitness for a particular purpose. In no event shall ELTEC be held liable for incidental or consequential damages. Warranty repairs are handled during normal business hours. Ship flasher to:

ELTEC
1310 Commerce St.
Marshall, TX 75672
U.S.A.

**Products requiring warranty service must have a
RETURN MATERIAL AUTHORIZATION (RMA) number**

- 1) Before returning any flasher, contact ELTEC's Technical Support Staff at 800-227-1734/ 903-938-1901, or company@elteccorp.com to receive a RMA number.
- 2) Fill out the Return Material Authorization form in its entirety. The form is available at www.ELTECCORP.com under the Tech Support tab.
- 3) Return the authorized item(s) per shipping instructions seen below.

Shipping instructions:

- 1) Make sure you include all item(s).
- 2) Pack item(s) carefully to avoid damage in transit.
- 3) Place the RMA form in box (we recommend you make a copy for your records).
- 4) Label each box with the valid RMA number on the outside. It must be recognizable.

